ENGINEERING EDUCATION FOR SUSTAINABLE DEVELOPMENT IN VIETNAMESE UNIVERSITIES: BUILDING CULTURALLY APPROPRIATE STRATEGIES FOR TRANSFORMING THE ENGINEERING CURRICULUM TOWARDS SUSTAINABLE DEVELOPMENT

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ABSTRACT

The main goal of this study was to improve the contribution of higher education to sustainable development in Vietnam, specifically in the area of engineering education. The study mapped the current scenario of sustainable development and engineering in higher education in Vietnam as well as investigated how a cultural perspective may influence change strategies in higher education for sustainable development.

This study addressed the need for empirical research on the education for sustainable development experience in Vietnam. It argued for and contributed to an emerging international dialogue about how to accelerate progress towards engineering curriculum transformation for sustainable development in different cultural contexts.

Located in the interpretivist tradition, the study utilised a wide range of qualitative research techniques to collect and validate data including open-ended questionnaires, interviews, group discussions, participant observation and documentary review. Empirical data was generated between May 2010 and August 2012 in both Vietnam and the UK through three research stages.

The first stage was informed by a qualitative survey which captured baseline data collected through a large group of stakeholders from different sectors and various levels of governance. The study mapped the current responses to sustainable development in Vietnam, and confirmed the need and expectation for change in Vietnamese engineering education towards sustainable development.

Case study research was carried out at three Vietnamese engineering universities during stage two. The focus was on understanding the current processes and opportunities for curriculum change for sustainable development, as well as investigating how the specific contextual and cultural factors might influence the desired change. The study found evidence of issues which hampered the current efforts in education for sustainable development in the engineering universities in Vietnam. The analysis also provided insights into the Vietnamese values, attitudes and expectancies, and behavioural preferences which contributed to explaining why these issues existed.
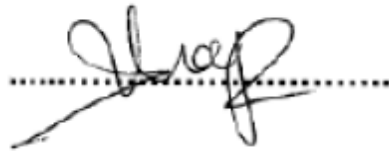
The final stage, through delineating the findings from the two previous stages, explored ways of building culturally appropriate strategies to transform the engineering curriculum in Vietnam. The main outcome of this study was a framework which assists Vietnamese managers and professionals operating at university level in this task. The core components of the framework include: resources, vision, communication, professional support, motivation and cooperation. For each component, key features of the strategies which are appropriate to the Vietnamese culture were identified. Whilst the framework serves as a guidance, specific solution packages must evolve through a process centred on the unique realities of the universities. This study therefore proposes that universities engage with the framework through a process of action research. Furthermore, this study suggests that future research explore other areas in which engineering education can contribute to sustainable development beside teaching and learning. Examples include university management for sustainability or university-business-community partnership for sustainability.

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of the University of Gloucestershire and is original except where indicated by specific reference in the text. No part of the thesis has been submitted as part of any other academic award. The thesis has not been presented to any other education institution in the United Kingdom or overseas.

Any views expressed in the thesis are those of the author and in no way represent those of the University.

Signed ………….   Phuong Nguyen

Date … 16 December, 2013……

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In loving memory of my grandparents – the great inspirations

To my parents and sister,

To my husband and daughter

"Would you tell me, please, which way I ought to go from here?"

"That depends a good deal on where you want to get to," said the Cat.

"I don't much care where…" said Alice.

"Then it doesn't matter which way you go," said the Cat.

"… so long as I get somewhere." Alice added as an explanation.

"Oh you're sure to do that," said the Cat…

(From Alice in Wonderland by Lewis Carroll)

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LIST OF ABBREVIATIONS

ASEAN	Association of Southeast Asian Nations
ARIES	Australian Research Institute in Education for Sustainability
BBC	British Broadcasting Corporation
CDM	Clean Development Mechanism
CSR	Corporate Social Responsibility
DESD	Decade of Education for Sustainable Development
DFID	Department for International Development
DOET	(Provincial) Department of Education and Training
DOIT	(Provincial) Department of Industry and Trade
DONRE	(Provincial) Department of Natural Resources and Environment
EESD	Engineering Education for Sustainable Development
ESD	Education for Sustainable Development
EU	European Union
FAO	Food and Agriculture Organization
GCI	Green Campus Initiative
GHF	Global Humanitarian Forum
GHG	Green-House Gases
HERA	Higher Education Reform Agenda
ICE	Institution of Civil Engineers
IDA	International Development Agency
ILO	International Labour Organization
IPCC	Intergovernmental Panel on Climate Change

MDGs	Millennium Development Goals
MOET	Ministry of Education and Training
MOFA	Ministry of Foreign Affairs
MOIT	Ministry of Industry and Trade
MPI	Ministry of Planning and Investment
MONRE	Ministry of Natural Resources and Environment
NGO	Non-Governmental Organization
OECD	Organization for Economic Cooperation and Development
SME	Small and Medium Enterprise
TVET	Technical and Vocational Education and Training
UNCSD	United Nations Commission on Sustainable Development
UNDESA	United Nations Department for Economic and Social Affairs
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNECE	United Nations Economic Commission for Europe
UNESCO	United Nations Educational, Scientific, and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNFPA	United Nations Population Fund
UNICEF	United Nations Children's Fund
UNIDO	United Nations Industrial Development Organization
VEA	Vietnam Environment Administration
VNCPC	Vietnam Cleaner Production Centre
WCED	World Commission on Environment and Development
WDR	World Development Report
WHO	World Health Organization

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LIST OF TABLES

PART I. INTRODUCTION, CONTEXT AND THEORETICAL FOUNDATIONS OF THE STUDY

Part I introduces the study and discusses the context as well as the theoretical foundations that shape the research. It locates the study in the broad foundations of sustainable development and education for sustainable development, outlines the need for research and delineates the research questions and objectives. Key philosophical and theoretical concepts underpinning the research are introduced.

This part also presents the key thematic areas relevant to this study and include: the Vietnamese culture, sustainable development, education for sustainable development (ESD) and culturally based strategies for sustainable development in Vietnam. It examines the Vietnamese context in sustainable development, and argues the need for a cultural perspective to embedding education for sustainable development into engineering education.

This section continues with an outline of the theoretical foundations of the study. It discusses the current movements in higher education for sustainable development, paying particular attention to engineering which is the area this study seeks to make a contribution to. It offers a discussion on the current efforts aimed at engineering curriculum transformation for sustainable development, which is the main focus of the study.

Part I contains the following chapters:

Chapter 1. Introducing the research

Chapter 2. Understanding the context: Vietnamese culture, Sustainable Development, Education for Sustainable Development and Culturally Based Strategies for Sustainable Development in Vietnam

Chapter 3. Higher Education for Sustainable Development: Changes to Engineering Education

CHAPTER 1. INTRODUCING THE RESEARCH

1.1. INTRODUCTION

Humankind faces an extremely complex set of challenges in the twenty-first century: climate stabilisation, energy and material security, sustainable land and resource use, poverty and equitable development. Addressing these challenges call for change towards sustainable development - a convergence between the three pillars of economic development, social equity and environmental protection[1]. Sustainable development calls for a shift from the current paradigm that underpins traditional ways of thinking and responding to social and environmental problems (United Nations, 2013; Baker, 2006; Hopwood, Mellor, & O' Brien, 2005).

In 1992, in an unprecedented attempt to make this paradigm shift happen, world leaders came together at the United Nations Conference on Environment and Development in Rio de Janeiro to set out the principles of sustainable development. Over the past 20 years, the concept of sustainable development remains elusive and implementation has proved difficult (International Institute for Sustainable Development, 2010; Brundtland, 2007; United Nations Economic and Social Council, 2002). Critical issues such as poverty and inadequate sanitation, economic crisis, social and political inequality and conflicts, environmental degradation have become more severe than ever resulting in social instability, unrest, fragility and breakdown in many communities in recent days. In 2012, world leaders gathered once again in Rio de Janeiro with a sense of urgency but lack of clarity on how to progress towards a more sustainable world. The outcomes document, "The Future We Want" (United Nations, 2012) reinstates sustainable development as the overarching goal of the international community [2] and pledges commitments from governments, non-governmental organisations, businesses and education communities.

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[1] The concept is formally introduced in the Rio Declaration on Environment and Development and Agenda 21 which were adopted at the United Nations Conference on Environment and Development in Rio de Janeiro, Brazil in 1992

[2] The future we want, Resolution adopted by the United Nations General Assembly at the Rio +20 Summit on 11 September 2012

It is within this context that education is seen as the greatest resource – the key to the achievement of sustainable development goals (Fien & Tilbury, 2002; Huckle & Sterling, 1996; Tilbury & Cooke, 2005). The UNESCO report "Education for Sustainability, From Rio to Johannesburg: Lesson learnt from a Decade of Commitment", presented at the Johannesburg World Summit for Sustainable Development in 2002 states:

> "Education not only informs people, it can change them. As a means for personal enlightenment and for cultural renewal, education is not only central to sustainable development, it is humanity's best hope and most effective means in the quest to achieve sustainable development" (p.8).

This perspective that education must underpin realistic change to sustainable development has initiated and informed a number of international declarations and agreements (UNESCO, 2002), most significantly the UN Decade of Education for Sustainable Development (DESD) 2005-2014 launched by UNESCO in 2005. In response to emergent international calls, different local and global movements in education have been initiated, such as the reform of curricula and teaching programmes in many countries, the establishment of sustainability education awards, the sustainable school and university movements and many other activities (Tilbury, 2010; GUNi, 2012; Hopkins, 2012; Fien, Maclean, & Park, 2008; UNESCO, 2011). These initiatives indicate an increasing commitment towards an ESD agenda in formal and higher education.

Alongside the increasing attention paid to Education for Sustainable Development (ESD) in the international arena, Engineering Education for Sustainable Development (EESD) has emerged among the engineering higher education community as the term. Underpinning this term is a new vision and paradigm for education which would change how engineers are educated. Whilst the contributions of engineering education to society have been widely acknowledged (Forum for the Future, 2003; Boyle, 2004), sustainable development poses an array of challenges including issues and problems that go far beyond what is generally found in the textbooks or experiences provided as part of engineers' formal training (Thom, 1998; Crofton, 2000). Within the engineering profession, engineering educators around the world are witnessing a significant shift in societal expectations and in response, seeking changes in the way that engineering education is conceived and delivered, in order that graduate engineers can contribute to more sustainable futures (Fenner, Ainger, Cruickshank, & Guthrie, 2005; Byrne, Desha, Fitzpatrick, & Hargroves, 2010; Kastenhofer, Lansu, van Dam-Mieras, & Sotoudeh, 2010).

The potential contribution of ESD and EESD to progress countries around the world towards sustainable development, however, needs grounding in the different cultures which influence lifestyles, individual behaviour, thinking patterns, values related to sustainable development, and the ways in which people interact with the social and natural environment. Amid the widely acknowledged argument that there is no universal model of ESD, emphasis has been made to processes of change which need to be specifically defined to meet the conditions of different localities and in culturally appropriate ways (UNESCO, 2002; Corcoran, Walker, & Wals, 2004). This approach aligns with the general call for cultural consideration as the phenomenon of globalisation becomes widespread. Many studies such as those of Dimmock and Walker (2000a), Cheng (1995) and Hallinger and Leithwood (1996) highlight how culture affects educational leadership and management especially in the context of globalisation of policy and practice. They argue that whilst policy-makers and practitioners are increasingly adopting policy blueprints, management structures, leadership practices and professional development programmes fashioned in different cultural settings, little consideration has been given to their cultural fit, leading to the failure of the imported practices.

This study looks at engineering education for sustainable development in Vietnam. The ultimate goal of the research is to develop a framework for building culturally appropriate strategies to transform the engineering curriculum in response to the challenges of sustainable development in Vietnam. This introductory chapter sketches out the territory in which the research was conducted. The chapter starts by contextualising the research through introducing the concepts and key features of sustainable development and education for sustainable development. It continues with an identification of the knowledge gaps and the relevance of a culturally appropriate approach to ESD that served as of the motivation for this research. The chapter then maps the research aims and processes, and highlights the contributions of the study. It positions the study within philosophical and theoretical frameworks and clarifies the researcher's position and research assumptions. The chapter ends by outlining the format of the thesis to enable readers to follow the chapter flow and travel easily through the text.

1.2. CONTEXTUALISATION OF THE STUDY

1.2.1. Sustainable development – the concept and international milestones

Sustainable development has started to receive attention on the international political agenda since the 1990s. However, issues of sustainable development could be traced back to the concerns about the long-term capability of the biosphere to support the way human populations live which have been raised significantly since the mid-twentieth century.

In the 1960s and 1970s the potentially harmful impacts of human activity became widely evident. Carson is recognised as a pioneer in the USA with her controversial book, Silent Spring (1962), prompted by the mass application of insecticides, which expressed outrage at heedless tampering with nature. In the UK, Goldsmith, in A Blueprint for Survival (1972), called for a world order founded on stable populations and no-growth economies, although it was discredited by many for its extremism (Pearce, 1991, p. 12). Following Carson in the USA, on worldwide biological research trips Ehrlich had witnessed destruction to the environment which resulted in the publication of The Population Bomb (1971) warning about environmental damage caused by ever expanding human enterprise. In 1972, Meadows et al. published Limits to Growth which examined global trends of poverty and environmental degradation using a mathematical model. Whereas Limits to Growth focused on the needs of the present generation, advocating a world system which was 'sustainable without sudden and uncontrollable collapse; and capable of satisfying the basic material requirements of all of its people' (Meadows, Meadows, Randers, & Behrens III, 1972, p. 158), Blutstein argues that Sir MacFarlane Burnet provided one of the earliest formulations of sustainability in 1966 when he asserted that the 'resources of the Earth must be maintained for the use and enjoyment of future generations in a measure not less than we now enjoy.' (Blutstein, 2003, p. 339). It was during this time period that many governments established environmental bodies and the environmental movement began to gather momentum (Pearce, 1991).

The theoretical framework for sustainable development evolved between 1972 and 1992 through a series of international conferences and initiatives. In 1972, the UN conference on Human Environment met in Stockholm, with the aim of "co-opting into a global alliance" the environmental bodies established by governments around the world (Pearce, 1991, p. 12). The outcomes of the conference include an Action Plan, a Declaration and an undertaking to

convene another conference. The conference in Stockholm addressed issues still debated today, and the concepts which have been incorporated into the later notion of sustainable development can be seen throughout the Declaration, for example (United Nations, 1972):

> 'To defend and improve the human environment for present and future generations has become an imperative goal for mankind – a goal to be pursued together with, and in harmony with, the established and fundamental goals of peace and of worldwide economic and social development.' (Proclamation 6)

Generally, the original proposal of the concept of sustainable development is attributed to the 1980 IUCN World Conservation Strategy (Hopwood, Mellor, & O' Brien, 2005), which defined sustainable development as 'the integration of conservation and development to ensure that modifications to the planet do indeed secure the survival and well-being of all people' (Dresner, 2002, p. 30). Sustainable development was, however, brought widely to the world's attention by means of the UN World Commission on Environment and Development, chaired by Gro Harlem Brundtland. Its report 'Our Common Future' stated that 'sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs' (WCED, 1987, p. 43). Weaknesses in the definition have been identified and acknowledged. Whilst it includes elements of inter- and intra- generational equity, it does not define needs or development (Guthrie, 2003; Wackernagel & Rees, 1996; Daly, 1993). Some point to the contradictions lingering below the surface of the concept (van der Hamsvoort & Latacz-Lohmann, 1998). Giddings, Hopwood and O' Brien (2002, p. 188) go as far as to suggest that 'Brundtland was a political fudge [...] based on an ambiguity of meaning [...] in order to gain widespread acceptance'. While many other definitions have been suggested, for example, Parkin, Sommer and Uren (2003) state that there are over 200 definitions, the Brundtland definition remains the mostly commonly used.

Hopwood, Mellor and O'Brien (2005) observe that the concept of sustainable development represents a shift in understanding of humanity's place on the planet, but it is open to interpretation of 'being anything from almost meaningless to of extreme importance to humanity' (p. 40). While there remain the deep debates and ambiguities about the meaning of sustainable development, some commonality has been found. Mitchell, May and McDonald (1995) identify four common principles underlying the generic concept: futurity (concern for future generations); equity (concern for today's poor and disadvantaged); public participation

(concern that individuals should have an opportunity to participate in decisions that affect them); and environment (concern for the protection of the integrity of eco-systems). Similarly, Haughton (1999) summarises the ideas of sustainable development in five principles based on equity: inter-generation equity (futurity); intra-generation equity (social justice); geographical equity (trans-frontier responsibility); procedural equity (people treated openly and fairly); and inter-species equity (importance of biodiversity).

In 1992, twenty years after the Stockholm conference, the international community gathered at the UN Conference on Environment and Development in Rio de Janeiro which laid the foundations for the global institutionalisation of sustainable development. Several agreements were adopted including: the Rio Declaration, a reaffirmation of the 1972 declaration; the Rio Declaration of Principles, a statement of twenty seven principles to help guide action; and Agenda 21, a set of developmental and environmental objectives for the 21st century. It was recommended that all countries should produce national sustainable development strategies and Principle 15 of the Rio Declaration set down the precautionary principle: 'Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation'. In regards to the Rio Declaration, George (1999) advocates that the Declaration can be taken in its entirety as a definition of Sustainable Development, approved by governments, with commitments to implementing it. Within the Declaration Principle 3 is Rio's equivalent of the more popular Brundtland definition, but stronger: 'to equitably meet developmental and environmental needs of present and future generations.' (p. 99). Whilst being considered successful from a political standpoint[3], the challenges to Rio Summit 1992 lay in two areas: (i) too much of an emphasis on the "environment pillar" in the negotiations and (ii) too little implementation of goals established under Agenda 21, particularly those related to development aid and cooperation (International Institute for Sustainable Development, 2010).

Since that time, a number of important international conferences on sustainable development have been held, including the 1997 Earth Summit +5 in New York and the World Summit on Sustainable Development (WSSD) in Johannesburg in 2002. The summits highlighted how

[3] Rio Summit received the world's vast attention and active engagement and attendance by virtually every national leader (United Nations Economic and Social Council, 2002)

current actions were leading to environmental degradation, poor quality of life and associated developmental issues. The UN General Assembly noted in 1997 (paragraphs 4 and 17) that:

> "the overall trends with respect to sustainable development are worse today than they were in 1992" and;

> "much remains to be done to activate the means of implementation set out in Agenda 21, in particular in the areas of finance and technology transfer, technical assistance and capacity-building."

In his 2002 report on implementing Agenda 21, United Nations Secretary-General Kofi Annan confirmed that (United Nations Economic and Social Council, 2002):

> "progress towards reaching the goals set at Rio has been slower than anticipated" and;

> "there is undoubtedly a gap in implementation."

With a sense of urgency, the WSSD's Declaration on Sustainable Development and Plan of Implementation reinforced the importance of global governance for sustainability and committed governments to actions in the next ten years. However, Baker, in her book on Sustainable Development, cited the words of the Chair of Friends of the Earth International:

> "This Summit has failed the poor and vulnerable peoples of the world. It has not reached agreement on the radical action – with clear timetables and targets – needed to tackle the world's environmental problems, from climate change and renewable energy to forest and species loss" and suggested that the declaration lacked the intellectual sophistication and authority that the Rio Declaration still commands, and that it was seen unlikely to lead to new international negotiations or legal conventions." (Baker, 2006, p. 66)

The Implementation plan was also criticised by some scholars as lacking in innovative thinking and failing to invoke the precautionary principle in dealing with potential development problems (Hens & Nath, 2003).

Despite the criticisms, these international movements have been acknowledged as playing a key role in shaping the international responses to sustainable development through facilitating the governance structure which allows for the legal, institutional and political engagement with sustainable development at the international level (Dodds, 1997; Baker, 2006; Ruffing, 2003). These key movements and milestones have catalysed the establishment of: (i) the international

environmental regimes, dealing with an array of environmental matters, from hazardous waste, ozone depletion and biodiversity loss to climate change, for examples those developed under the auspices of the UN such as the UN Framework Convention on Climate Change (UNFCCC) and the Convention on Biological Diversity (CBD); (ii) new institutions and agencies for sustainable development such as the Commission on Sustainable Development (CSD); (iii) legally binding conventions and protocols namely the Montreal Protocol on Substances that Deplete the Ozone Layer 1987 and the UN Convention to Combat Desertification 1995; and (iv) numerous related conferences, reports and initiatives, for examples the International Conference on Population and Development in Cairo 1994, the World Summit for Social Development in Copenhagen 1995, the First Global Ministerial Environmental Forum in Malmo 1999, "We the Peoples" – Millennium report of the UN Secretary General 2000 and the Earth Charter 2000.

At the most recent UN Conference on Sustainable Development – The Rio +20 Summit in 2012, governments and organisations around the world, once more in Rio de Janeiro, gathered and reviewed the implementation of Agenda 21. Rio +20 focused on green economy and institutional frameworks for sustainable development as central themes and highlighted seven areas which need priority attention including decent jobs, energy, sustainable cities, food security and sustainable agriculture, water, oceans and disaster readiness. Whilst it seemed early to assess the contribution of the conference to the global progress towards sustainable development at the moment, the conference was significant as it reminded the global community of the limited achievements in the sustainable development efforts and renewed the political commitment for sustainable development, especially in the context of new and emerging challenges associated with the current financial and political crises[4].

Since the Rio +20 Summit, actions have been taken seeking to reorient the identified unsustainable trends and the still dominant paradigm which views development as economic growth towards the sustainable development paradigm (United Nations, 2012). At the international level, significant efforts have been put on the establishment of a comprehensive study on global progress to sustainable development. Two examples of these efforts include the "Sustainable development in the 21st century" project (SD21) and the Global Sustainable

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[4] The future we want, Resolution adopted by the United Nations General Assembly at the Rio +20 Summit on 11 September 2012

Development report 2013. The approach to SD21 was based on the idea that for sustainable development to progress, its political nature has to be recognised. SD21 reports expose different views regarding how sustainable development should be pursued and how specific issues should be addressed. The aim is to forge a better understanding and help overcome the current gridlock on the most divisive issues. SD21 provides an empirical basis and a frame of analysis to better understand much of today's work on the key issues of sustainability[5]. The Global Sustainable Development Report 2013 undertaken by the UN Division for Sustainable Development, on the other hand, seeks the participation of social and natural scientists in an in-depth analysis and evaluation of sustainable development implementation. The aim is to document the lessons learnt, best practices and new challenges, and cross-sectoral analysis of sustainable development issues in a truly integrated way (United Nations, 2013).

1.2.2. Education for Sustainable Development movements

There is a wide consensus that the quest for sustainable development challenges humankind's current paradigms, structures and practices of living – ones that underpin the traditional ways of thinking and acting upon social and environmental problems (Hopwood, Mellor, & O' Brien, 2005). In the early 1970s, Schumacher described education as the "greatest resource" for achieving a just and ecological society (Schumacher, 1973, p. 64). Ever since, and especially since the Earth Summit in Rio de Janeiro in 1992, education as an essential tool for the attainment of sustainability - broadly referred to in the literature as "education for sustainable development" (ESD) or "education for sustainability" (EfS)- has emerged.   Agenda 21, the action blueprint from the Rio Earth Summit dedicates a whole chapter, the Chapter 36, to advocate for this pivotal role of education:

> "Education, including formal education, public awareness and training should be recognized as a process by which human beings and societies can reach their fullest potential. Education is critical for promoting sustainable development and improving the capacity of the people to address environment and development issues." (Agenda 21, Chapter 36, p. 3).

Since Rio, an international consensus has emerged that education possesses the power to initiate, motivate and sustain changes towards sustainable development (Tilbury & Wortman,

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[5] For more information, see http://sustainabledevelopment.un.org/sd21.html

2004; UNESCO, 2011). A report by UNESCO, presented at the Johannesburg World Summit for Sustainable Development states: "Education not only informs people, it can change them. As a means for personal enlightenment and for cultural renewal, education is not only central to sustainable development, it is humanity's best hope and most effective means in the quest to achieve sustainable development." (Dimmock & Walker, Developing Comparative and International Educational Leadership and Management: a cross-cultural model, 2000a). The role of education has also been valued in a number of declarations and agreements from international conferences and meetings over the last few decades such as the Stockholm declaration, Tbilisi declaration, Talloires declaration, Halifax declaration, Swansea declaration, Kyoto declaration, Luneburg declaration and Declaration UBUNTU etc. However, it is the UN Decade of Education for Sustainable Development (DESD) 2005-2014 launched by UNESCO in 2005 that has significantly raised the profile of education in change towards sustainable development, and facilitated international cooperation to promote education for sustainable development (Elias & Sachathep, 2009; Hopkins, 2012; Tilbury & Cooke, 2005). The UN DESD makes explicit the key roles of education in sustainable development as (UNESCO, 2005b):

- Education is the primary agent of transformation towards sustainable development, increasing people's capacities to transform their visions for society into reality.
- Education fosters the values, behaviour and lifestyles required for a sustainable future.
- Education for sustainable development is a process of learning how to make decisions that consider the long-term future of the equity, economy and ecology of all communities.
- Education builds the capacity for such future-oriented thinking.

In addition, the UNDESD International Implementation Scheme, proposed by UNESCO, requests that each country, as well as institutions within each country, develop national and regional ESD strategies for the UNDESD. In many countries, the Decade offers an opportunity for education concerned groups that would not normally have communicated to meet and join in partnerships that supports movements towards a more sustainable future (Hopkins, 2012; Tilbury & Wortman, 2004).

Alongside the international efforts in envisioning a sustainable world, much work of UNESCO, other international agencies, governments, education systems and many other organizations

and actors have been done in seeking to clarify and communicate the concept and key messages of education for sustainable development (Hopkins & McKeown, 2002; UNESCO, 2002). A lesson commonly being identified is that whilst education is viewed as a tool for change, it is widely argued that deep and lasting change for sustainability can only be achieved when there is a fundamental change in education itself (Sterling, 2004a; Fien, 1993; Huckle, 1996; Fien & Tilbury, 2002). Such change requires that issues of sustainable development be addressed in a more systemic way that involves the whole of the institution in learning-based strategies for change (Huckle & Sterling, 1996; Sterling, 2004a; Tilbury, 2011b). As being emphasised in the chapter 36 of the Agenda 21, simply increasing education to higher levels has not led to sustainability, existing education needs to be reoriented towards sustainable development. ESD literature over the last two decades has advocated for the transitions from traditional approaches to critical approaches which contribute to a sustainability-reoriented education (see *Table 1* which captures the essence of this movement).

Shifting from:	*Moving towards:*
Bolt-on additions to existing curricula	Innovation within existing curricula
Passing on knowledge and raising awareness of issues	Questioning, understanding and getting to the roots of issues
Teaching about attitudes and values	Encouraging clarification of existing values
Seeing people as the problem	Seeing people as agents for change
Sending message	Creating opportunities for dialogue, reflection, negotiation, participation and action
Behaving as expert	Acting as partner
Raising awareness and trying to change behaviour	Challenging the mental models that influence decisions and actions
More focus on the individual and personal change	More focus on the professional and social change
"Problem-solving" approach	Creation of alternative futures
Isolated changes	Learning to change

Table 1. Transitions towards Education for Sustainable Development[6]

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[6] Source: (Tilbury, 2010)

The new vision for education is underpinned by futures thinking, critical reflection, systemic thinking, participation and partnership in decision-making, and values clarification (Tilbury & Wortman, 2004). Current initiatives that aim to progress ESD take various forms such as the reform of curricula and teaching programmes in many countries, the establishment of sustainability education awards[7], the sustainable school movement[8] and many other activities (UNESCO, 2011; Hopkins, 2012; UNESCO, 2002; Tilbury, 2010; Huckle & Sterling, 1996). However, it is argued that the current work on small-scale sporadic initiatives has failed to shift societal behaviour for sustainable development (Hopkins, 2012; UNESCO/BMBF/German Commission for UNESCO, 2009), and that the required change towards education and learning for a sustainable future has not been evidenced (Tilbury, 2012).

By the middle of the UNDESD in 2009, the UNESCO World Conference on ESD was held in Bonn, gathering senior formal education leaders and ESD experts with the aims of reviewing the progress of the first half of the UNDESD and setting key actions and priorities for the second half of the Decade[9]. The Bonn Declaration which was later endorsed by the UNESCO General Conference becomes an important international policy statement. It stresses that the engagement of formal education systems in ESD is not an option but a necessity, and that ESD is critical to quality education. The Bonn Declaration renews the concept of ESD as an overarching purpose of the world's education systems (UNESCO/BMBF/German Commission for UNESCO, 2009) and along with the UNESCO Strategy for the Second Half of the DESD (UNESCO, 2010b), continues to call for the development of ESD policies and strategies in all nations and the integration of sustainable development into all education levels.

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[7] For examples, the Times Higher Education (THE) and Green Gown Awards in the UK and the EDUCATE Prize. For more information, see: http://www.eauc.org.uk/green_gown_awards; http://www.timeshighereducation.co.uk/; http://www.educate-sustainability.eu/prize

[8] For example in Canada, the Sustainability and Education Academy (SEdA) has developed several programmes to assist entire school systems in their orientation to address sustainability (Hopkins, 2012). The most notable programme is a two and a half-day residential undertaking for the superintendents and trustees to understand the need and then plan their reorientation strategies in a systemic manner. The entire system from policy statements to practice in areas such as hiring, promotion, purchasing, maintenance, food services, transportation and psychological and social services are examined and reoriented towards sustainable development. For more information, visit website: http://www.yorku.ca/seda/

[9] For further information: http://www.esd-world-conference-2009.org/

1.3. RESEARCH RATIONALE AND MOTIVATION

The main motivation for this research was to improve the contribution of higher education to sustainable development in Vietnam, specifically in the area of engineering education. The research was designed to address the knowledge gaps identified through a literature review of ESD in Vietnam and of ESD especially in engineering education at international level (see section 1.3.1). In addition, the need for taking into consideration the cultural dimension of change for ESD has influenced the choice of a culturally appropriate approach which is central to this study (see *Figure 1*).
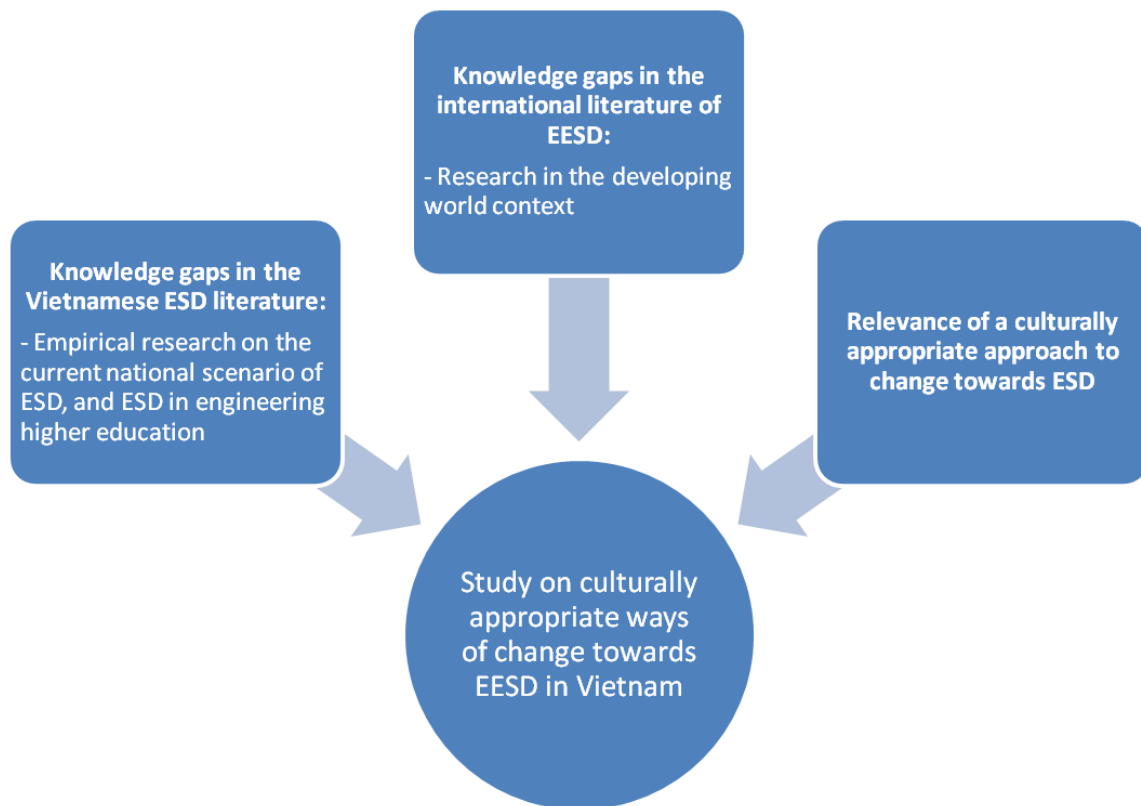
Figure 1. Research rationale

1.3.1. Identifying the knowledge gaps

As the study commenced, knowledge gaps were identified which have shaped the direction and focus of the research.

In the Vietnamese context, there is a lack of empirical research on the current national scenario of ESD and EESD. During its socio-economic development process starting from the National

Reform in the mid-1980s, Vietnam has enjoyed a high economic growth rate and significant social improvements, but at the same time encountered a wide range of critical issues related to sustainable development that require urgent and appropriate responses[10] (see section 2.2). Like many other countries, Vietnam recognises the need for actions towards sustainable development, including in the area of education. Over the recent years, the Vietnamese government has expressed a high level political commitment in implementation of the key international movements on ESD, most remarkable of which is the engagement with the UN Decade of Education for Sustainable Development (DESD) since 2006 (see section 2.3). The profile of ESD therefore has been raised to a new level in the Vietnamese education community, resulting in a number of conferences and seminars on ESD and ESD projects at different levels (see section 6.2). However, the researcher has found that little if any study has been done either to document these movements in a scientific way beyond mere description, or to advance the understanding of ESD, or to support fundamental change for ESD in the country's context. This requires a comprehensive scanning of ESD experience within Vietnam. The intention is to enable decision-makers at different levels to respond effectively to the need for transformation towards sustainable development.

Within the engineering discipline, the picture is even more fragmented. Early communication with ESD experts in Vietnam at the beginning of the research has revealed that there has been hardly any interest shown from the discipline on the national ESD arena[11]. The researcher was unable to find any empirical research focusing on EESD in particular. In Vietnam, science and technology has been regarded as being crucial for the socio-economic development, industrialisation and modernisation processes. Moreover, as a discipline, engineering has always been at the forefront of the national education agenda. Therefore, it is suggested that the higher education engineering community faces a great responsibility in responding to the sustainable development challenges Vietnam. This study argues that there is an urgent need to assess and act upon the current practice of engineering education to ensure it meets the new and challenging demand.

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[10] According to the Resolution of the Eleventh National Congress of the Communist Party of Vietnam, 2012
[11] The communication was made during the researcher's visit to the country in November – December 2009

Moving from national to international level, review on the current research trend in ESD in engineering education shows two main gaps in the literature of EESD (see section 3.3). Firstly, although from a global perspective engineering is generally considered as a discipline in which ESD is achieving an increasingly higher profile, a review of scientific publications on the topic of EESD[12] has revealed a strong bias towards research carried out in the context of developed countries influenced by Western cultures and assumptions. There remains a lack of understanding about EESD in the developing world[13]. If global EESD is to be achieved, it is crucial to engage the participation of the less developed world accounting for more than eighty percent of the global population.

Secondly, in the previous ten years or so, most investigation of change, or proposal of strategies for change in EESD had been from a technological or a political perspective[14]. One example of the technological approach is the problem-oriented and project-based learning model developed by the Department of Development and Planning at Aalborg University in Denmark (Lehmann, Christensen, Du, & Thrane, 2008). The model offers engineering departments a formula for embedding sustainable development principles into the engineering curriculum. Such an approach assumed that if an engineering department implements the model, the result will be a successful transformation of curriculum for sustainable development. Many other attempts of providing a general strategy for EESD with a technological perspective could be found in the literature (see section 3.3). Similarly, for the political approach, many studies have focused on evaluating tensions and conflicts of stakeholder groups, and other resistance factors,

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[12] This is based on a literature review of over 50 publications on the topic of EESD which have been sourced between October 2009 to May 2010 by the researcher from journals including the European Journal of Engineering Education, the Australasian Journal of Engineering Education, Engineering Education: Journal of the Higher Education Academy Engineering Subject Centre (HEA UK), Global Journal of Engineering Education, The Journal of Engineering Education (American Society for Engineering Education), International Journal of Continuing Engineering Education and Life-long Learning (UNESCO), International Journal of Engineering Education, and The International Journal of Sustainability in Higher Education.

[13] This observation was confirmed by the delegates at the International Conference on Engineering Education for Sustainable Development, Chalmers University of Technology, Gothenburg, Sweden, September 2010. Notably, Arjen Wals, a keynote speaker, commented that "It would be great to know about the other part of the world" (recorded by the researcher during her participation in the conference).

[14] This study investigates the changes happening in the context of Higher Education as it is the main focus of the study.

both internal and external (Holmberg, Svanstrom, Peet, Mulder, Ferrer-Balas, & Segalas, 2008). General observation of such approaches is that the technological change models tend to reduce the change process to a formula, and the political approaches focus on the political aspects of resistance to change, most of the time, from a generalised view point, without providing the "how" to overcome those barriers (Henstrand, 2006).

However, this study argues that specific context and culture should be equally considered as key issues in successful efforts of change towards sustainable development besides technological and political dimensions. With the emergent and rapidly spreading phenomenon of globalisation, the export of theory, policy and practice from some systems, mostly in the Western world, and their import into others, particularly non-Western and developing countries become more and more intensive, especially with the help of the non-governmental organisations (NGOs) sector. Whilst different benefits of globalisation have been discussed and acknowledged elsewhere, there are criticisms over the cultural aspect of the transfer and mobility of such theory, policy and practice between systems (Dimmock & Walker, 2000a). In many cases, there is a failure to respect the grounding of practices in specific cultural settings (Bottery, 1999; Waters, 1995).

In the field of educational policy and practice, there are also concerns over the suitability and appropriateness for the new host systems[15], setting aside the possible debates on the effectiveness for the exporting systems[16]. Dimmock and Walker (2000b) argue that theories, ideas and practices derived in one social setting should not be assumed valid in other social-political-cultural contexts and that, "societal cultures, along with local economic, political and religious conditions act as mediators and filters to policies and practices imported from overseas" (2000b, p. 307). Similarly, Crossley and Broadfoot (1992) highlight the importance of cultural understanding and cross-cultural experience in ensuring appropriate international transfer of educational policies and practices. Supporting this approach, in the analysis of journal articles on sustainability in higher education, Corcoran, Walker and Wals (2004) state that "it is unfeasible and even undesirable to look for […] universal models for the development, implementation and evaluation of sustainability" (p. 9). Building from a core principle of ESD

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[15] i.e. the systems in which the policies and practices are being introduced and to be implemented.
[16] i.e. the systems from which the policies and practices originated.

being honoured that ESD should be locally relevant and culturally appropriate (Hopkins, 2012; UNESCO, 2002), in the area of higher education for sustainable development, the call for taking into account the cultural appropriateness of change has been widely acknowledged and advocated for (Corcoran, Walker, & Wals, 2004; Fien, 2002).

The next section seeks to provide a brief review of theories and research studies which underpin the consideration of a culturally appropriate approach to change in this research.

1.3.2.   Culturally appropriate approach to change

According to the World Conference on Cultural Policies in Mexico (1982), and the UNESCO Universal Declaration on Cultural Diversity (2001) culture, in its anthropological approach, is a set of distinctive spiritual, material, intellectual and emotional features of a society or social groups, which encompasses, in addition to arts and literature, lifestyles, ways of living together, value systems, traditions and beliefs. There is a growing awareness that culture is not only a driving force and goal of development but also a key factor influencing every step in the development process (United Nations, 2003). Experience over the past decades across continents has shown that development approaches, that take full account of national and local culture, often have a higher chance of success and sustainability (UNESCO, 2002). This has led to the stimulation of many initiatives around the world to promote the crucial role of culture in sustainable development, examples of which include the Agenda 21 (1992), the UNESCO Universal Declaration on Cultural Diversity (2001), and the Johannesburg Plan of Implementation (2002). These initiatives call for the establishment of culturally-sensitive development agendas which not only pay attention to the contribution of the tangible and intangible facets of culture in development but also recognise that since cultural factors influence lifestyles, behaviour, patterns, values and the human ways of interaction, change for sustainable development will need to engage with and utilise culture in an appropriate manner.

In the wider literature beyond the area of sustainable development, the concept of cultural appropriateness or cultural relevance is not new. Hofstede, a noted authority on culture, defines culture as 'patterns of thinking, feeling and acting' underpinning 'the collective programming of the mind which distinguishes the members of one group or category of people from another' (Hofstede, 1991, pp. 4-5). The "collective programming of the mind" refers to shared beliefs,

values and practices of a group of people, whether that group can be a society, nation state, or organisation. Over the last few decades especially with the rapid spread of globalisation and increase of cross-cultural policy and practice transfer, criticism has been made of the approaches which ignore the cultural differences and assume that the imported packages are equally applicable and effective across cultures (Bottery, 1999; Schwartz, 1994; Hofstede, 2001; Trompenaars & Hampden-Turner, 1997; Cheng & Wong, 1996; Burnes, 2009). At the same time, there are a substantial number of experiences that show the effectiveness of change strategies that are shaped to reflect the targeted groups' characteristics or change agents who are familiar with the group's culture (Griswold, 2008; Marin, 1993; Suzuki, Ponterotto, & Meller, 2001). Scientific research and government documents have been calling for the development and implementation of culturally appropriate practices, programmes and strategies for changes for different cultural groups in various subject areas. These range from education, which includes curriculum and pedagogy (Reyhner, Gilbert, & Lockard, 2001; Yazzie, 1999), and policy and administration (Dimmock & Walker, 2000; Cheng, 1995; Hallinger & Leithwood, 1996) to business (Lincoln & Kalleberg, 1990; Burnes, 2009); management (Doney, Cannon, & Mullen, 1998; Baydoun & Willett, 1995; May, Puffer, & McCarthy, 2005; Kelly, Whatley, & Worthley, 1991); technology transfer (Kedia & Bhagat, 1988); and health and healthcare provision (Catalano, et al., 1993; Padilla, 2001; Marin, 1993).

- *What is a culturally appropriate strategy for change?*

Social science research has clearly shown that cultures differ across a number of dimensions from both studies based on theory and those achieved through empirical research (Hofstede, 2001; Trompenaars & Hampden-Turner, 1997; Detert, Schroeder, & Mauriel, 2000; Griswold, 2008; Doney, Cannon, & Mullen, 1998). Hofstede (1980) suggests four dimensions of culture difference between nations, and clusters of societal cultures according to whether they are high or low on each of these dimensions which he labels as: Power-Distance, Uncertainty Avoidance, Individualism-Collectivism and Masculinity-Femininity. Later work revealed a fifth dimension which has been labelled Confucian Dynamism (Hofstede & Bond, 1988) and relates to the cultural preference for long or short term orientation in life and the Eastern preference for "virtue" compared with the Western search for "truth". Trompenaars (1993, p. 8), and later on

together with Hampden-Turner (Trompenaars & Hampden-Turner, 1997) from a large-scale survey[17] deduces that "every culture distinguishes itself from others by the specific solutions it chooses to certain problems", and that these problems can be classified into seven dimensions within three categories: relationships with people, attitudes to time, and attitudes to the environment. In the specific area of educational management, Dimmock and Walker (2000b) propose a cultural framework, which according to the authors, helps facilitate cultural sensitivity when policy, theory and practice are transported between education systems. Even though defining cultural dimensions as "core axes around which significant sets of values, beliefs and practices cluster", the authors, in agreement with Hofstede's cautionary remarks, note that the proposed framework's dimensions, whilst being tools for analysis, are also constructs that should not be reified (Dimmock & Walker, 2000b, p. 308).

Such recognition of different worldviews and assumptions, as well as traditions, values, attitudes, expectancies and behaviours has led to the argument that change strategies need to reflect what is central to the targeted group's cultural characteristics. Failure to do so might hamper or lead to failure of the change effort. For example, a study by Cheng and Wong (1996) on schools in East Asia which examines the concepts, origins and implications of school effectiveness suggests that the cultural differences between East Asian and Western societies might be responsible for the crises in countries like Hongkong where the imported Western educational practices do not match with the Confucian societal values. Similarly, Lincoln and Kalleberg's research (1990) offers a good example of how culture affects organisational outcomes. The researchers begin by observing that American managers and scholars, intrigued by the success of Japanese management techniques, wonder which of these techniques might be successfully imported. Their conclusion is that, from a "culturalist" approach, the Japanese management techniques and strategies are suited to Japanese culture, which valued collectivity over the individual, cooperation, and a dependent personal relationship between employees and supervisors, and that these forms would not be as successful if exported to other countries.

Whilst the need for a culturally appropriate approach to change has been widely accepted, there is little in the literature that theoretically characterises it (Suzuki, Ponterotto, & Meller, 2001;

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[17] His survey uses a database of 15,000 questionnaire responses from 30 companies spanning 50 different countries (Trompenaars, 1993).

Marin, 1993; Doney, Cannon, & Mullen, 1998; Baydoun & Willett, 1995). Generally, a culturally appropriate approach to change entails strategies that are developed to fit the expectations and cultural pattern of the group being served. A review of the empirical studies in the subject areas reveals that in order for the change to become appropriate for the targeted cultural groups, there are three main ways in which cultural characteristics are taken into account in the development of the strategies. First, the values of the group's culture are used as the foundation of the change initiative. Significant cultural values such as orientation of time (Kluckhohn & Strodtbeck, 1961), power distance (Hofstede, 1980), personal interactions (Trompenaars & Hampden-Turner, 1997) are considered as a cultural frame in the creation of the strategies. Strategies which do not conform to these cultural values, for example, emphasising long-term goals to a culture that prefers a present orientation (May, Puffer, & McCarthy, 2005); or challenge a group's values, for example, assertive techniques in a society that values social harmony and consensus (Nguyen, Terlouw, & Pilot, 2006) can be expected to fail given the cultural inappropriateness. Second, the strategies reflect the attitudes, expectancies and norms regarding particular behaviours related to the intended change. A number of researchers have argued that in order for the strategies to be effective, they need to take into consideration the attitudes and expectancies of the cultural group being targeted. As an example, Yang and Sonmez (2007) look at intellectual property (IP) in Asian countries and find that these Confucian cultures perceive IP as a "communal good" and copying as a "legitimate means of learning and sharing". In such societies where creations belong to the public, the authors argue that motivation for creativity might be fame rather than materialistic reward. Similarly, Marin (1993) proposes that for a group which perceives the worst result of smoking as providing a bad example to children and not as creating long-term health effects, a culturally appropriate message for smoking cessation would need to be based primarily on how individuals, by smoking, present a negative image to children rather than on the consequences to physical health. Third, change which ensures cultural appropriateness requires that the strategies fit within the preferred behavioural repertoire of the targeted group. This means the components of the strategies reflect patterns of use of the possible change channels, for example the use of traditional media for communication for ethnic minorities in awareness raising campaigns (Nazzar, Adongo, Binka, Phillips, & Debpuur, 1995); and the actual preferences of the members of the targeted group for certain strategies, for example, studies show that since for many Chinese people, personal relationship ('guanxi') is considered more important than any other

key success business factors, importing of Western business practices should take into account this cultural preference (Hwang & Stanley, 2005; Lou, 1995).

These different experiences of the approach imply that in order to develop culturally appropriate change strategies, one must go beyond a simple adaptation of a change initiative that is already in existence. The development of such strategies requires research which identifies the "real" needs and issues underpinning change, and investigates the group-specific cultural characteristics including values, attitudes, norms and behavioural preferences towards the targeted behaviours for change.

- ***Why a culturally appropriate approach to change towards education for sustainable development?***

As previously stated, in the time of globalisation and internationalism, and in the context of sustainable development and education for sustainable development (ESD), it is well recognised that change initiative does not follow a single, uniform, one-size-fits-all formula (UNESCO, 2002). Different countries, communities or social groups are likely to experience different types of development challenges, possessing different types of resources to deal with different issues, and to achieve them at different rates and time.

A culturally appropriate approach is particularly relevant to change towards sustainable development, including ESD, for its contribution to accessibility, empowerment and criticality of ESD change effort:

- ✓ Whilst the quest for sustainable development and ESD require change in social groups varying in culture, language, capacities and many other characteristics, a culturally appropriate approach to change could minimise the receiving group's alienation as they attempt to adjust to the new demands and challenges posed by sustainable development.
- ✓ A culturally appropriate approach to change is empowering because it enables the individuals and the social groups to be more effective in fulfilling their goals and responsibilities, and encourage individual and collective initiatives for sustainable development and ESD. It helps promote the belief that they can succeed in sustainable

development related tasks, have motivation to persevere and aim for higher achievement.

✓ A culturally appropriate approach to change is also critical in that it guides cultural groups in understanding that no single version of "truth" is total and permanent. A culturally appropriate approach underlines the acceptance of change towards ESD as something to be co-constructed, critiqued, revised and renewed. It is critical in the sense that it helps identify the cultural factors (i.e. worldviews, values, beliefs, attitudes and behavioural repertoires) that hamper the needed changes and ways to resolve them which are grounded in the specific context and not simply adopted from elsewhere.

This study has been designed to fill in the aforementioned knowledge gaps by looking at a developing country context taking into consideration its specific culture and characteristics. It is important to note that whilst being approached with a cultural perspective, the study does not seek to provide any comparison between the developing world's context (which, in this case, is the Vietnamese context) and the Western ones. Rather, it seeks to provide an example of how strategies could be built in a way that is culturally appropriate and will bring the most effectiveness to the change effort aimed at ESD, especially in engineering education. In addition to the main motivation that is to contribute in the particular case of Vietnam, the research also hopes to inform change initiatives elsewhere aimed at a transition towards EESD beyond the Vietnamese context.

1.4.   RESEARCH AIMS AND CONTRIBUTIONS OF THE STUDY

The study is entitled "Engineering Education for Sustainable Development in Vietnamese Universities: Building culturally appropriate strategies for transforming the engineering curriculum towards sustainable development". It seeks to address the following research questions:

1. How is Vietnam responding to the challenges of sustainable development? What are the implications for Vietnamese engineering education?

2. What are the visions and issues underpinning a transformation of the engineering education for sustainable development?

3. Which culturally appropriate strategies are needed for the transformation of the engineering curriculum towards sustainable development in Vietnam? What framework would assist in building the strategies?

This research sets out, not to focus on studying the culture of Vietnamese universities, but to seek an understanding of the cultural influences to help bring about strategies for change appropriate in this particular context. Specific research aims and the design of processes to achieve these aims are outlined below, followed by the discussion on the contributions of the research.

1.4.1. Research aims

The ultimate goal of the research is to develop a framework identifying ways of building culturally appropriate strategies to transform the engineering curriculum in response to the challenges of sustainable development in Vietnam. Specifically, the research seeks to address different aims through three research stages:

- *Stage 1 - Mapping: To map the current movements towards sustainable development in Vietnam and the implications for engineering education*

Stage 1 has been designed in the form of an exploratory survey. It seeks to ascertain what is happening in the country with regards to sustainable development and engineering education, and to identify the components that constitute change towards a transformation of the current engineering curriculum for sustainable development in Vietnam.

Even though the focus of the overall research is on engineering universities, the survey has gone beyond the universities which offer engineering courses to also cover different stakeholder groups including the international development agencies and non-governmental organisations, national authorities and, engineering corporations and companies. There are two reasons for this. Firstly, the current status and issues surrounding sustainable development movements in Vietnam might provide a contextual platform for engineering education, which has helped identify the "real" needs for change instead of imposing the universally perceived ones. Secondly, since the ultimate objective of the research is to seek culturally appropriate ways for change towards sustainable development in engineering universities, it has been decided that it would be amiss to not establish an understanding of the wider context and culture related to

sustainable development efforts. Data generated from this stage are used to complement the data from the second stage in informing the construction of the framework in the third stage.

- *Stage 2 – Case studies: (i) To explore the issues and identify the possibilities for change in engineering education for sustainable development in Vietnamese universities; and (ii) to review critically contextual and cultural factors with a view to understanding the influences over transformation of the engineering curriculum for sustainable development in Vietnamese universities*

Stage 2 involves research into different engineering universities in Vietnam which have been wrestling with embedding sustainable development into the curriculum. Case study as the method of inquiry has been used in this stage to generate descriptive and interpretive accounts that allow rich understanding. A grounded approach to research has been taken as the framework that guided the methodology of this stage including data collection and data analysis strategy.

- *Stage 3 – Framework development: To develop a framework for building culturally appropriate strategies for transforming the engineering curriculum towards sustainable development in Vietnam*

Stage 3 seeks to identify ways of building culturally appropriate strategies to transform the engineering curriculum in response to the challenges of sustainable development. This is captured in the form of a framework constructed from the results of the previous stages of this study. Key informants from the ESD field in Vietnam (including participants from stage one) were involved in reviewing the framework and shaping its final form.

1.4.2. Contributions of the study

Overall, this study seeks to advance the understanding of change towards sustainable development in engineering education. The research was grounded in the specific context of

Vietnam, and has contributed to engineering education for sustainable development in Vietnam as well as influence frameworks and approaches adopted in other countries[18].

At national level, this study has attempted to deepen the understanding of ESD in general and EESD in particular. It documents, through empirical research, the current status of EESD in Vietnam and the implications for engineering education. The findings are sought to inform policy makers, university managers and international and national organisations interested in promoting ESD and EESD in Vietnam. This research also aims at envisioning a transformation for EESD in Vietnamese universities. It provides a framework to help realise the desired transformation in Vietnamese engineering universities taken into account the unique characteristics due to the specific context and culture. Furthermore, the study serves as an example for universities of other disciplines in Vietnam seeking a transformation for sustainable development. By providing case studies describing how people actually experience change and perceive the contextual and cultural factors as influences on desired change, this study is intended to create a dialogue between those who experience change and those who want to know about and to seek change. Ultimately, the study helps to improve the contribution of higher education to sustainable development in Vietnam, especially in the area of engineering education.

For the international EESD community, the study has provided a conceptual model of engineering curriculum transformation for sustainable development aimed at bridging different approaches to engineering curriculum change for sustainable development. By looking at a specific context of change for EESD, the study hopes to add to an emerging body of literature on change towards ESD in general and EESD in particular from a cultural perspective. Instead of the common approach in the literature which uses pre-determined cultural frameworks to guide the study into the cultural influences, the study took a grounded approach to research in which generated findings and constructed framework are field-based inductive and embedded in the context. Even though not seeking to provide a prescription or formula for carrying out future

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[18] This means interrogating practices so that they are culturally appropriate rather than transfer or adoption of a specific framework.

change efforts in other institutions or national contexts, it informs change initiatives elsewhere aimed at a transition towards EESD beyond the Vietnamese context[19].

1.5. GROUNDING THE RESEARCH IN PHILOSOPHICAL AND THEORETICAL TRADITIONS

Creswell (2007) asserts that good research requires the researcher to make explicit the philosophical and theoretical frameworks that shape and inform the study. Within the research field concerning sustainability in higher education, Fien (2002) advocates that different philosophical frameworks have an appropriate role to play, depending on the type of problem being investigated. Fien, and Corcoran, Walker and Wals (2004) alert that there is a need for research to be more strongly grounded in and guided by underlying philosophical and theoretical foundations. In studies on cultural interpretation, the use of theory in qualitative research is also argued for since it increases rigour and elevates qualitative research to the level of a science (Geertz, 1973; Goetz & LeCompte, 1984).

Seeking to make this research a worthy example, especially for the research community interested in ESD in Vietnam, from the beginning, the researcher was determined to design and conduct the research based on rigorous and coherent philosophical and theoretical stances. The study draws upon philosophical assumptions of interpretivism and the theory of culture within the tradition of cognitive anthropology to identify culturally appropriate ways for transforming the engineering curriculum towards sustainable development in Vietnam. Three philosophical questions guided the research in achieving the research aims along with the theoretical frameworks that shape and inform this study:

- *What constitutes the social reality of culturally appropriateness of change towards engineering curriculum for sustainable development in Vietnamese universities?*

This ontological question was addressed by drawing upon social constructionism. Ward Goodenough's definition of culture provides ontological lenses for observing, analysing and explaining the cultural influences over the change effort.

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[19] This is done by providing an example of how change initiatives for ESD could be designed in a specific cultural context.

- *What are ways of knowing the social reality of culturally appropriateness of change towards engineering curriculum for sustainable development in Vietnamese universities?*

This epistemological question was addressed by utilising interpretivism that underpins Ward Goodenough's theory of "cultures as ideational systems". Goodenough's theory provides a coherent framework for exploring the culturally appropriateness of change.

- *How can we access ways of knowing the social reality of culturally appropriateness of change towards engineering curriculum for sustainable development in Vietnamese universities?*

This methodological question was answered by locating the research within the grounded approach framework and utilising the qualitative survey and case study methods. Important features of Strauss and Corbin's work on grounded theory provides guiding principles for designing the research and undertaking data collection and data analysis.

1.5.1. Locating the research in the interpretivist paradigm:

This research into ways for change which are appropriate in the specific context and culture is based on the underlying assumptions and philosophies of interpretivisim (see sections 4.2 and 4.3). The research is featured as:

- being interactive and field-based inductive (Crotty, 1998; Robottom & Hart, 1993). The study takes a grounded approach in which no fixed presuppositions and constructions were imposed on the data. It was designed to ensure understandings were produced through dialogue and interaction, and meanings were negotiated mutually between the informants and the researcher in the act of interpretation;

- being embedded in practice and within a context (Schwandt, 2000; Patton, 1990; Geertz, 1973). Interpretivist epistemologies are believed to be, in one sense, characterised as hermeneutic because they emphasise that one must grasp the situation in which human actions make (or acquire) meaning in order to say one has an understanding of the particular action. The researcher attempted to collect data which was embedded in the particular context to ensure the reality was truly understood and interpreted;

- aiming to construct holistic patterns or webs of influence (Robottom & Hart, 1993; Schwandt, 2000). This research sought the perspectives and meanings of participants,

both propositional and tacit, which resulted in "thick" description. The researcher aims to grasp the whole complex of intentions, beliefs, desires as well as the institutional and cultural context, practice, and so on; and,

-   seeking transferability rather than generalisability (Crotty, 1998; Robottom & Hart, 1993; Corcoran, Walker, & Wals, 2004). This study advocates the importance of local relevance and cultural appropriateness. It aims to showcase the "how" and informs changes pursuing similar goals and did not seek to provide a prescription or formula for carrying out future change efforts in other contexts.

1.5.2.   Utilising the cultural theory of cognitive anthropology:

This study chooses to utilise the concept of culture as developed in cognitive anthropology because of the paradigmatic alignments of this tradition to interpretivism including the view over the social reality of culture, and the epistemological device it offers in understanding culture and its influences.

More specifically, Goodenough's theory of culture provided ontological and epistemological lenses for this study (see section 4.3):

-   The research seeks to identify the issues underpinning a transformation of the engineering curriculum for sustainable development in the Vietnamese engineering universities. Identifying such issues within Goodenough's definition of culture which centres around the questions of "what is?", "what can be?", "how one feels about it?", what to do about it?", and "how to go about doing it?" enables one to make distinct analyses of the concepts, beliefs, values and "grammatical" principles of action (Goodenough, 1963). This has the potential of illuminating the different cultural factors which influence the possibilities for change.

-   Goodenough's cognitive model which involves the use of the concepts of Culture, culture pool and propriospect contributes to addressing the epistemological question (Goodenough, 1981, p. 98): each of the informants as the propriospect shares characteristics with the Culture and with subgroups to which it belongs, and also possesses characteristics that are unique to itself. Because propriospect is a collection of individual's experiences, it was a tool for understanding how the operating culture of the informants influenced their ideas and behaviours in the change effort aimed at

curriculum for sustainable development at the participating Vietnamese universities. In addition, propriospect was an aid in understanding informants' individual and collective response to the change. Different research techniques such as interviews, group discussions and observation etc. (see section 4.4) were utilised through a series of research activities (see section 5.4) to reveal characteristics that were common to all informants. These were standards that cut across all cases and were present in individual propriospects. The framework has been constructed based on the finding on Culture (with the capital C) - the shared standards that are understood by members of the culture pool.

1.5.3. Following a grounded approach to research

Aimed at building culturally appropriate strategies for EESD in Vietnamese universities, this research has taken a grounded approach to research methodology. The following key features associated with grounded theory has been adopted as core tenets of the research approach (Denscombe, 2007):

- The study uses empirical field research as its starting point: Unlike the majority of research with a cultural perspective which utilise pre-determined frameworks for understanding culture and exploring cultural characteristics, the researcher started the field work research early in the investigation without any a priori cultural constructs being imposed on the data.

- The study develops its analysis with constant reference to fieldwork data: Data analysis was carried out in an iterative process which intertwined with data collection, especially at the beginning of the data collection process, based on the method of constant comparison (see section 4.3.2)

- The study produces explanations that are recognisable to the subjects of research, which are the opportunities for change, the issues underpinning change and the contextual and cultural influences over the change processes (see chapter 7)

- The study is geared to modest localised explanations based on the immediate evidence gained through a number of case studies being carried out in different Vietnamese engineering university settings (see section 5.4)

- The study adopts an emergent design: the research was designed based on theoretical sampling (see section 4.3.2) and an opportunistic and flexible data collection strategy (see section 5.4.3)

- Literature addressing cultural appropriateness and the identification of cultural characteristics as influential factors were read as the research progressed, but were not evaluated until the end of the research when they were compared with the findings of the research (see chapter 7)

1.6. CLARIFYING THE RESEARCHER'S POSITION AND RESEARCH ASSUMPTIONS

This section acknowledges the unavoidable subjectivity that shapes the research and influences the findings of the study. It positions the researcher and reflects on the strategies being used to manage the subjectivity. The section also clarifies the research assumptions which underpin the study.

First, the researcher is a Vietnamese citizen who puts herself, to a certain extent, in the position of a "native" when researching in the Vietnamese context. The researcher was a student at an engineering university in Vietnam[20] from 2000 to 2005 and after graduation, continued to be involved with the university as a young academic member of staff at the Institute for Environmental Science and Technology for two years. The researcher started to develop an interest in the concept of sustainable development in the penultimate year during a lecture on environmental management. She then had a chance to work on a large-scale project promoting cleaner production in Vietnamese small and medium enterprises (SMEs) undertaken by the Institute in cooperation with the United Nations Industrial Development Organisation. During her involvement with the project, the researcher also acted as a trainer on environmental management and accounting for managers of the SMEs in Vietnam. Through these experiences, the researcher gained some insights into the contemporary practices of ESD in engineering universities in Vietnam, and realised the needs for a new set of skills for engineering graduates posed by the engineering community. She then came to England to pursue a Master's course in Engineering for Sustainable Development at the University of Cambridge. The course was established from an initiative supported by the UK Royal Academy of Engineering to introduce

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[20] i.e. Hanoi University of Science and Technology

concepts of sustainable development in engineering education. During the study, the researcher's interest in the field of sustainable development intensified and she found herself constantly comparing and contrasting the practices being encountered in England with those being experienced in Vietnam, not only from the engineering but also from the educational point of view. After that, the researcher worked on a Sustainability project for an NGO specialised in the metal industry for nearly two years.

The opportunities to study and work in a developed country's context, as well as the improved knowledge on sustainable development issues, have not only benefited the researcher in terms of personal development but she was also given the unique position of observing and experiencing similar activities concerning sustainable development in different contexts. This has contributed to the researcher's strong beliefs in the importance of locally relevant and culturally appropriate solutions. In her opinion, the specific situation including the context and culture of Vietnam is so different that it would be unwise and somehow impossible to try applying practices that are available somewhere else, for example, those of the UK. This was where the research found its very first inspiration and emerged.

Deeply aware of the background and position, throughout the course of the research, from design to implementation to interpretation, the researcher constantly sought to manage the subjectivity of an "interpreter". Being a Vietnamese and having the experience of working in an engineering university in the past, the researcher shared some, if not many beliefs and values, as well as assumptions with the participants. To manage the subjectivity, during data collection and data analysis, the researcher consciously retreated from her status as a native and stepped into the role of researcher by applying the chosen theoretical framework and following the research strategies. For example, when spending time socialising with a group of young lecturers, the researcher found herself empathising with many of the frustrations related to the current practice of communication within the Vietnamese higher education institutions. Some strong comments somehow reflected her own feelings and there were some discussions in which she would tend to engage emotionally. However, the researcher tried to assume her research role by looking for cultural standards revealed by the participants. A research diary was used as the main mechanism for the researcher to reflect on and gain insights into her pre-understanding and potential bias, making reflexivity an integral part of the study (see section 4.4.4)

When writing the thesis, "third person" is used to prevent the researcher's voice from overpowering or imposing on the readers. The researcher provides her own reflection over the research processes in several sections in chapter 5 (see sections 5.3.4, 5.4.4 and 5.5.3), especially focusing on the challenges due to the unique working culture in Vietnam. It is believed that besides the research data and findings, such information is also valuable for the readers to gain insights into how research could be done in a culturally specific context, and to be able to judge the researcher's handling and undertaking of the research activities. By adopting a reflexive style of writing in those sections, the researcher aims to allow the readers to interrogate her personal involvement in the study.

In the chapters on research findings (see chapters 6 and 7), when presenting the finding statements, examples are provided in the form of narrative accounts taken from interview transcripts and observation notes. Consciously seeking to provide "thick description"[21] in order to support the interpretation, the researcher wants to provide enough description for the readers to be able to form independent understanding and interpretations.

1.7. FORMAT OF THE THESIS

This thesis reports the doctoral study on Engineering Education for Sustainable Development in Vietnamese universities, being structured into eight chapters under four parts as presented in Figure 2.

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[21] Geertz proposes that the anthropologist be immersed in the complex clusterings of symbols people use to confer meaning upon their world; and that the anthropologist engage in an intellectual effort that is 'an elaborate venture in, to borrow a notion from Gilbert Ryle, "thick description"'(pp. 5-6). The researcher chose to follow Geertz's concept of "thick description" as data collecting strategy since she wanted to provide enough description for the readers to be able to understand, experience and form independent interpretations.
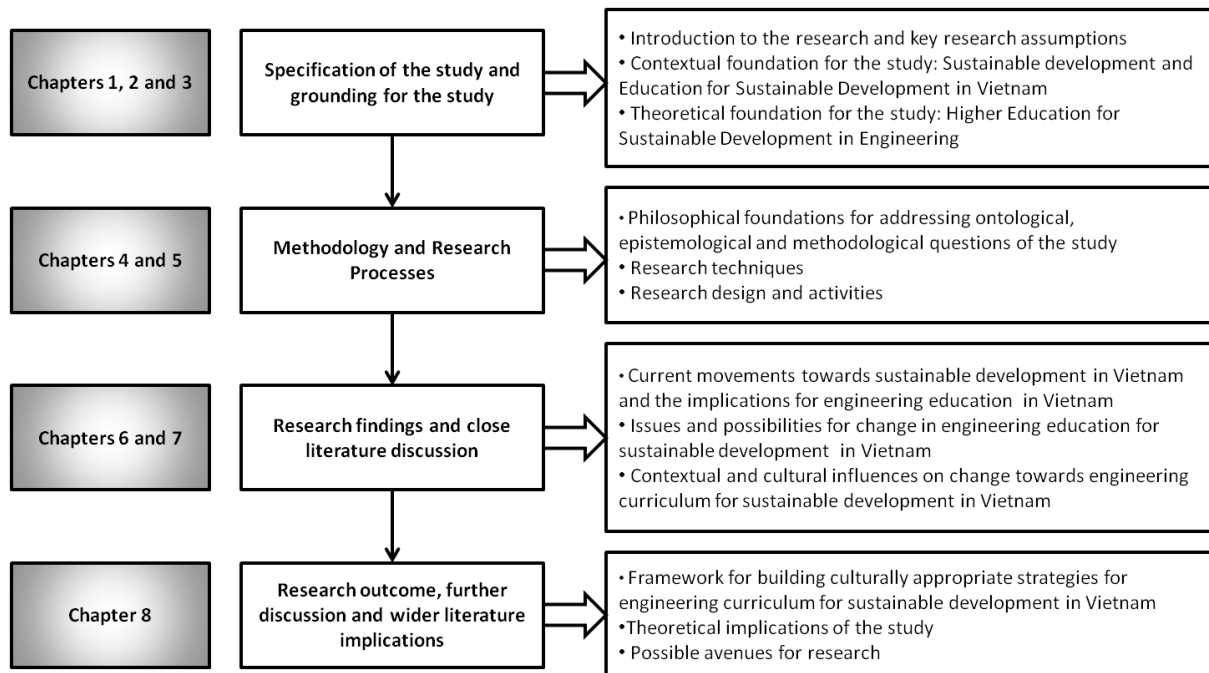
Figure 2. Structure of the thesis

Part 1 consists of three chapters and presents the introduction and grounding for the study. This first chapter introduces the research and seeks to illustrate the flow of the whole thesis. Chapter 2 provides the background to how the Vietnamese context in the areas of sustainable development and education for sustainable development has influenced this empirically grounded research into engineering education for sustainable development in Vietnam. The chapter also offers a discussion on the possible role of Vietnamese culture in progressing the sustainable development agenda in the country. Chapter 3 investigates the changes towards sustainable development currently experienced in higher education and engineering higher education. It also seeks to provide, frames and lenses through which the transformation of engineering curriculum towards sustainable development has been understood, and proposes a conceptual model for understanding such transformation. This work is informed by literature and expert reviews.

Part 2 consists of chapter 4 and chapter 5 which explain the research methodology and research design and processes respectively. Chapter 4 provides the philosophical and theoretical foundations upon which the research was designed and conducted. This includes clarification of the underlying philosophical assumptions and the research paradigm, as well as the cultural theory which provides ontological and epistemological lenses for exploring cultural

appropriateness in change. The chapter then explains the grounded approach being taken and the research techniques employed. Strategies to deal with quality and validity of the research are also discussed. In chapter 5, the research design and processes are described. The chapter presents three research stages: (i) mapping the current scenario of sustainable development movements in Vietnam, (ii) case studies to explore contextual and cultural influences over the change towards engineering curriculum for sustainable development, and (iii) development of a framework for building culturally appropriate strategies for change. The chapter documents how data was collected, managed, analysed and interpreted. It also provides some reflections of the researcher on the challenges encountered, and reports on how ethical issues were addressed during the research processes.

Part 3 presents research findings along with discussion in two chapters 6 and 7. Chapter 6 reports on findings from stage one. It maps various movements of different stakeholder groups in response to the challenges of sustainable development in Vietnam, and discusses the implications for engineering education. Chapter 7, which draws on data from stages two, explores the issues underpinning the desired change and identifies the respective cultural influences. Alongside research findings, the chapter also turns to the extant literature to compare it with the emergent constructs.

Part 4 consists of chapter 8 that outlines the outcomes of the research. The chapter provides a framework for building culturally appropriate strategies for transforming the engineering curriculum towards sustainable development, as well as recommendations for key stakeholder groups. The chapter also examines the implications of the study with reference to the knowledge gaps and research aims stated in chapter 1. It discusses and reflects on the research processes, and acknowledges the research limitations. Finally, the chapter suggests some practical and immediate actions for engineering universities in Vietnam, and recommends potential directions for future research in the knowledge area.

Appendices 1-10 provide supplemental information on literature review, research design, processes and findings of the study.

1.8. SUMMARY

This first chapter has introduced the doctoral study and delineated its research territory. It has explained the contextualisation including the international movement on sustainable development and ESD, and argued the need for the research. The lack of empirical research on the current national scenario of ESD, and ESD in the engineering discipline in particular, along with the wish to contribute to progress towards EESD in Vietnam, have been the main motivations behind this research. Central to the research is the argument that in order for change initiatives aimed at ESD to be effective, strategies for change should be appropriately built taking into consideration the contextual and cultural characteristics of the targeted group.

The chapter poses research questions that guide this research inquiry, states the respective research objectives and points out how they are addressed through different research stages. The study was undertaken within the philosophical assumptions of interpretivism and its methodology influenced by the theoretical frameworks including cultural theory in cognitive anthropology and grounded approach adopted from the grounded theory tradition. The chapter has made explicit how these frameworks inform the approach and shape the design of the research, as well as offer lenses for understanding and exploring the cultural appropriateness of change towards EESD in Vietnam.

Grounding the research in the Vietnamese context and within the field of sustainable development, education and engineering has located the study within the researcher's personal, academic and professional background. The researcher's position and research assumptions that underpin the research approach, design and interpretation have also been clarified in order to help the reader interrogate the validity of the study.

CHAPTER 2. UNDERSTANDING THE CONTEXT: VIETNAMESE CULTURE, SUSTAINABLE DEVELOPMENT, EDUCATION FOR SUSTAINABLE DEVELOPMENT AND CULTURALLY BASED STRATEGIES FOR SUSTAINABLE DEVELOPMENT IN VIETNAM

2.1. INTRODUCTION

Vietnam has been praised by the international community for its remarkable progress in socio-economic development, changing from an extremely poor country to a lower middle income country in less than 20 years. During the development process, as many other countries, Vietnam recognises the need for actions towards sustainable development, including in the area of education. Over the recent years, alongside the efforts in accelerating growth in Vietnam, the Vietnamese government has expressed a high level political commitment in implementation of the key international movements on sustainable development and education for sustainable development. Evidences of this commitment include the establishment of governmental bodies as well as strategies, policies and action plans aimed at progressing these agendas at all levels of governance and across all sectors. These attempts, however, need grounding in the specific context of Vietnam. The country's unique cultural characteristics and resources should be recognised and pain attention to ensure the effectiveness and sustainability of the development interventions. The literature argues that acknowledging and utilising culture in an appropriate manner is likely to propel and accelerate development efforts, and yield sustainable, inclusive and equitable outcomes (UNESCO, 2012).

This chapter aims to capture the context that influences the responses of Vietnam to the challenges posed by sustainable development. It first introduces the country and its culture as well as unpacks the key challenges of sustainable development being faced. The chapter provides an overview of the Vietnamese institutional and policy framework that supports the implementation of sustainable development and ESD in the country. It also highlights how the role of culture has been emphasised in the country's development agenda.

The chapter then offers a comprehensive scan of the Vietnamese context through the sustainable development lenses drawing attention to economic, social and environmental dimensions. Finally, the chapter clarifies the need for a cultural perspective in designing and implementing change efforts aimed at sustainable development in Vietnam.

2.2. VIETNAM AND ITS CULTURE IN THE CONTEXT OF SUSTAINABLE DEVELOPMENT

2.2.1. Introducing Vietnam

Vietnam is a tropical country which has a surface area of 331,100 square kilometres and stretches for more than 1,600 kilometres along the edge of the South-East Asian mainland from the South China Sea to the Gulf of Thailand, with over 3,000 kilometres of coastline. At its narrowest, in the centre, Vietnam is only 40 kilometres wide and it is bordered on the north by China and on the west by Laos and Cambodia. The special location makes Vietnam a country with abundant natural resources namely forestry, marine and mineral but at the same time one of the most disaster-prone countries in the world.

Being a densely-populated developing country with the population just reaching 90 million in early November 2013, in the last 30 years, the country has had to recover from the ravages of war, the loss of financial support from the old Soviet Bloc, and the rigidities of a centrally-planned economy. However since the mid 1980s, Vietnam has experienced a period of rapid economic growth that has been closely associated with re-engagement with the international and regional Pacific Asian economies. These developments have been facilitated by the implementation, since 1986, of a programme of reforms referred to as Doi Moi which has opened the economy to international capital, introduced elements of the market economy and substantially reduced the central control exercised by the state.

In the recent years, Vietnam has enjoyed a high economic growth rate, its economic structures have witnessed a positive shift toward industrialisation and modernisation, its macro-economy remained fundamentally stable and its major economic balances relatively well maintained. The economic achievements have helped create resources for addressing a series of social issues, such as eradication of hunger, reduction of poverty, development of education and healthcare, and partly accomplishment of the Millennium Development Goals. The review of 10 years' implementation of the 2001-2010 Socio-Economic Development Strategy (SEDS) shows that

Vietnam has been to some extent successful in taking advantage of opportunities and favourable conditions and overcoming difficulties and challenges, particularly the impacts of the two regional and global financial and economic crises, and recorded some important achievements (Vietnam Ministry of Planning and Investment, 2011). The most significant achievement has been the country's moving out of the under-development status and into the group of lower-middle-income developing countries in 2009. According to the Vietnamese government's report, many of the key objectives set in the 2001-2010 SEDS have been realised, driving the country onto a new step of development and international integration (Vietnam Ministry of Planning and Investment, 2012b). Being one of the fastest-growing economies in the world, however, entails harnessing new and more complex social challenges and increases pressures on the resource base and environment. Besides the challenge of keeping the economic growth pace, Vietnam currently faces many social and environmental issues such as poor human healthcare services, relatively low living and education standards, hardship and uncertainty for the majority of people especially the disadvantaged and more vulnerable ones, longer-term losses of ecosystem productivity, and reduced environmental quality (The World Bank, 2010; The World Bank, 2007). Like many other countries at the dawn of socio-economic transformation, it is clear that Vietnam has to learn to lead a development that is just and sustainable not only economically but also socially and environmentally.

2.2.2. Vietnamese culture and the challenges in sustainable development

Vietnam is a country with 54 ethnic groups belonging to the language groups: Viet-Muong, Tay-Thai, H'Mong-Dzao, Mol-Khmer, Tang-Myanmar, Malayo-Polinezien and Hoa. The diversity of nations has marked Vietnamese traditional culture, which is inclusive in its nature, with many different styles of cultural expression and preservation of traditional values. Throughout the history, Vietnam has fought for its cultural heritage and independent identity and guarded from external domination. Those circumstances have made understanding of culture as a source of preservation of national and ethnic identity, as a heritage to be guarded and fought for. Culture has been a value celebrated even without material conditions or possibility to develop the industry of cultural activities and expressions (Vietnamese Government, 2000).

A brief timeline of the history of the Vietnamese culture is compiled in *Table 2*. In summary, the cultural personality of the Vietnamese is marked by the following traits (Ngoc, 1998; Pham N. X., 1997):

- The predominance of the Viet ethnic majority, which inhabits the lowlands. The 54 ethnic minorities, who live mostly in the mountains, have their own specific cultures, and have maintained, over the course of history, continual contact with the ethnic majority.

- The Viet culture is made up of a Southeast Asian substratum onto which were grafted foreign cultural elements, especially from Asia (China and India, above all), and the West (France and the Soviet Union)

Time	Phase	Characteristics
The first millennium B.C.	Formation of the Southeast Asian substratum: Bronze age Dong Son culture in the Red River basin	People who cultivated rice in flooded fields, sharing the same language, the same beliefs and the same ways of life; Cultural exchanges with other peoples of Southeast Asia
179 B.C. – Middle of the 19th Century	Acculturation, with Chinese influence predominating	Period of Chinese domination (more than 1000 years): Buddhism and Confucianism's deep influence on material and spiritual culture
		Period of the independent royal dynasties (900 years): persistence of the nation through struggles for independence and expansion to the south; Culture and society marked by Confucianism
Middle of the 19th Century - 1945	Acculturation, with Western (French) influence predominating	French colonisation starting in 1862: modernisation and struggle for national independence crowned by

		the 1945 independence
1945 - present	Cultural independence	Preservation and redefining of cultural identity; Culture and society marked by socialism, and influenced by globalisation and information and technology revolution

Table 2: Timeline of the Vietnamese culture[22]

Since adopting the market-oriented economy of Doi Moi reforms, Vietnam started to be exposed to the globalisation influence, information and technology revolution. A sharp decrease in trade and aid from the Soviet Union in the early 1980s and China's economic reforms in the late 1970s have motivated Vietnam to look for a solution to its deepening poverty and bad economic situations. Whilst remaining a socialist country, it pursues an open-door policy, actively integrating into global economy and international relations. Vietnam has invented a unique combination of market liberalisation and socialist orientation of state-owned enterprises (Bach, 2002). With the Doi Moi reforms, Vietnam is currently undergoing a metamorphosis from a relatively closed society with a centrally-planned economy to a rapidly urbanising one with a global outlook (Le, 2008). These political and economic transformations have been the catalyst for a ferment of changes in culture, with those involved benefiting from the diversifications in patterns of consumption, the slowly increasing levels of wealth and the gradual freeing up of state control over the activities of the people (Drummond & Thomas, 2003).

The current changes in culture in Vietnam, together with the intrinsic values and the diverse historical influences have brought various challenges to the Vietnamese society, especially from the sustainable development point of view. First, the influence of the dominant Western models of consumerism is believed to be significant in the consumption patterns of the population,

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[22] Source: Constructed from (Ngoc, 1998)

especially urban population (Drummond & Thomas, 2003). The dramatic changes in the Vietnamese economy, begun by Doi Moi and fuelled by increasing levels of international investment and aid in the early nineties, have had a profound impact upon the social life and consumer practices of the Vietnamese populace. The changes in the culture underpinning production and consumption attitudes and patterns in the context of rapid economic growth are of particular concern in shifting a country towards sustainable development.

Second, various forms of tangible and intangible heritage resources are under threat from increasing tourism, rapid urbanisation, as well as human activities and natural deteriorations and disasters. In addition, indigenous knowledge systems, such as traditional medicine, as well as endemic gene pools, which are both an integral part of the Vietnamese heritage, are of growing concern as they are being explored and exploited (Le, 2008; Logan, 1998). Whilst tourism and urbanisation are considered among the main contributors to the socio-development of the country, the negative impacts mostly due to inefficient planning and management of cultural resources threaten the availability and possibility of these resources in generating employment, revenues, incomes and boosting the production and growth in the future (The World Bank, 2010).

Third, Vietnam's culturally diverse population, with 54 ethnic groups, each with its own cultural identity and concerns, impacts directly on all development policies. These identities and characteristics complement and sometimes overlap each other. And while they enrich the cultural diversity in Vietnam, they also influence the directions of national unity, equality, community transactions and communications across the country. It is important to recognise that there may exist the cultural values or practices that are not necessarily conducive to socio-economic development and environmental management, for example in relation to health and hygiene, gender roles, or beliefs (UNESCO, 2009). Thus, the challenge also lies in how policies in Vietnam could ensure a continuous process of mutual enrichment and reconciliation of requirements for development and cultural preservation.

Last, and building on the above remark, it is also important to recognise that whilst Vietnam has been exposed to the globalisation influence, information and technology revolution, Vietnamese culture should be regarded as the set of distinctive features that is unique to any other cultures. Any attempts in progressing the development of the country should interpret and respect the associated cultural values and practices. This requires a thorough assessment and an open

dialogue with the concerned communities in determining the kind of cultural characteristics and norms to be adopted in the development process, as well as the kind of development interventions and efforts that are appropriate to the recipient culture (UNESCO, 2009).

2.3. VIETNAMESE POLICY IN RESPONSE TO THE CHALLENGES OF SUSTAINABLE DEVELOPMENT

This section examines the Vietnamese political responses to the international calls for sustainable development, ESD, and culture in sustainable development as documented in chapter 1 (see sections 1.2.1, 1.2.2 and 1.3.2). These responses illustrate the level of awareness and commitment of the Vietnamese government to sustainable development. They play the key role in initiating and shaping the various sustainable development movements in the country that this research seeks to investigate.

2.3.1. The institutional and policy framework for sustainable development in Vietnam

Sustainable development has gained significant attention of the Vietnamese government since as early as the 1990s. Like other countries in the area and over the world, Vietnam realised the unparalleled and complex environmental and sustainability issues associated with the fast changing economic and social contexts. In 1991, the Government established "The National Plan for Environment and Sustainable Development 1991-2000" and promulgated the Law on Environmental Protection, marking the first movement of the country towards environmental sustainability and sustainable development. The view over the need for sustainable development was later affirmed in the Directive 36-CT/TW on the 25th June 1998 of the Political Bureau Central Committee of Communist Party of Vietnam (The Political Bureau). It is stated that "Environmental protection is one of the basic content of the socioeconomic development strategy, policy and plan of all governmental levels and sectors. It is the vital foundation for the achievement of sustainable development and successful implementation of the industrialisation and modernisation of the country" (Directive 36-CT/TW). Following this, sustainable development has gradually increased its status in the Government's development agenda. Most significantly, at the 9th Congress of the National Communist Party of Vietnam in 2001, the national development goal has been established as "fast, efficient and sustainable development that ensures economic growth, social advancement and equality, and environment conservation." At the Congress, the government articulated its development vision for the

coming decade in "The Socio-Economic Development Strategy 2001-2010", which expressed a strong commitment to growth, poverty reduction and social equity.

On the global and regional arena, Vietnam has been an active participant of many international summits and conventions on environment and sustainable development, significant of which are the United Nations (UN) Conference on the Human Environment (Stockholm, 1972), the UN Conference in Environment and Development (Rio de Janeiro, 1992), the World Summit on Sustainable Development (Johannesburg, 2002), and the UN Conference on Sustainable Development Rio +20 (Rio de Janeiro, 2012). At the first Global Ministerial Environment Forum held by the United Nations Environment Programme (UNEP) in Malmo in 2002, among others, Vietnam has ratified the Malmo Ministerial Declaration. By doing this, Vietnam has affirmed its commitment in the speedy implementation of the political and legal commitments entered into by the international community, in particular at the Rio Conference. At the regional – the Association of Southeast Asian Nations (ASEAN) level, Vietnam has also actively contributed to the establishment of a number of regional Ministerial Declarations on environment and development including the declarations of Manila (1981), Bangkok (1984), Jakarta (1987), Kuala Lumpur (1990), Banda Seri Begawan (1994), Jakarta (1997), Kota Kinabalu (2000), Yangon (2003) and Cebu (2006). Some key agreements and milestones reflecting the Vietnamese commitment to international movements on sustainable development are presented in *Figure 3*.
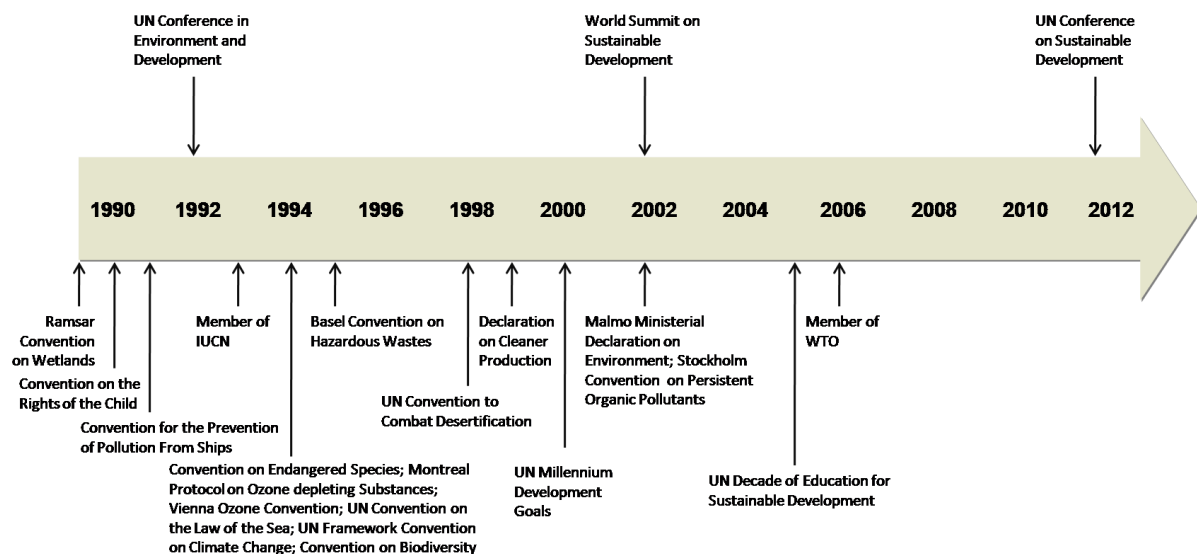
Figure 3. The Vietnamese timeline of commitment to the international movements on sustainable development

In response to the agreements made to the international community at Rio and later on at Johannesburg, the government assigned the Ministry of Planning and Investment (MPI) to develop a National Agenda 21 for Vietnam. In 2004, the "Strategic Orientation for Sustainable Development in Vietnam – Vietnam Agenda 21" was issued (in accordance with the Decision 153/2004/TTg of the Prime Minister), and the Agenda 21 office was established by the Ministry of Planning and Investment (Decision 685/QD-BKH) with the main responsibility of developing action plans, annual and five-year plans for the implementation of the Vietnam Agenda 21. At the highest level of governance for sustainable development, in 2005, the National Council on Sustainable Development was established by the Prime Minister (Decision No. 1032/QD-TTg) with the main tasks of assisting the Prime Minister in the organisation and guiding of the implementation of sustainable development strategies, policies and practices throughout the whole country.

The Vietnam Agenda 21, since its establishment, has become the important strategic framework for ministries, sectors, local governments, associations and individuals to act on and collaborate for the achievement of sustainable development goals. Vietnam Agenda 21 consists of five sections covering the challenges of Sustainable Development facing the country, the guiding principles and policies, the legal and institutional instruments, and the priorities for action. It was developed, not to replace the current comprehensive national plan but to lay a detailed foundation for the implementation of the National Socio-Economic Strategy to the year 2010 and the National Environmental Protection Strategy to the year 2010 orienting to the year 2020, and for the development of the five-year Plan 2006-2010.

The Agenda 21 of Vietnam adopts the Brundtland definition on Sustainable Development and sets out eight general principles of Sustainable Development in Vietnam as (National Council on Sustainable Development , 2006):

1. Human beings are the centre of Sustainable Development.

2. Economic development is the central task that needs to be coupled in solidarity and harmony with social development and environmental preservation based on win-win-win principle.

3. Protection and enhancement of the environment quality is an inseparable factor from the development process.

4. Development must equally satisfy the needs of the present generation without compromising the life of future generations.

5. Science and technology is the foundation and motivation for the country's industrialisation and modernisation processes, and its rapid and sustainable development.

6. Sustainable Development is the cause of the whole Party, all levels of governments, all ministries, sectors and localities, all agencies, businesses and social associations, all communities and citizens.

7. Promoting an independent and autonomous economy while actively integrating with the global economy.

8. Socioeconomic development and environment protection should be closely combined with ensuring the national military defence and social security and safety and order.

It could be observed from Vietnam Agenda 21- the strategic orientation that the Vietnamese government has come to understand and approach sustainable development with the three-pillar model of development: economic growth, social progress and equality, and environmental preservation as it states:

> "Sustainable development means that all three major aspects relating to mankind life as economy, society and environment must be harmonized, combined comprehensively and integrated and balanced effectively through policies, mechanism, tools and processes of implementing policies." (Vietnam Agenda 21 Office, 2008).

The nineteen priorities for Sustainable Development are grouped into three dimensions of economic sustainability, social sustainability and environmental sustainability (see *Figure 4*).
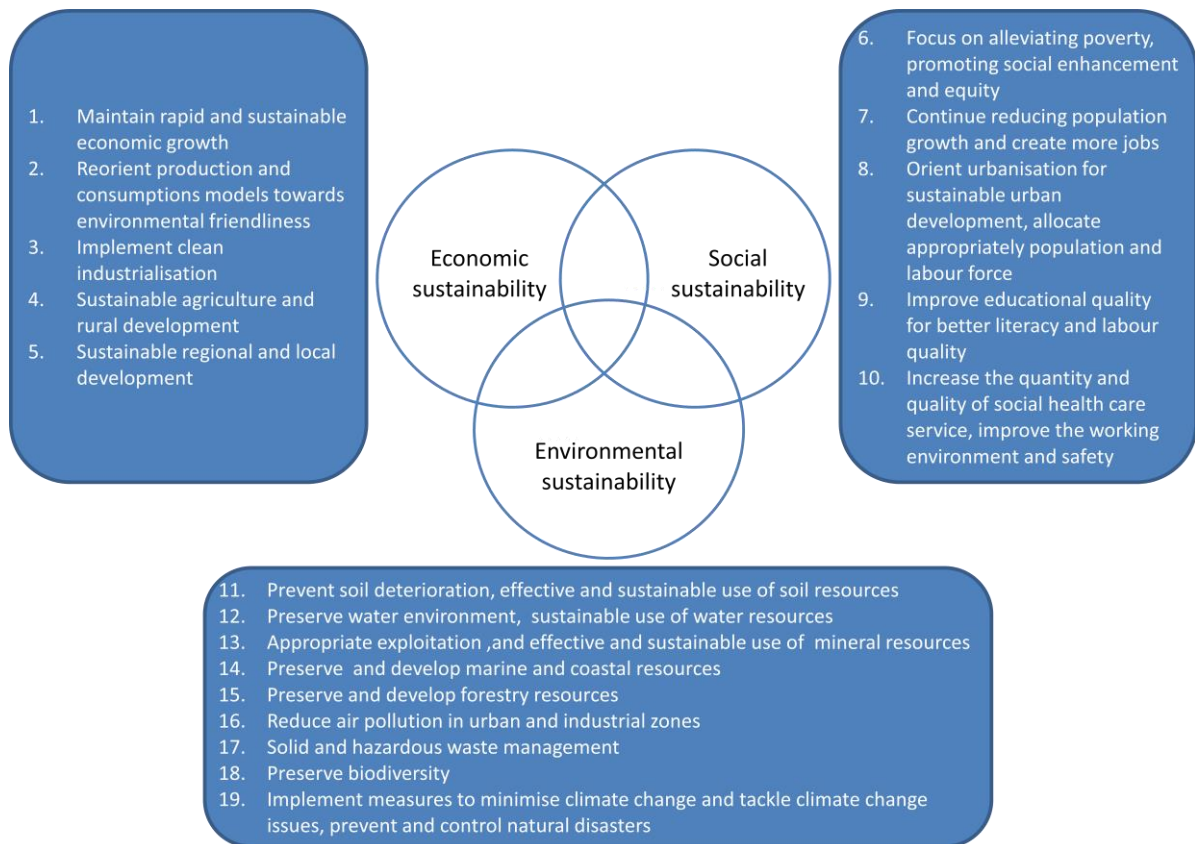
Figure 4. Sustainable development priorities in Vietnam

After the establishment of the Agenda 21, the government has assigned the National Council on Sustainable Development to set out guidelines for the development of Sustainable Development Plan for different sectors. The Council which consists of senior officials from the ministries, has the responsibility of ensuring and monitoring the progress made by associating sectors. The Circular No 01/2005/TT-BKH issued by the MPI in 2005 provides a specific guidance for governments at provincial level, which includes various steps of the process to develop a local Sustainable Development Plan.

Ever since, several sectors have been actively responding to the sustainable development call. Four ministries in Vietnam namely Industry and Trade, Natural Resources and Environment, Fisheries and Construction have developed the Agenda 21 for the sectors. The Ministry of Industry and Trade (MOIT), and the Ministry of Natural Resources and Environment (MONRE) have established the steering committees for sustainable development (Vietnam Ministry of Planning and Investment, 2011). These committees have played a critical role in catalysing

sustainable development efforts in the sectors through developing policies as well as initiating programmes and projects aimed at progressing sustainable development. Examples in the industry sector include the "National Programme on energy efficiency" from 2006, the "National Plan to monitor environmental impacts towards 2010" and the strategy on "Cleaner Production in the Industries towards 2020". In the area of natural resources and environment, the steering committee has established the Agenda 21 for the sector in which nine priority goals, along with a number of policies and programmes to support the achievement of these goals, are outlined (Vietnam Ministry of Natural Resources and Environment, 2011). Sustainable development offices have also been set up in 26 of the 63 cities and provinces in Vietnam to help realise the central government's vision for sustainable development at local communities (Vietnam Ministry of Planning and Investment, 2011).

Following the overarching Agenda 21, the Vietnamese government continues to demonstrate their commitment to foster actions towards sustainable development through a number of policies and programmes focussing on the Agenda 21's nineteen areas of priority (Vietnam Ministry of Planning and Investment, 2011; Vietnam Ministry of Planning and Investment, 2012b). (A table capturing these movements is provided in the appendix)

Most recently at the UN Conference on Sustainable Development Rio +20 in 2012, the Vietnamese government has announced their strategy to follow the green growth model for development in the coming period. The Vietnamese government presents their view over green growth as[23]:

> "the process of restructuring of economic activities and infrastructure to obtain better results from investments in natural, human and financial resources, while reducing greenhouse gas emissions, exploiting and using less natural resources, creating less waste and reducing the social inequality."

It is argued that the approach fits with the perspective and orientation set by the 11th Congress of the Communist Party of Vietnam in 2011 and elaborated in the Socio-economic Development Strategy for the period 2011-2020:

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[23] As presented by the Vietnamese government at the UN Conference on Sustainable Development Rio +20 in 2012, see http://www.uncsd2012.org/index.php?page=view&nr=420&type=1000&menu=126 (last accessed 20/08/2012)

"It is required to develop a sustainable economy, to maintain macroeconomic stability and ensure economic security. To promote economic restructuring, transformation of growth model, give top priority to growth quality, productivity, efficiency, competitiveness; focus on intensive development and knowledge economy. Economic growth must be combined in harmony with cultural development, social progress and equity, continuous improvement of the quality of life of the people. The socio-economic development should always take into account the protection and rehabilitation of the environment and active response to climate change".

The Vietnamese green growth strategy is currently in formulation and meant to be an overarching document for sectors, localities, organizations and individuals in Vietnam. Its aim is to shift the growth pattern towards the efficient use of natural resources and reduction of greenhouse gas emissions, restructure the economy towards sustainable development, and mitigate impacts of climate change (Vietnam Ministry of Planning and Investment, 2012b).

2.3.2. Vietnamese policy for Education for Sustainable Development

Ever since the awareness about sustainable development was raised in the country's leading Party and the government, environmental education and later on, ESD has been highlighted in the Party's, governmental and other authoritative documents as key in the national Sustainable Development agenda. The Vietnam Agenda 21 identifies education as one priority area for the attainment of sustainable development and states:

> "The responsibilities of education and training sector in sustainable development strategy is to continuously strive for improvement in the people's intellectual level, create equal opportunities for people to access education and training services and improve the quality of human resources as well as develop individual capacities." (2008, p. 27)

However, the viewpoint over ESD is not explicitly expressed in this important document. The stress is on education about environment protection and sustainable development with the aim of raising awareness amongst the people. A policy review of the ESD journey in Vietnam[24] suggests that ESD only started to receive attention of the Party and the Government in recent years. However, the last two decades have witnessed the establishment of some policy strands

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[24] Being done by the researcher as part of the literature review for this research.

in the Vietnamese education policy that provide the grounds for ESD promotion at the national level. The first one is environmental education, one of the foundations of ESD.

The first Vietnamese Law on Environmental Protection issued in 1993 defines environmental education for all citizens as one of the main responsibilities of the government in the cause of environmental protection (Vietnamese Government, 1993), and the revised version of the Law in 1995 once again stipulates that "Vietnamese citizens should receive comprehensive education on environment in order to enhance knowledge and awareness of environmental protection" (Vietnamese Government, 2005). In 1998, the Political Bureau issued Directive No. 36/CT-TW stating that environmental protection remains a critical issue of the country, and providing "Instruction on Strengthening Environment Protection Activities in the period of Industrialisation and Modernisation of the country". In 2001, the Prime Minister signed the approval of the scheme on "The inclusion of Environmental Protection contents into the Programme of the National Education System" (Decision No. 1363/QD-TTg). The Decision goes further by not only stating the importance of integrating environmental protection contents into the teaching activities in educational settings, but also stressing that environmental education should as well be delivered in the out-of-school contexts aiming at the whole communities. Most remarkably, the Political Bureau's Resolution No. 41/NQ-TW on "Environmental Protection in Industrialisation and Modernisation of the country" in 2004 considers propaganda and education the first among seven solutions for environmental preservation, and requires "the integration of environmental protection content into curricula, textbooks of the national education system, an increase of allocated teaching time, and the development of official subjects for the secondary level". In response to the governmental policies, the Vietnamese Minister of Education and Training, in 2005, promulgated the Directive No. 02/2005/CT-BGD&DT on strengthening education on environmental protection. It is important to mention that in this directive, the important goals of environmental protection are stated as not only making people clearly understand the need of environmental protection, but also forming habits and behaviours that show respect to the living environment, promoting skills for recognising and actively managing particular environmental issues. The policy marks a new approach to environmental education in Vietnam: education on the environment, education in the environment and education for the environment.

The second strand of policy that closely relates to ESD is one on building child-friendly schools and active students. The concepts of Child-Friendly Schools and Inclusive Learning-Friendly Environments were initiated by the United Nations Children's Fund (UNICEF) in 1998. These concepts were also introduced by UNESCO in 1994, and have been particularly promoted by UNESCO in the Asia and the Pacific region since 2004. In 2008, the Vietnamese Ministry of Education and Training (MOET) launched the campaign "Building child-friendly schools and active students" in the period 2008-2013 (Directive No. 40/2008/CT-BGD&DT). The objectives of the campaign are to build a safe, friendly and effective educational environment suitable to local conditions and meeting social needs, and to promote the pro-activeness and creativity of students in learning and in public activities in an effective and appropriate manner. The initiative is set to be implemented in all provinces and all general education institutions, and MOET has provided further guiding policy documents to ensure the successful implementation: the Plan for the Implementation of the campaign (No. 307/KH-BGD&DT) for school managers, and the Inter-sector Plan for the Implementation of the campaign (No. 7575/KHLN/BGD&DT) issued by the Ministry in collaboration with other concerning ministries and associations for coordination across related sectors.

The third strand relating to ESD is the policy that promotes Vietnamese society as a learning society. In 2005, the Prime Minister approved the Proposal for "Building learning society in the period 2005-2010" (Decision No. 112/2005/QD-TTg) confirming the viewpoint of the government as "building up the Vietnamese society as a learning society in which all people at all ages are given the opportunities and favourable conditions for regular, continuous and lifelong learning at any place, any time and any level of education". The policy aims at increasing the social literacy especially for the ethnic minorities, and providing living and working skills for people from all walks of life to improve the living quality. The government encourages the provision of learning opportunities particularly in poor socioeconomic areas and development of Community Learning Centres in localities nationwide. Whilst not entirely covering the concept of ESD, environmental education and other educational initiatives implemented in Vietnam have shown the gradual increase in the awareness and understanding of the Vietnamese leaders over the importance of an innovative educational approach which helps realise the country's sustainable development goals.

It was the launch of the United Nations Decade of Education for Sustainable Development (DESD) 2005 -2014 that has created a remarkable impact which contributes to raising the profile of ESD in Vietnam to a new level. Since 2005, Vietnamese government has expressed a high level political commitment in the implementation of UNDESD 2005-2014. In November 2005, the Prime Minister signed the Decision No 295/QD-TTg on the establishment of the Vietnam National Committee for Decade of Education for Sustainable Development headed by a Deputy Prime Minister and comprised of representatives from relevant ministries/sectors. In February 2006, the UNDESD was officially launched in Hanoi marking a starting point of more active involvement in and implementation of ESD in Vietnam.

In the first five years of the DESD, Vietnam has focused on research and consultation strategies, and implemented awareness-raising and networking activities (National Commitee for the Decade of Education for Sustainable Development , 2010). The highlights of the first half of the DESD in Vietnam are the country's ratification of the Bonn Declaration in March 2009; and the close cooperation between the state and UNESCO Hanoi in ESD activities in UNESCO associated schools network (Vietnam Ministry of Planning and Investment, 2011). A number of conferences and training workshops for ESD capacity building have been held with some most significant ones include: (i) two national seminars on "Raising Awareness on Education for Sustainable Development" organised for the leaders of the Provincial Department of Education and Training (DOET) and People's Committees in Hanoi and Ho Chi Minh city in 2007; (ii) the conference on "Networking for Research and Implementation of Education for Sustainable Development Activities in Vietnam" in 2007 and; (iii) the seminars on "Integrating Education for Sustainable Development in the Curriculum of the Community Learning Centres" in 2007-2008. Partnership for ESD has been initiated, for examples, (i) the National Committee for DESD, along with UNESCO Hanoi, has signed a cooperative agreement with the Agenda 21 office to investigate the possibility of using some biosphere reserves in Vietnam as "learning laboratories" for ESD; and (ii) an ESD Forum which gathers different organisations including UNESCO Hanoi and the Live and Learn centre has been set up to promote collaboration for ESD activities in Vietnam. Research centres and institutions focusing on ESD have also been established, such as the Centre for Research and Promotion of ESD and the Centre for Education Technology.

Approaching the second half of the DESD, in the Action Plan of ESD for 2010-2014, the National Committee declared the overall goal as

"to promote education as a foundation for a more sustainable society, and to integrate sustainable development elements into education system at all levels in order to encourage changes in behaviour for a more sustainable future for all" (National Commitee for the Decade of Education for Sustainable Development , 2010, p. 6).

It continues to state the objectives of the Action Plan which include:

- To continue in raising awareness and capacity for implementing ESD: education is the foundation for sustainable development, and people are the subject and heart of sustainable development;

- To translate awareness of sustainable development into practical actions through integrating and embedding the concepts and contents of Agenda 21 into educational strategies, policies, and programmes; To promote educational renovation, building the education strategy for 2011-2020 and reform the curriculum towards Sustainable Development; and,

- To strengthen partnership and cooperation among all stakeholders, sectors and agencies, between the state and local and international businesses in all sectors and at all levels, in all forms of education (formal and non-formal), and in all educational areas to promote ESD.

The fundamental principles underlying the Vietnamese Action Plan for ESD are: i) it seeks to fulfil the national sustainable development objectives (Agenda 21); ii) ESD is for everyone and everyone is responsible for getting involved in ESD whether in the family, school or society, in formal or non-formal education; iii) ESD contributes to efforts, strategies and plans for educational development, curriculum reform and renovation; iv) it also contributes to addressing other emerging issues in Viet Nam and worldwide, such as climate change, natural disasters, and epidemics; and that v) the national ESD polices and plans are commonly shared but implementation must be diverse and locally appropriate (National Commitee for the Decade of Education for Sustainable Development , 2010). The Action Plan also sets out eight main areas of content on which ESD efforts in Vietnam need to focus, and under each area, elaborates different activities which should be undertaken (see *Figure 5*).
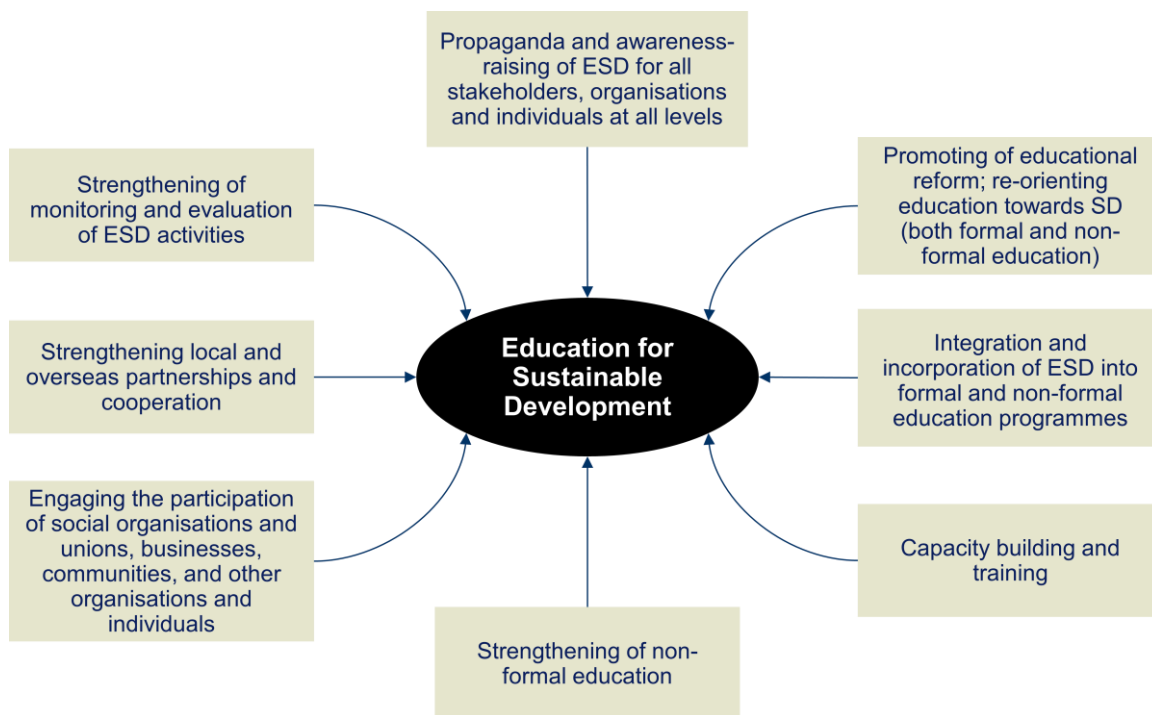
Figure 5. Main contents of the National Action Plan for Education for Sustainable Development in Vietnam (2010-2014)

Aware of the wide coverage of the ESD Action Plan in which the contents relate to areas under management functions of different ministries and sectors, the Vietnam National Committee for DESD has stressed the importance of collaboration in the implementation of the Plan. While the National Committee takes the main responsibility, it set out a clear list of key actors with respective tasks and responsibilities (see *Table 3*).

Key actor	Responsibility
Ministry for Foreign Affairs	Managing and ensuring the collaboration of other ministries and relating organisations in the implementation of the Plan
Ministry of Education and Training	Promoting educational reform and reorienting education towards sustainable development; incorporating and integrating ESD into formal and informal education;

Key actor	Responsibility
	training and building staff capacity for ESD implementation; Improving non-formal education
Ministry of Culture, Sports and Tourism	Providing recommendations for SD themes to be integrated in cultural, sports and tourism programmes and activities; implementing and integrating the related activities in the Plan
Ministry of Information and Communication	Providing recommendations on awareness raising activities for all levels, sectors, and people in sustainable development; implementing and integrating activities to inform and publicise about sustainable development and ESD on mass media channels at central and local levels
Ministry of Natural Resources and Environment	Providing recommendations on contents relating to natural resources management, environmental protection and climate change which need to be incorporated in ESD activities; implementing the related activities in the Plan
Ministry of Science and Technology	Providing recommendations on contents relating to science and technology which need to be incorporated in ESD activities; implementing the related activities in the Plan such as, awareness raising about green energy and clean technology
Ministry of Agriculture and Rural Development	Providing recommendations on contents relating to agriculture which need to be incorporated in ESD activities; implementing the related activities in the Plan such as,

Key actor	Responsibility
	education for natural disasters management and prevention, sustainable rural development, forestry, fishery sustainable production models.
Ministry of Planning and Investment	Managing and collaborating with relevant ministries/sectors to integrate various activities of the Plan into the Agenda 21; proposing plan for the implementation of the national plan and the comprehensive educational project towards achieving Agenda 21's goals; seeking support from international organisations, businesses, organisations and individuals to help achieving the Plan's objectives
Ministry of Finance	Providing guidance on budgeting for ESD Action Plan implementation in accordance with the State Budget Law; monitoring the management and utilisation of expenditures
Viet Nam Academy of Natural and Social Sciences and the Academy of Science and Technology	Collaborating with relevant ministries/sectors to propose relevant activities to raise awareness and promote sustainable development models on the basis of balance between the environment and culture, between human beings and the nature
Provincial/City People's Committees	Organising the implementation of ESD Action Plan in the respective provinces; monitoring the progress and submitting report to the National Committee for DESD

Key actor	Responsibility
Vietnamese Fatherland Front, National Farmers Union, Women's Union Central Committee, Ho Chi Minh Communist Youth Union Central Committee, Businesses' Associations, NGOs and other social organisations and unions	Collaborating closely with relevant ministries, sectors and governments of different levels to implement, promote and seek resources for ESD activities in various localities.

Table 3. Key actors in the implementation of the National Action Plan on Education for Sustainable Development in Vietnam (2010-2014)

The ESD Action Plan was meant to show the strong commitment of the Vietnamese Government in promoting ESD in Vietnam, and serve as a good guiding framework for further work on ESD in Vietnam in the coming years.

Apart from the ESD Action Plan, however, a review of the development of key policies on education in Vietnam over the last decade has shown a rather sombre picture with regards to ESD. The review suggests that ESD in policy has been merely the response of the Vietnamese government to the international call namely the DESD, and has not become a guiding principle or core part of the government's orientation in education development. Worthy of attention in the review are the two recent national documents on education and higher education including the National Strategy on Education Development in 2011-2020 ratified by the Prime Minister in June 2012 and the Resolution on the "Fundamental and Comprehensive Reform of Higher Education in Vietnam 2006-2020" (also known as the Higher Education Reform Agenda, or HERA) promulgated in 2005. The National Strategy on Education Development, representing the most up-to-date view of the government on how education in Vietnam in general would be, states:

> "Approaching the year 2020, the Vietnamese education will be fundamentally and comprehensively reformed towards standardised, modernised, socialised, democratised and internationally integrated; the education quality will be improved in all aspects including moral

education, life-skills, the ability of creative thinking and practice, language and computing skills; education will meet the demand of human resources, especially the high-quality human resources for the cause of industrialisation and modernisation of the country, and development of the intellectual economy; education will ensure the social equality and lifelong learning opportunities for all citizens, gradually progressing towards a learning society." (2012)

The strategy is the highest - level authoritative document which shapes the country's educational policies and actions in the decade 2011 - 2020 through outlining the strategic objectives and solutions, as well as a general roadmap and responsibility assignment for the implementation of the strategy. HERA, on the other hand, presents a vision of what the Vietnam's higher education system should become, and it has, since then, been the most important strategic document, being central to many discussions and workshops on policy making and planning in higher education. The general aim of HERA is expressed as follows:

"To carry out fundamental and comprehensive reform of higher education; undertake a process of profound renews in the area of the quantity, quality and effectiveness in order to meet all the demands of industrialisation, modernisation, global economic integration and society's demand for learning opportunities. By 2020, Vietnam aims to have a higher education system that is advanced by international standard, highly competitive, and appropriate to the socialist-oriented market mechanism." (2005)

Even though the visions of these two key documents embrace some elements of ESD, a scanning through the bodies of the documents found no specific reference to sustainable development or education for sustainable development. The failure to mainstream ESD in educational policies has also been identified when reviewing the latest report of MOET to the Government on the response of the sector to the Agenda 21 in the period 2006-2010 (Vietnam Ministry of Education and Training, 2010a). Whilst the report touches on the efforts of integrating the concept of sustainable development in the curriculum, it misses out the other key points that underpin sustainability generally being advocated for in the international ESD literature (see section 2.4.1). The accompanied list of educational policies related to ESD provided by MOET provides further evidence for this remark.

This finding signals a lack of appreciation of ESD as a journey that requires a paradigm shift rather than a checklist to be ticked off or a component to be added in. At policy level, it seems

that the Vietnamese government and educational authority have yet to fully recognise the need for and engage in the envisioning and planning for a transformation of ESD.

2.3.3. Culture in Vietnamese development policies

After a period of being forgotten in war time, neglected by the early Socialist regime and suffered limitations due to economic difficulties, cultural aspect has, since the Doi Moi reforms, started to gain more attention in the Vietnamese development policies and strategies. Over the years, cultural factors have increasingly played a significant role in the development agenda of Vietnam.

The Vietnamese government has placed high value on the international declarations and normative initiatives of the United Nations[25], led by UNESCO, in this regard (Pham N. X., 1998). Most notable of these documents are the Rio Declaration on Environment and Development and the Agenda 21 adopted at the UN Conference on Environment and Development in 1972[26]; the UNESCO Universal Declaration on Cultural Diversity adopted at the 31st Session of the UNESCO General Conference in Paris in 2001; the Johannesburg Plan of Implementation from the World Summit on Sustainable Development in Johannesburg in 2002[27]; and, the Outcome Document of the 2010 Millennium Development Goals (MDGs) Summit in New York[28]. These

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[25] A historic turning point in the recognition of the role of culture in development was the World Conference on Cultural Policies (MONDIACULT) convened by UNESCO in Mexico in 1982. This conference laid down the initial working definition of culture that has subsequently informed the work in this area.

[26] The Agenda 21 recognises the crucial role of culture in sustainable development by emphasising cultural considerations in the implementation of programmes in a number of areas such as human settlements, education, health and population activities. It calls for specific attention to cultural groups, highlights their roles and urges states to "recognise and duly support their identity, culture and interests and enable their effective participation in the achievement of sustainable development"(Principle 22 in Annex 1: Rio Declaration on Environment and Development, of Resolution 1 adopted at the UN Conference on Environment and Development in 1992)

[27] The UNESCO Declaration on Cultural Diversity and the Johannesburg Plan of Implementation reiterate the crucial role of culture for sustainable development, as well as underline the importance of maintaining cultural diversity and promoting the effective participation of cultural communities in decision and policy making.

[28] Culture was viewed as a factor contributing to the achievement of the MDGs (United Nations General Assembly, Outcome Document of the 2010 Millennium Summit, Keeping the Promise: United to achieve the Millennium Development Goals, A/65/L.1, New York, 2010). The crucial remarks from the Outcome Document of the 2010 MDGs Summit were reiterated in two consecutive "Culture and Development" UN General Assembly Resolutions in 2010 and 2011, which advocate for the mainstreaming of culture into development policies and strategies. The overarching message of all these initiatives is that they call for the establishment of culturally-sensitive development agendas which pay attention to the contribution of

key documents set the international framework for the establishment of policies on culture in development, and support governments including the Vietnamese government in their policy development. Other remarkable movements include the World Commission on Culture and Development[29], the Inter-governmental Conference on Cultural Policies for Development in Stockholm in 1998, and the World Culture Report[30], all of which advocate and reinforce the concept that sustainable development and culture go hand in hand. Apart from the declarations adopted over the last two decades, there is a set of conventions and agreements which legally bind member states in the area of culture[31]. These legal instruments provide important tools for the harmonising of national legislation to be on par with international standards. By adopting these declarations and signing, ratifying and acceding to UN conventions and agreements, Vietnam has sent a signal to the international community of its current stand in relation to culture and sustainable development and related policies.

Through the country's recognition and active participation in the United Nations World Decade for Cultural Development (WDCD)[32], its main objectives were taken into consideration in the resolution of the Fifth Conference of the Central Committee of the Communist Party of Vietnam emphasising on "building a progressive culture with the character of the Vietnamese nation". The resolution was then concretised into detailed policy measures and action programmes of

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the tangible and intangible facets of culture in development and also recognise that since cultural factors influence lifestyles, behaviour, patterns, values and the human ways of interaction, change for sustainable development will need to engage with and utilise culture in an appropriate manner.

[29] The independent World Commission on Culture and Development, chaired by Javier Perez de Cuellar, former Secretary General of the United Nations, was established during the WDCD and completed its work in 1995.

[30] (UNESCO Culture sector, 2000)

[31] Some examples include: the 1950 Agreement on the Importation of Educational, Scientific and Cultural Materials (Florence, 1950; Nairobi, 1976); the Convention concerning the Protection of the World Cultural and Natural Heritage (Paris, 1972); the Convention for the Safeguarding of the Intangible Cultural Heritage (Paris, 2003); and the Convention on the Protection and Promotion of the Diversity of Cultural Expressions (Paris, 2005)

[32] The United Nations World Decade for Cultural Development (WDCD) was launched during the period 1988-1997. Together with the debates at the World Summit on Sustainable Development in Johannesburg in 2002, the WDCD contributed to the improved understanding of the interaction between cultural factors and the development process and stimulated many concrete initiatives around the world (UNESCO, 2012). In the first series of international conferences, which initiated the still evolving process of bringing culture to the heart of the policy making agenda, it was noted that "the diversity of national cultures, their uniqueness and originality are an essential basis for human progress" (Quoted from the Resolution adopted at the Intergovernmental Conference on Institutional, Administrative and Financial Aspects of Cultural Policies, Venice, Italy, 1970).

related ministries, sectors and organisations. Parallel to the principal drive for economic reform and growth, Vietnam strives to meet the WDCD objectives, where policies formulated recognise the cultural factors in development (Le, 2008). Toward this end, research work of Vietnamese scientists and practitioners has aimed at clarifying the concept and role of culture, particularly its contribution to national socio-economic development, along with the country's integration into the international community. The results of these efforts are seen in the substantial number of books written about Vietnamese culture during the period of the WDCD[33].

At the policy level, the socio-economic development measures and targets for the period 2011-2015, as approved by the National Assembly of Vietnam, include the provision "to strive for successful implementation of national pilot cultural programmes, increase investment for activities that boost cultural and art creativity, reorganise with a view to improve quality of cultural service establishments, and widen the national campaign to promote culture lifestyles, especially at grassroots level."[34] The Government Cabinet has recently reviewed a ten-year development programme for culture with a broad ranging vision for culture development. The programme seeks to strengthen Vietnamese culture, enable citizens to participate in cultural activities, build a healthy environment while maintaining and promoting cultural heritage and creating new cultural values. It was reaffirmed that culture is considered as the spiritual foundation of the society, and both the target for and driving force of socio-economic development. In this programme, cultural development is considered a long-term revolutionary cause of the entire people, which aims at achieving an advanced culture imbued with national identity, patriotism and national unity, and promoting the spirit of independence and self-reliance in building a socialist Vietnam[35].

In relation to economic growth and poverty reduction, the role of culture has been acknowledged by the Vietnamese government and embedded in its strategies. For example, the

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[33] Some key publications include: Culture and Development: A view from Vietnam (Pham N. X., 1997); Culture in Development and Globalization (Nguyen, Ho, & Pham, 1996); Issues on Culture and Development (Hoang, 1996); Culture in Development of Vietnamese Society (Thanh, 1996); Culture and Business (Pham N. X., Culture and Business, 1996); Culture and Art in Social and Human Development (Dinh, 1995)
[34] Socialist Republic of Vietnam (Resolution 10/2011/QH13), Socio-Economic Development Targets for 2011-2015, adopted by the National Assembly on 08 November 2011
[35] Prime Minister of Vietnam (Decision 581/QĐ-TTg), National Strategy for Cultural Development towards 2020, issued on 06 May 2009

Comprehensive Poverty Reduction and Growth Strategy recognises that major policies and measures to develop sectors and industries to promote poverty reduction and sustainable growth must also recognise culture, in support of these actions to "development an advanced culture, strong national identity" and "preserve and restore the tangible and intangible cultural heritage to serve as a foundation for cultural exchanges among communities and regions throughout the nation as well as in the international arenas."[36]

2.4. VIETNAMESE CONTEXT FROM THE SUSTAINABLE DEVELOPMENT PERSPECTIVE

This section examines the country's recent development under the economic, social and environmental dimensions. It seeks to understand the current achievements and the issues being faced in Vietnam. From a holistic point of view, this brief review of the Vietnamese context suggest that since the economic growth has not been harmoniously combined with social progress and equity, and protection of natural resources and the environment, the quality and sustainability of growth in Vietnam remain a source of concern. The conclusion is that, whilst Vietnam has fulfilled some short-term development objectives, the foundation for the country to secure a sustainable future has not sufficiently taken shape.

This section ends by discussing the role that Vietnamese culture plays in the country's progress towards sustainable development, as well as opening up the question about the need for a culturally appropriate approach in efforts aimed at sustainable development in Vietnam. This information is useful for understanding the context in which this research is framed. It clarifies the need for cultural factors to be taken into account in initiatives and actions aimed at sustainable development which is central to this research.

2.4.1. Economic development

Vietnam is commended by the international community as one among the developing countries with noticeable achievements in economic reform toward growth and poverty reduction (The World Bank, 2004; The World Bank, 2010). In recent years, the Vietnamese economy has grown relatively rapidly and stably. Its GDP growth during 2000-2008 has averaged at a high rate of

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[36] Socialist Republic of Vietnam, The Comprehensive Poverty Reduction and Growth Strategy (CPRGS), Hanoi, 2002

7.85%. In 2011, the GDP growth rate of Vietnam was 5.9% with main reason for decrease being the recurrent macro-economic instability. Both the size of the economy and the productive capacity of all sectors have increased. Its GDP in actual price in USD was estimated at USD 101.6 billion or 3.2 times that in 2000[37]. GDP per capita in 2011[38] increased three times from the 2000 level (Vietnam Ministry of Planning and Investment, 2011). In 2009, Vietnam has moved into the group of lower middle income countries from being one of the poorest countries in the world (ibid).

In agriculture, major achievements have been recorded in Vietnam, most notably those in food production, aquaculture and industrial plants. From being a country short of food, Vietnam has emerged not only sufficient in food for domestic consumption and assured of its national food security, considering an annual population increase of approximately one million, but also the world's 2nd largest rice exporter. Its economic structure has made a transformative change, from being a country with agriculture accounting for more than 40% of GDP 20 years ago, to being a country with industry and services currently accounting for as much as 80% of GDP (Vietnam Ministry of Planning and Investment, 2011). Economic regions have also enjoyed vigorous development. In this process, along with reform of the state sector, facilitation has been given to domestic and foreign private economic sectors[39] to develop with growing competitiveness.

The market reform and economic growth promotion in Vietnam have coupled with the country's deep integration into the global economy, attraction of foreign investments and exploitation of international market opportunities to boost export growth. More than 20 years since the launch of Doi Moi have witnessed Vietnam establish trade relations with nearly 200 countries, sign more than 90 economic agreements on bilateral trade, and welcome over 84 countries to have an investment project in Vietnam (Vietnam Ministry of Planning and Investment, 2012b). Since 1995 when admitted into the Association of Southeast Asian Nations (ASEAN), Vietnam has committed to trade liberalization under the ASEAN Free Trade Area (AFTA), become a member of the World Trade Organization (WTO) and participated in the Asia-Pacific Economic Cooperation forum (APEC). Such memberships have provided Vietnam an anchor to the global

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[37] In comparative price, the GDP in 2010 was more than two times that in 2000 (Vietnam Ministry of Planning and Investment, 2011).

[38] As over USD 1,200 USD in nominal price (Vietnam Ministry of Planning and Investment, 2011).

[39] Now accounting for two thirds of the country's GDP and the vast majority of the workforce.

market, brought more openness and reinforced the domestic economic reform process (The World Bank, 2012). Its export turnovers have doubled from over USD 48 billion in 2007 up to USD 96 billion in 2011. Foreign direct investment has seen record new commitments with the realised capital reaching an increasingly large amount, accounting for approximately 20% of the country's general total investment, a higher rate than that in many other countries, including China (Vietnam Ministry of Planning and Investment, 2012b).

However, rapid growth has revealed new structural problems; the quality and efficiency of the economy remain low (The World Bank, 2012; Vietnam Ministry of Planning and Investment, 2012b). Economic growth has mainly been extensive and based on increased domestic and foreign investments as well as on exploitation of raw natural resources, and the competitiveness is lacking in both domestic and offshore markets. The social productivity is declining and considerably lower than that in other countries in the region. Skill shortages are becoming more widespread whilst the scientific and technological innovation content in industrial and agricultural production remains very limited. The growth in many economic aspects have mainly relied on export of raw natural resources or subcontracting industry with a low value-added content and lack of diversification, for example the wood, mining and food industries (The World Bank, 2012).

Approaching the landmark year of 2020 when Vietnam aims to transit its economy to an industrialised and modern one, the latest Socio-Economic Development Strategy 2011-2020 identifies the country's key priorities to meet this ambitious target: stabilise the economy, build world-class infrastructure, create a skilled labour force, and strengthen market-based institutions. However, with the bouts of macroeconomic turbulence (i.e. double-digit inflation, depreciating currency, capital flight, and loss of international reserves and investor confidence) experienced in the recent years, recent studies indicate that Vietnam's competitiveness[40] is under threat and the country is facing many challenges in meeting these aspirations (Van Arkadie, et al., 2010; The World Bank, 2012).

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[40] In 2009, Vietnam ranked 75th for global competitiveness among 133 countries surveyed, well behind some of its important neighbours, including Singapore (3rd), Malaysia (24th), China (29th), Thailand (36th) and Indonesia (54th) (World Economic Forum, 2009).

2.4.2. Social development

Data from national and international studies suggest not only that there is remarkable economic growth, but also there is progress with respect to key indicators of wellbeing (Vietnam Ministry of Planning and Investment, 2011; The World Bank, 2007; UNDP, 2011). Over the last two decades, efforts on poverty reduction, population, public healthcare, education and training, and generation of employment for the people in Vietnam have all yielded initial encouraging results. The Vietnamese government has shown strong commitments and put many efforts in achieving the Millennium Development Goals (MDGs). Importance has been attached to social security with a view to ensuring stability for the people's livelihoods and production, especially given the high inflation and frequent natural disasters. The rate of poverty has gone down sharply, from 60% in 1993 to 28.9% in 2002 to 9.45% in 2010, an average of 2% reduction per year on the national scale (Vietnam Ministry of Planning and Investment, 2012b; The World Bank, 2007). The average income of a poor household has doubled during 2002 - 2010, with the poor's livelihoods improved and the rural and mountain areas' physiognomy witnessing considerable changes. The population's housing conditions have remarkably improved. The implementation of policy to do away with poor people's poorly built houses has continued, with people living in poverty-stricken areas or areas in especially difficult circumstances enjoying materials or financial support to have their housing conditions improved. Whilst poverty recurrence in disadvantaged areas such as high mountain areas, ethnic minorities' areas and natural disaster-prone areas remains high, a recent study of the World Bank on social issues in Vietnam reports an encouraging sign of convergence of poverty declines in richer and poorer areas (The World Bank, 2007),

The average annual population growth rates have gone down gradually, from 2.33% in 1998 to being 1.2% during 1999-2009 and staying at 1.14% in 2010 partly as a result of the vigorous family planning campaigns implemented over the last two decades (Vietnam Ministry of Planning and Investment, 2012b). The scale and network of healthcare have both expanded across the country. Alongside the State healthcare system, the private healthcare system has started to develop. The quality of health check and treatment at health stations, of the preventive medical work and of the control of diseases has improved. The under-1 child mortality rate has been brought down to 25 per thousand, whereas the child malnutrition rate has come down to 18% per year, below the country's targets for the period and within the

likelihood of MDGs achievement. Improvements in living standards and healthcare have increased life expectancy[41]. However, the population structures have seen strong changes and increasingly serious sex imbalance. Moreover, whilst traditional infectious diseases are receding, emerging communicable diseases such as SARS, HIV/AIDS and Avian Influenza pose new threats to public health (The World Bank, 2007). Recently, food contamination, food poisoning and disease contagion through food have been warned as pervasive and beyond the government's control[42]. Weaknesses and shortcomings in healthcare for the people still persist. The most significant ones include discrepancies and inequalities in health services especially in the remote and ethnic minorities' areas, monopoly and lack of monitoring mechanism in medicine manufacturing, management and use, and inappropriate drug policies (The World Bank, 2007; Van Arkadie, et al., 2010).

Vietnam's strong record in terms of growth and poverty reduction has been associated with only modest increases in inequality. According global statistics, Vietnam's Gender-related Development Index (GDI) ranked 94th of the 155 countries in 2009. GDI's absolute value has kept increasing over the past years, from 0.668 in 1998, to 0.689 in 2004, and 0.723 in 2009 (UNDP, 2009). The same report ranks Vietnam the 62nd in Gender Empowerment Measure (GEM) among 109 countries rated. Notably in management and leadership, reports of the Vietnamese government indicate a trend of women enjoying ever greater equality in nomination and self-nomination for membership in the National Assembly, People's Councils, and leadership positions in political – social – professional organisations. Female cadres and public officials in State administrative bodies from the district to central levels also increase in number, allowing women to have their voice heard in grassroots socio-economic development (Vietnam Ministry of Planning and Investment, 2011). Despite the progress, from an international point of view, whilst Vietnam's gender equality indices are slightly higher than those in countries with similar level of development and income in Africa, they are consistently lower than neighbouring countries such as Thailand, Indonesia and Malaysia (UNDP, 2011).

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[41] In 1999, a newborn could hope to live to the average age of 68.3. By 2005, life expectancy at birth had risen to 71.3 (The World Bank, 2007).
[42] This is the consistent message being found in newspapers, television and other means of mass communication, observed by the researcher during the course of the study.

The gains of Vietnam in education have been viewed by experts as impressive, especially in primary and secondary education (Van Arkadie, et al., 2010). Vietnam accomplished the target of universal primary education by the national standard in 2000, while gradually improving education quality (Vietnam Ministry of Planning and Investment, 2008). At higher education levels, however, the progress being made has not been sufficient for meeting the demand of the country's next stage of growth (Harman, Hayden, & Pham, 2010). Despite the significant effort in increasing the size and diversity of the Vietnamese higher education system since the Doi Moi process, international assessments of the current situation of the system, for example those of the World Bank (2008) and the World Economic Forum (2009), have reported sobering results. Significant deficiencies remain, particularly in the areas of governance, curricula, teaching methods, research capacity, infrastructure and equity of access, etc. (Hayden, 2005a; Pham, 2010).

At 71%, the fraction of the working-age population that is economically active in Vietnam is high compared to other countries and among the highest in the South East Asia region. With roughly 1.4 million people joining the labour force every year, both economic prosperity and social stability hinge on very rapid job creation. A study carried out by the World Bank suggests that the performance of the labour market has been quite remarkable in this respect and the unemployment rate remained stable and relatively low (The World Bank, 2007). Over the past 5 years, the Vietnamese government reports an estimate of more than 8 million workers who have gained employed; the ratio of trained workforce to the total social workforce has gone up to reach 40%, and the urban unemployment rate reduced to 4.2% (Vietnam Ministry of Planning and Investment, 2012b). However, in rural areas, underemployment remains serious, with imminent danger of unemployment, particularly in urbanised and land use purpose converted areas. Whilst Vietnam's Human Development Index (HDI) has increased from 0.457 in 1990 to 0.528 in 2000 and 0.593 in 2011 (UNDP, 2011), it has always stayed below the average for countries in the medium human development group as well as below the average for countries in East Asia and the Pacific, being ranked 128 among 187 countries surveyed in 2011.

Experts, especially ones from international organisations in Vietnam, suggest that economic growth alone is not sufficient to deal with social issues and more importantly, rapid improvements in wellbeing should not deflect attention from the fact that social problems and challenges still exist such as severe poverty in rural areas, inequality in many aspects, poor

higher education quality and unskilled labour force (ActionAid Vietnam and Institute of Economics, 2004; Van Arkadie, et al., 2010; The World Bank, 2007). Government's recent development strategies and reports indicate that the Vietnamese leaders have recognised these challenges and are committed to delivering further and deeper social progress in the coming development period.

2.4.3. Environmental protection and management

Since the start of the rapid development period, environmental degradation has been one of the thorny problems of Vietnam, and environmental protection become part of all Party and State's development guidelines and policies. The system of laws and policies on environmental protection has been developed rather comprehensively, with the framework documents enacted comprising the Law on Environmental Protection of 2005 and the Law on Biodiversity of 2008. The system of documents guiding implementation has also been completed. The Laws on Land, Water Resources, Forest Protection and Development, Aquaculture, Chemicals, Minerals, etc. have better provided for environmental protection in a more sufficient and concrete manner due to the gradual amendments and revisions during the past time. Vietnam has established the "National Plan of Action on Biodiversity to 2010 and Orientation for Implementation of the Convention on Biodiversity and the Cartagena Protocol on Biosafety". Accordingly, a series of biodiversity conservation zoning schemes have been formulated and implemented (Vietnam Ministry of Planning and Investment, 2012b). Funding for environmental protection has been enhanced with state budget expenditures targeting environmental protection increased over the years, accounting for 1% of the total budget expenditures. The system of State governance bodies responsible for environmental protection from the central to local levels has step by step been established and put into operation[43]. Some achievements in environmental protection and management, therefore, have been evidenced.

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[43] The Ministry of Natural Resources and Environment (MONRE) was set up in 2002 and in key ministries and agencies, departments on environment or units administering the environment governance established. Most provinces and cities have an environmental protection agency subordinate to the department on natural resources and environment, and most rural communes and urban wards a cadastral official on environmental protection. Many businesses, economic groups, corporations, industrial zone managements as well as production and business units have also set up their divisions,

Many tasks regarding pollution prevention and control and biodiversity conservation have been implemented with encouraging results. The integration of environment-related issues into strategies, schemes and plans as early as during their design stage as well as at the stage of project investment preparation has contributed to limiting environmental pollution (The World Bank, 2010; Vietnam Ministry of Planning and Investment, 2012b; Van Arkadie, et al., 2010). Vietnam has mobilised different resources to invest in building up a system of clean water supply for 76% of the urban population. The rate of urban solid waste collection has gone up, estimated at 80-82% in downtown areas and 70-72% in urban areas in general (as against 60-70% in 2003), whereas 80% of hospital solid wastes has been collected and treated, by the Vietnamese environmental standard. In agricultural production, the rate of communes having applied Integrated Pest Management (IPM) is reaching some 60-65%, with a majority of communes have access to information and training about regulations regarding fertilisers and pesticides. The rural environmental sanitation has step by step been upgraded, with about 53% of rural roads having been fortified, 8 - 10% of households using biogas, some 63% of households in possession of appropriate latrines (as against 28 – 30% in 2003), 83% of rural population in 2010 having access to clean water (as against 40% in 2003), and the land acreage under forest coverage increasing from 34.4% in 2003 to 39.5% in 2010 (Vietnam Ministry of Planning and Investment, 2011). Regarding conservation of nature and biodiversity, 164 in-land conservation sites have been established, including 30 national parks, 69 nature conservation sites, 45 cultural and historical conservation sites and 20 experimental research forests; the Government also endorsed 45 in-land wetland conservation sites (in 2008) and the system of 16 marine conservation sites (in 2010) (ibid).

From an international point of view, Vietnam is ranked 85th among 163 countries in the 2010 Environmental Performance Index (EPI)[44] rankings[45]. In comparison with countries in the same

subdivisions or assigned a full-time staff to work on the environment (Vietnam Ministry of Planning and Investment, 2011).

[44] The Environmental Performance Index (EPI) measures countries' performance level relative to their established environmental policies targets. There are two core objectives of environmental policy: environmental public health and ecosystem vitality. Under these core objectives, the EPI is based on the weighted scores for 10 policy goals based on their underlying indicators: the environmental burden of disease, water resources for human health, air quality for human health, air quality for ecosystems, water resources for ecosystems, biodiversity, forestry, fisheries, agriculture, and climate change.

region, Vietnam does reasonably well[46]. Moreover, the study of the World Bank on Natural Resources Management in Vietnam has also positively pointed out that the intensity of use of some basic natural resources such as land, water, and energy to produce one unit of economic output in Vietnam tended to decrease during 1990–2007 (The World Bank, 2010).

Nevertheless, recent population growth, urbanisation, and industrialisation have had significant impacts on the natural environment (Vietnam Ministry of Planning and Investment, 2011; The World Bank, 2010; Vietnam Ministry of Natural Resources and Environment, 2011). As mentioned in the previous section, economic growth in Vietnam has been fuelled by intensive exploitation and inefficient use of natural resources. Utilisation of land has intensified, water resources are increasingly stretched, natural forests have been logged, capture fisheries have depleted their resource base, and mineral resources are increasingly exploited. Environmental pollution problems such as water and air pollution, unfulfilled solid waste collection rates and rampant environmental destruction have caused resentment in the population. The most serious pollution problems arise in and around the biggest cities namely Ho Chi Minh City and Hanoi. By sector, the most serious water pollution emanates from the production of textiles, furniture and food. In general, violations of laws on environmental protection and natural resources management in Vietnam are viewed as pervasive (Vietnam Ministry of Planning and Investment, 2011; Van Arkadie, et al., 2010). Such issues were explained by the Vietnamese government as due to the unsynchronised and somehow incompetent system of laws and policies on environmental protection, especially at the current pace of the socio-economic development process; sanctions against violations of environment laws are not rigorous enough to punish, or deter violations of environment laws; the pool of natural resources and environment management cadres is weak in both quality and quantity; and awareness among public officials at different levels and in different sectors as well as among the population remains low (Vietnam Ministry of Planning and Investment, 2012b).

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[45] In 2010, Vietnam is given an EPI score of 59. Some of the highest-ranking countries are Iceland, Switzerland, and Costa Rica with 94 being the highest score. Countries with the worst environmental performance are Sierra Leone, Central African Republic, and Mauritania with the lowest score being 32.
[46] Regional comparisons can be made with the Philippines (66), Thailand (62), Lao PDR (60), China (49), Indonesia (45), Mongolia (43), and Cambodia (42) (The World Bank, 2010).

Meanwhile, Vietnam has to face increasing pressures and new challenges with regard to environmental protection and management. International as well as national studies, such as the Fourth Assessment Report of the Intergovernmental Panel on Climate Change released in 2007 (IPCC, 2007), the World Bank's study on the impacts of sea level rise on developing countries (The World Bank, 2007), the National Target Programme to Respond to Climate Change (Vietnam Ministry of Natural Resources and Environment, 2008) and the Climate Change Scenarios for Viet Nam (Vietnam Ministry of Natural Resources and Environment, 2009), have indicated that Vietnam is "particularly vulnerable to the adverse effects of climate change" as defined in the UN Framework Convention on Climate Change (UNFCCC). Even though much about the long-term impacts of climate change to the country is uncertain, enough is known to prompt action: temperatures will increase, the sea level is rising, and saltwater intrusion increases. Precipitation is likely to exacerbate droughts and floods, and extreme climate events become more frequent and intense, while the current level of impact has been significant and warranted countermeasures. It is widely affirmed that climate change will add another complication to natural resource management, increasing over time and involving aspects of mitigation and adaptation.

Besides, continuing economic growth means more intense utilisation of natural resources. To some extent this is counterbalanced by increasing efficiency in the use of natural resources and technological progress (The World Bank, 2012). But the net result is increasing pressures on the resource base and pollution. In many cases the benefits may be registered by way of economic growth but the costs will be "hidden" as poor human health, longer-term losses of ecosystem productivity, and reduced environmental quality. Moreover, intensive use of natural resources which will also bring about more competition and even conflict over resources, thus increase the need for clear property rights, rules of transactions, and conflict resolution. Another challenge to environmental management in Vietnam is that since the economy is increasingly integrated into the global system and at the same time relying on export – oriented industries such as wood processing, marine fisheries and aquaculture and mining for growth, it will face new legislations and demands from the importing markets, especially those related to sustainable resource management. Addressing issues of environmental protection and management therefore becomes an imperative for the long-term development of Vietnam (Vietnam Ministry of Planning and Investment, 2012b).

2.4.4. Culturally based strategies in sustainable development in Vietnam

Experience over the past decades across continents has shown that development approaches, which take full account of national and local culture, often have a higher chance of success and sustainability (UNESCO, 2002). In the case of Vietnam, the role of culture has been reflected in the development response in many forms and at various levels. The current strands that highlight the contribution of culture in sustainable development in Vietnam include: tapping on cultural tourism[47]; developing cultural goods and services[48]; rehabilitating historic urban centres[49]; and building a culture of peace[50].

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[47] The economic dimension of culture is becoming well understood in Vietnam in the realms of tourism (Salemink, 2001), and it is already important to both regional and local economies in terms of income and employment generation. International tourism, especially cultural tourism based on Vietnam's cultural assets, has been viewed as highly successful since 1990s (Le, 2008). Tapping into the global heritage conservation system, Vietnam has been successful in having inscribed many cultural heritage sites and monuments on the World Heritage List. This inclusion has given further impetus to cultural tourism, to associated arts and crafts, and to local development. Domestic tourism is also growing over the years. The revised national tourism strategy for 2011-2020 suggests policies geared towards this market segment, including publicising local festivals and sporting events, developing local excursions and circuits, and encouraging provincial tourist exchanges.

[48] Closely related to tourism is the cultural heritage embodied in artefacts and represented in intangible features, as well as the creative skills that produce them. Cultural services tap into the heritage by providing cultural performances and events, cultural information and preservation. The market for cultural goods and services are increasing rapidly and becoming globalised, and these commodities also make an important contribution to national, regional and local economic development (UNESCO, 2009). In Vietnam, the growth rate of this sector has been comparatively high given the low starting point in the early 1990s (Le, 2008). Domestically the trade is linked to sales to tourists, both international and domestic. Much internationally negotiated trade in cultural goods from Vietnam is in response to overseas Vietnamese demand but there is also a growing number of handicrafts being shipped by agents in Vietnam (Nguyen, Ho, & Pham, 1996).

[49] The built environment of Vietnam's towns and cities is a major tourist attraction because it reflects Vietnamese cultural and political history as well as provides the frame for cultural life today (Aplin, 2002). Vietnam's current urban master plan, which was approved by the Government of Vietnam in 1998, lists eight directions for urban development in the period to 2020, one of which is to combine the "rehabilitation of old works with construction of new ones, respecting and preserving cultural identity and national traditions" (Vietnam Ministry of Construction (1998). Orientation Master Plan for Urban Development 2020. Hanoi). Examples of the above is the capital city of Hanoi, where a significant shift in attitudes towards protecting cultural heritage during the process of urban development could be seen. Special planning regulations have been introduced to control the height of new buildings around Hoan Kiem lake and in the Ancient Quarter. The latter has its own management board of which the principal tasks include planning and providing recommendations about the quarter, conducting research and studies, and issuance of construction or renovation permits (Logan, 1998). Similar approach is taken in other cities and town, such as Hue and Hoi An. The renewal and restoration of the heritage buildings and other built environments has contributed to the expansion of cultural tourism industry, which brings along with it economic and social benefits to the people and the communities.

One important strand, of interest to this study, is the role of cultural understanding in change efforts for sustainable development. As discussed in chapter 1 (section 1.3.2), it is argued that development interventions that are responsive to the cultural context and the particularities of a place and community, and advance a human-centred approach to development, are believed to be most effective, and likely to yield sustainable, inclusive and equitable outcomes (UNESCO, 2012). This study is interested in how a cultural perspective may influence change strategies aimed at sustainable development, particularly in higher education for sustainable development. A literature review with the aim of shedding lights into this topic area found little evidence of culturally based strategies in sustainable development in Vietnam. Furthermore, the available information on the current work has been limited to general description of the aims and key processes involved. Details on the methodological approach and research findings could not be found. The two significant examples in the literature include:

- *Culturally based strategies to build healthy communities:*

The review of the Vietnamese context in the previous section has pointed out that in spite of the recent development, there are still many communes in Vietnam where poverty and other concerns centre on water supply, communicable diseases and provision of medicine, hygiene and education remain the major issues to be addressed.

In the development of reproductive and health care services, the role of culture in facilitating attitudinal and behaviour changes on the part of both the clients and the service providers, as well as informal community leaders, is recognised. A number of behavioural change

[50] Culture has been highlighted for the role it plays in building solidarity and equality, sustaining tolerance and unity, and respecting rights, freedom and peace, which are all prerequisites for sustainable development (UNESCO Culture sector, 2000). These are the characteristics of a culture of peace, which rejects violence and prevents conflicts by tackling their root causes and solving problems through education, dialogue and cooperation among individuals, groups and nations (Hoang, 1996). While Vietnam, together with other countries in the region, is undergoing a rapid urbanisation process, a culture of peace becomes crucial. Urban populations of differing origins living in and moving into cities transform them into meeting places where nationalities, cultures, beliefs and behaviours jostle together. The challenge is to design and manage overall plans that are in line with the economy, environment and culture. Therefore, there is a quest for cities to have the policies to accommodate the needs of the population and see to it that they evolve into places where the principles of a culture of peace become a daily reality. In this context, it is worth-noting that in the years 1998-1999, the municipality of Hanoi was awarded the UNESCO Cities for Peace Prize for its exemplary actions against exclusion and in support of the dialogue between communities, as well as for its environmental activities.

communication programmes have been piloted. The advocacy of such strategies is primarily through social marketing, but could include the mobilisation of Vietnamese mass organisations, such as the Vietnam Youth Federation and the Hochiminh Communist Youth Union and their respective provincial and local branches. These grassroots organisations play an important role in facilitating teaching and learning of life skills through schooling and peer education in different contexts (UN Country Team Vietnam, 2003).

The importance of cultural factors in improving community health and well-being as well as responding to learning needs is particularly stressed by the UN agencies in Vietnam. A concrete example is an UNAIDS/UNESCO interdisciplinary project on the culturally appropriate approach to HIV/AIDS prevention, care and support. Internationally, HIV/AIDS epidemics have become a threat to development, and the need for a culturally sensitive and grounded approach to prevention, care and support has been widely advocated. In Vietnam, two research studies were conducted with the support of UNESCO Vietnam following this approach. These studies sought to reveal the characteristics of Vietnamese culture, based on which intervention strategies and action programmes could be drawn (UN Country Team Vietnam, 2003).

- *Culturally relevant approach in development of resource materials on sustainable development:*

Another example includes the project which develops resource materials on sustainable development for adult education (REMASD)[51]. REMASD was designed for nation-wide use in community learning centres (CLCs) targeting adult learners in an effort to respond to learning needs of local communities. REMASD was developed for facilitators of CLCs to use as reference learning materials and base on these to develop relevant local learning materials. Whilst based on a list of 20 topics from four main themes related to sustainable development (Economic, Environment, Health and Culture), the development process of REMASD follow the principle that learning contents can meet the most imperative local learning needs, and should not strictly limit knowledge provided by a fixed number of lessons or duration of each theme or

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[51] REMASD is the project undertaken by the Research Centre for Non-formal Education, Vietnam National Institute for Education Science (VNIES) in partnership with the Community Learning Centres (CLCs) and UNESCO.

topic. REMASD was also designed with consideration over the cultural relevance of technical contents, structure, writing style and illustration, as well as being gender sensitive[52].

Whilst the need for change for sustainable development in all walks of life in Vietnam has been identified, and the role of a cultural perspective in change for sustainable development confirmed, little has been known and/or documented about how Vietnamese cultural factors affect and influence the strategies for change. There is also a lack of empirical research on how such understanding could help make change efforts in sustainable development successful and sustainable. In this context, this study, with its aims and objectives as discussed in chapter 1, sought to contribute to addressing this important question.

2.5. SUMMARY

This chapter sought to define the context that underpins this study: sustainable development, ESD, and culturally based strategies for sustainable development in Vietnam.

Coincided with the process of major reform which led to the rapid economic growth in Vietnam since the mid 1980s, a process has been accelerated in the international arena to awaken the world to the urgency of sustainable development (see section 1.2.1). The chapter started by introducing Vietnam and its culture since the reform, as well as its challenges from the sustainable development point of view.

The chapter has presented the Vietnamese policy context of sustainable development in various areas that concern this research. First, the chapter reviewed the institutional and policy framework for sustainable development in Vietnam. It highlighted the Vietnamese government's political commitment to sustainable development and outlined the key policy documents as well as management structures which affirm the vision for and foster the implementation of sustainable development in Vietnam. The chapter also discussed the Vietnamese policy on ESD. It provided an overview of the context that challenges the current educational practices and influences the responses of the education professionals in Vietnam in the pathway towards sustainable development. Whilst documenting key policies for ESD in Vietnam, the chapter has pointed out the need for refocusing the existing education policies

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[52] For more information: http://esdvietnam.wordpress.com/category/esd-mappings-result/

towards sustainable development. This allows for the education system in Vietnam to be reoriented so that it can fulfill its critical role in contributing to the country's sustainable future. The chapter then outlined key policies in Vietnam that highlight the role of culture and the need for cultural consideration in sustainable development. It supported the key assumption of this research which advocates for a cultural perspective in change for sustainable development (see section 1.5).

The chapter went on to examine the current status of Vietnam systemically as the integration of economic, social and environmental aspects through the lenses of sustainable development. The chapter has provided a holistic picture of the country's current development state through highlighting some main achievements as well as various key challenges that arise recently. It suggested that whilst the country has made remarkable success during the last two decades especially in economic growth, improving living conditions and reducing the incidence of poverty, many social issues still remain, and the pressures on natural resources and the environment increase. The current ways of operating and dealing with challenges in economic as well as in social and environmental fields are not sufficient to sustain economic development and ensure the long-term wellbeing of the society. Fundamental change, therefore, become an imperative for Vietnam in the pathway towards becoming an industrialised and modern country in 2020 as set out in the Vietnamese government's strategic plan. Through providing some examples, it underlined the important role that Vietnamese culture plays not only in addressing economic dimensions of poverty and development but also in providing solutions to complex development issues in an effective and sustainable manner. It makes a case for a study such as the one presented in this thesis which seeks to improve the contribution of higher education to sustainable development through adoption of a cultural perspective in strategies for change.

CHAPTER 3. HIGHER EDUCATION FOR SUSTAINABLE DEVELOPMENT: CHANGES TO ENGINEERING EDUCATION

3.1. INTRODUCTION

Higher education has in the past played a pivotal role in the theoretical debates and practical advances that contribute to progress mankind towards development and civilisation (Bawden, 2004). Currently, in times of failing political systems, religious and moral intolerance, unjust and unsustainable socio-economic development, and serious anthropogenic environmental crises, higher education has been trusted to be among the most prominent players in steering society to a more sustainable path (Corcoran & Wals, 2004; Tilbury, 2012). As Cortese puts it: "Higher education institutions bear a profound moral responsibility to increase the awareness, knowledge, skills and values needed to create a just and sustainable future" (Cortese, 2003, p. 17). Within the academic world, engineering has been faced with increasing expectation in fulfilling this global quest. Recent debates and research in this area acknowledge that appropriate engineering education design and practices could effectively contribute to addressing sustainable development challenges and building sustainable futures (Svanstrom, 2011; Byrne, Desha, Fitzpatrick, & Hargroves, 2010). Over the last few decades, evidences of commitment to progressing sustainability could be witnessed across higher education institutions in general and the engineering discipline in particular. The literature, however, suggests a struggle of these institutions in realising the need for a paradigm shift, and thus in transforming their current structures and practices to support changes towards sustainable development (Sterling, 1996; Velaquez, Munguia, & Sanchez, 2005; Tilbury, 2012; Lozano, 2007).

This chapter first provides an overview of higher education in the context of sustainable development. It seeks to affirm the education for sustainable development challenges faced by universities and colleges in the world, and document the international progress in reorienting higher education towards sustainability. The chapter then focuses on the engineering discipline to understand the current expectation on, and the challenges to the engineering education community. This is done through a review of the specific implications of sustainable

development for engineering education, and the global movements seeking to respond to these concerns.

The chapter also offers a desk-based review on the current approaches documented in the literature aimed at change in engineering curriculum for sustainable development. The intent of the review is to clarify the different terms being used for, and deepen the understanding of engineering curriculum transformation for sustainable development that is central to this doctoral thesis.

3.2. HIGHER EDUCATION AND THE CHALLENGES OF SUSTAINABLE DEVELOPMENT

3.2.1. The problems and prospects of sustainable development in higher education

Higher education has been given and trusted by society with the mission of changing the world for the better through imparting and improving knowledge, skills and values, and preparing responsible and competent intellectuals and leaders who will make meaningful contribution to the society (Cortese, 1992). Institutions of higher education, through their teaching and research activities, operations and partnerships with community, have the unique power to inform and address the sustainability challenges being faced worldwide (Corcoran & Wals, 2004). They are expected to provide the awareness, knowledge, skills, and values that equip individuals to pursue life goals in a manner that enhances and sustains human and non-human well-being, and to contribute to addressing sustainability issues UNESCO ref needed here. The leading role of higher education in the achievement of sustainable development has therefore been widely acknowledged and appreciated (Calder & Clugston, 2003; GUNi, 2012).

However, higher education is currently being seen as a contributor to the current sustainability crisis (Corcoran & Wals, 2004). Among the higher education profession, it has been questioned and argued that it is the people coming out of the world's best colleges and universities, the people with the highest professional qualifications that are leading humanity down the current unhealthy, inequitable and unsustainable path (Orr, 2004). In addition, higher education is being criticised for reproducing the paradigms that underpin the exploitative relationships with people and environment (Velaquez, Munguia, & Sanchez, 2005; Huisingh & Mebratu, 2000; Tilbury, 2012). It is believed that sustainability is pivotal for higher education as it offers not only an opportunity for reflection on the missions and overarching goals of the universities and colleges,

but also a chance to enhance the quality and the emancipatory value of the learning process (Wals & Jickling, 2002; Corcoran & Wals, 2004; Tilbury, 2004).

To reorient higher education towards sustainable development, the consistent message being found throughout the literature is that there is a need for a change in the current paradigms and structures as well as predominant practices of teaching, research, management and operation in higher education institutions (Sterling, 1996; Calder & Clugston, 2003; Tilbury, 2012; Lozano, 2007). Ever since the Stockholm Conference on the Human Environment in 1972 when higher education was formally identified as essential to promote sustainable development, there have been a number of significant international movements resulting in the development of declarations and charters aimed at such change (see *Table 4*). These declarations and charters call for the commitment and actions of universities leaders, higher education associations and governments in progressing sustainability agenda with emphasis on the ethical and moral responsibility of the universities, environmental and carbon management on campuses, curriculum design for sustainable development, capacity building, and social and cultural contribution through research and public engagement. Over the last twenty years of commitment to sustainability in higher education, actions have been taken with the significant driving force being government support and international partnerships (Tilbury, 2012; Tanaka, 2012; Rikers, de Snoo, & van Dam-Mieras, 2012).

Year	Declaration/ Charter	Partner(s) involved	Scope	Description/Key message
1990	Talloires Declaration	University Leaders for a Sustainable Future	Global	The first international document which focuses on sustainability in HE and represents a commitment to environmental sustainability in academe.
1991	Halifax Declaration	Consortium of Canadian Institutions; IAU; UNU	Global	Emphasis on responsibility of universities to help societies shape their development to achieve sustainability.

Year	Declaration/ Charter	Partner(s) involved	Scope	Description/Key message
1993	Kyoto Declaration on Sustainable Development	IAU	Global	Challenges universities to promote SD through both teaching and research, and operations that reflect best SD practice.
1993	Swansea Declaration	Association of Australian Government Universities	Global	Repeats the educational, research and public service roles of HE manifested in the previous declarations and calls for major attitudinal and policy changes.
1994	COPERNICUS University Charter for Sustainable Development	Association of European Universities	Regional (Europe)	Stresses the desire for universities to become leaders in creating sustainable societies through environmental literacy, ethics and attitudes; education of university employees; interdisciplinary; networking and partnerships; and technology transfer.
2001	Luneburg Declaration	Global Higher Education for Sustainability Partnership	Global	A synthetic of declarations related to SD in HE which calls for the development of a toolkit for universities to turn commitment into action; and stresses the need for the empowerment of all people to work towards SD.

Year	Declaration/ Charter	Partner(s) involved	Scope	Description/Key message
2002	Unbuntu Declaration	UNU, UNESCO, IAU, Third World Academy of Science, African Academy of Sciences and the Science Council of Asia, COPERNICUS – CAMPUS, Global Higher Education for Sustainability Partnership and University Leaders for Sustainable Future	Global	Calls for the creation of a global learning environment for education in SD; a toolkit and strategies for taking SD and reform for SD in all areas including teaching, research, outreach and operations; and an inventory of best practices and case studies.
2005	Graz Declaration on Committing Universities to Sustainable Development, Austria	COPERNICUS-CAMPUS, Karl-Franzens University Graz, Technical University Graz, Oikos International, UNESCO	Global	Calls on universities to give status to SD in their strategies and activities; and use SD as a framework to enhance the social dimension of European Higher Education.
2005	Bergen	European education ministers, European Commission and other consultative members	Regional (Europe)	Strongly suggests that the Bologna Process for establishing a European HE Area by 2010 and promoting the European system of HE worldwide should be based on SD principle.
2006	American College and University Presidents' Climate Commitment	AASHE	National (USA)	Calls for an emissions inventory and a date for becoming "climate neutral"; the integration of SD into the

Year	Declaration/ Charter	Partner(s) involved	Scope	Description/Key message
				curriculum; and public transparency of action plan, inventory and progress reports.
2008	Declaration of the Regional Conference on Higher Education in Latin America and the Carribean – CRES 2008	UNESCO	Regional (Carribean and Latin American)	Emphasis on social and cultural sustainability; calls for contribution to democratic relations and tolerance, solidarity and cooperation, and critical and rigorous intellectual ability.
2008	Sapporo Sustainability Declaration	G8 University Network	Global	Stresses the need for cooperation with policy makers; leadership; training and dissemination of information; and interdisciplinarity.
2009	World Conference on Higher Education	UNESCO	Global	Calls for increased investment in HE to advance understanding of complex issues and the ability to respond; promote interdisciplinarity and critical thinking; contribute to peace, well-being, human rights and ethical citizenship.
2009	Turin Declaration on Education and Research for	G8 University Network	Global	Acknowledges the role of HEIs in supporting SD at global and local levels; Calls for new

Year	Declaration/ Charter	Partner(s) involved	Scope	Description/Key message
	Sustainable and Responsible Development, Italy			models of social and economic development consistent with SD principles; ethical approaches to SD.
2010	UNICA Green Academic Footprint Pledge	UNICA Network	Regional (Capitals of Europe)	Emphasises the unique position of universities at the different capitals of Europe; calls for development of campuses as living laboratories in the area of sustainability.
2011	Declaración de las Américas "Por la sustentabilidad de y desde la universidad"	Inter-American Organization for Higher Education IOHE /OUI	Regional (Inter-American)	Commitment of Universities of the OUI to assume institutional responsibility to the global environmental crisis and encourage other social actors to do the same.
2012	Higher Education Declaration for Rio+20	UNESCO, UNEP, PRIME, UNU, Academic Impact	Global	Declaration supported in the lead-up to Rio+20.
2012	The People's Treaty on Sustainability for Higher Education	Copernicus Alliance and 35 HE agencies, associations and organisations	Global	A formal voluntary commitment of Rio+20 developed to influence international negotiations and dialogues.

Table 4. Key Declarations on Education for Sustainable Development in Higher Education[53]

3.2.2. The current practice of education for sustainable development in higher education

Current efforts towards higher education for sustainable development could be categorised into five areas of education and learning; research; modelling practice; partnerships and outreach for sustainability; and leadership and strategy (Tilbury, 2012; Cortese, 2003; Velazquez, Munguia, Alberto, & Taddei, 2006).

Notable in education for sustainable development movement in higher education is the area of curricula and learning where the need for change is evident (Fien, 1993; Tilbury, Keogh, Leighton, & Kent, 2005). The aim is to empower and equip people for change towards sustainability (Sterling, 2004a; Cotton & Winter, 2010; Cortese, 2003). Curriculum change offers the opportunities to embed the principles of education for sustainability through development of new specialised courses and revision of existing ones. The literature suggests that a few initiatives in curriculum change have provided some opportunity to improve the student's knowledge and skills for sustainable development[54]. However, authors in ESD argue that curriculum change requires not integration but innovation in the teaching approach to help students envision and construct their own concept of sustainability (Tilbury, 2004; Sterling, 2004b). Innovative teaching and learning processes create meaningful experience for students to develop skills and orient them towards actions for sustainable development. Reviews in the area of education and learning for sustainable development in higher education, nevertheless, found little evidence of curriculum and pedagogy transformation for sustainable development (Thomas, 2004; Velaquez, Munguia, & Sanchez, 2005; Moore, 2005; Cotton & Winter, 2010).

In the area of research for sustainable development in higher education, new forms of research activities have emerged. As argued by leading authors in ESD, sustainable development requires change in the research focus and goals, the underlying research paradigms and the way that research is undertaken including the researcher – research participants relationship and the methods of inquiry being deployed (Tilbury, 2012; Fien, 2002; Corcoran, Walker, & Wals, 2004). In practice, this change is demonstrated in various forms, for example: Research has begun to

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[54] Examples of these initiatives could be found in the International Journal of Sustainability in Higher Education (IJSHE) or the 2012 publication of the Global University Network for Innovation (GUNi) on Higher Education's Commitment to Sustainability (GUNi, 2012) (see also section 3.4 for specific examples in the engineering discipline).

shift from focusing on a single academic discipline to multi- and interdisciplinary basis; and, relationship between researcher and the people under study redefined, with the central role being moved from researcher as expert to people as collaborative participants[55]. There are also emerging evidences of research for sustainability in higher education being reoriented towards emphasis on practical social contributions and transformation of the professional practice itself (Tilbury, 2012).

Besides curriculum and research, higher education institutions pursuing sustainable development goals have been looking to demonstrate sustainability in operations, planning, facility design, purchasing, transport and investment (Barlett & Chase, 2004; Wright & Elliot, 2012; Clugston & Calder, 2000). Being the main focus of energies and funding in higher education for sustainable development, the rationale for these movements is based on the view that a university is a microcosm of the larger community and thus, the manner in which it carries out its daily activities is an important demonstration of ways to achieve sustainable living and to reinforce desired values and attitudes in the wider community (Cortese, 2003). Through engaging in the practice of sustainability, members of the institutions including managers, staff and students are provided with unparalleled opportunities for improved understanding and potential shift of the paradigms that underpin the pervasive unsustainable way of living (Tilbury, 2012). Examples of these "modelling" activities in higher education institutions are the Greening the Campus movement (Wright & Elliot, 2012), sustainable procurement practice (Helmink & de Jong, 2008; Van Weenen, 2000), sustainable transport policies and initiatives (Balsas, 2003), sustainable laboratories (Woolliams, Lloyd, & Spengler, 2005), and environmental management policies and practices (Clugston & Calder, 2000).

It is increasingly recognised that the attainment of sustainable development in HE depends upon not only the institutions themselves but the widespread public engagement and support (Lozano, 2007; Ryan, Tilbury, Corcoran, Abe, & Nomura, 2010; Hall, 2009). Relationships between universities and the communities that they serve, as well as the partnerships among universities and other stakeholder organisations have proved to be of importance in the efforts

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[55] Examples of research activities which demonstrate these changes could be found in the regional papers being featured in the latest publication of the Global University Network for Innovation on "Higher Education's Commitment to Sustainability: from Understanding to Action" (GUNi, 2012).

aimed at progressing sustainability. Over the last two decades, there have been an increasing number of activities in the area of partnerships and outreach that help to improve regional development and capacity-building processes with regards to sustainable development. These activities take forms of:

(i) partnership between university and community to address sustainable development issues[56] as well as to foster information sharing and communication[57];

(ii) universities' participation in NGOs initiatives and campaigns for environment conservation and sustainability[58] (Lipscombe, Burek, Potter, Ribchester, & Degg, 2008);

(iii) university alliances and networks which serve as essential platforms for universities to share common issues and best practices, and collaborate in addressing the sustainability imperative[59] (Tilbury, 2012).

As argued by many authors in the area of ESD, change for sustainable development in higher education implies strategic management which requires fundamental adjustments to the current structures and practices of the institutions (Sterling, 2004a; Bawden, 2004; Ryan, Tilbury, Corcoran, Abe, & Nomura, 2010), and strategic leadership is key in the happening of such change (Scott, Deane, Tilbury, & Sharp, 2011; Thomson & Green, 2005; Williams, 2008). However, there have been suggestions that the progress towards sustainability in higher education has been hampered by the lack of leadership development opportunities offered to universities' managers (Lozano, 2007; Tilbury, 2011). Scattered examples of initiatives on

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[56] For example, the University of Ilorin in Nigeria through its establishment of the Community based Experience Services has not only provided the students with experience on HIV/AIDS education but at the same time, contributed to HIV/AIDS prevention and control in rural communities in Nigeria (Oloyede, 2012).

[57] For example, the United Nations University Regional Centres of Expertise (UNU RCEs) hosted by universities which seek partnership with local community and across regions aimed at information sharing, and dialogues and communication establishment (Leah Filho & Schwarz, 2008; Kitamura & Hoshii, 2010).

[58] For example, the Earth Day initiative (www.earthday.org).

[59] The most significant examples include The COPERNICUS Alliance in Europe (www.copernicus-alliance.org/) ; and the Association for the Advancement of Sustainability in Higher Education in the US (www.aashe.org/).

leadership for sustainability can be found in the literature such as the Cambridge Programme for Sustainability Leadership[60] and the Sustainable Futures Leadership Academy[61].

Within ESD, engineering is one of the disciplines being viewed as critical and active in responding to the challenges of sustainability. Whilst sharing common issues and experiencing changes similar to the general higher education movements towards sustainable development, the engineering education community faces specific challenges and requires bespoke solution packages. The next section examines the implications of sustainable development for engineering education and reviews the international progress of the engineering education for sustainable development.

3.3. THE CURRENT RESPONSES TO SUSTAINABLE DEVELOPMENT OF THE ENGINEERING EDUCATION COMMUNITY

In many ways the effectiveness of engineering education and its contributions to human life has been widely acknowledged (Forum for the Future, 2003; Boyle, 2004). Engineers, through their practice, have contributed to addressing the societal needs for housing, manufacturing, transportation, sanitation, healthcare, communications, energy production, waste management, and pollution control systems. Sustainable development, however, poses an array of challenges including issues and problems that go far beyond what is generally found in the textbooks or experiences provided as part of engineers' formal training (Thom, 1998; Crofton, 2000). Within the engineering profession, engineering educators around the world are witnessing a significant shift in societal expectations to help address immediate and longer-term sustainable development challenges (Desha, Hargroves, & Smith, 2009; Mihelcic, et al., 2008; Kastenhofer, Lansu, van Dam-Mieras, & Sotoudeh, 2010). Over the last two decades, studies of the engagement with the concepts of sustainability of engineering institutions and organisations, for example the civil engineering industry (Jowitt, 2004), the construction industry (Adetunji, Price, Fleming, & Kemp, 2003) and the mining industry (Hacking, 2006) show that substantial progress has only been made regarding the environmental aspects of sustainable development. In many cases, there remain a lack of understanding, and vagueness about sustainability concepts and

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[60] For more information: http://www.cpsl.cam.ac.uk/
[61] For more information: http://salzburgglobal.org/wp-sfa/

their implementation into current engineering thinking and practice. To address this issue, a handful of higher education engineering academics are calling for changes in the way that engineering education is conceived and delivered, so that graduate engineers can contribute to more sustainable futures (Fenner, Ainger, Cruickshank, & Guthrie, 2005; Byrne, Desha, Fitzpatrick, & Hargroves, 2010). This section looks closely at the implications of sustainable development for engineering education in higher education including the problems of the so-called traditional ways of teaching engineering disciplines in the university settings, and the new demand from the society for a different type of engineers. It then goes on to investigate the current movements of engineering education worldwide in response to the challenges posed by sustainable development goals.

3.3.1. The implications of sustainable development for engineering education

The emergence of the Industrial Revolution that marked the beginning of the engineering era has brought enormous achievements in socio-economic development all over the world. However, the technical rationality embedded in engineering science has put economic and technical progress in 'narrow technical disciplines which, despite our scientific understanding, have not anticipated the wider physical and non-physical consequences at the systems level' (Jowitt, 2004, p. 82). This approach has led to the design of traditional academic courses in engineering, which focus on the solution of problems and equip students with the skills to resolve complex problems within a relatively narrow solution space (Ashford, 2004; Lucena & Schneider, 2008). This reflected the Newtonian or deterministic approach rooted in commanding a thorough knowledge of engineering science. Fenner, Ainger, Cruickshank, & Guthrie (2005) argue that whilst engineers must develop a rigorous understanding of the physical and mathematical principles through which their designs will function, 'engineering design is only one of a spectrum of skills needed in the delivery of projects, products and services' (p. 230). Furthermore, Ashford (2004) criticises the fashion of 'single-purpose or narrowly fashioned solutions by technical and political decision makers' (p. 240) and suggests that many engineers limit themselves to conventional and established approaches and arrangements, which leads to a one-dimensional and restricted specification for the available design space.

Commonalities in recent views on the relation between sustainable development and engineers are that sustainable development is not a technological problem as such but a societal challenge

that needs the contribution of engineers (UNESCO, 2010; Lucena & Schneider, 2008; Mulder, 2012); and engineers must possess the skills to become proponents for the implementation of sustainable practices in their organisations (Kastenhofer, Lansu, van Dam-Mieras, & Sotoudeh, 2010; Thom, 1998). It is now widely acknowledged that there is a need for a different kind of engineer, one who has a long-term, systemic approach to decision-making and a holistic understanding beyond the field of specialisation, one who is guided by ethics, justice, equality and solidarity (EESD, 2004).

In education terms much greater emphasis must be placed on problem definition and the recognition of the context in which the solution is required. The Guiding Principles for Engineering Education for Sustainable Development published by the Royal Academy of Engineering in 2005 states that "engineering input to sustainable development solutions must be provided in partnership with many other interests, [...] begins with participation in framing the issue of concern or how it is described in terms of the actual needs and wants underlying the issue to be addressed" (The Royal Academy of Engineering, 2005, pp. 8-9). This challenging obligation requires engineers to retain a robust, rigorous and analytical approach whilst dealing increasingly with non-technical details i.e. economic, social and environmental factors which constitute sustainability. This will help avoid past mistakes where narrow technologies and technical fixes have produced solutions that 'tend towards dealing with complication (detail) rather than complexity (structure)' (Jowitt, 2004, p. 82). Understanding that there is a need to challenge orthodoxy in the traditional problem solving paradigm, and to redefine the design space which allows the problems of sustainable development to be encompassed, international organisations and many national governments have taken action to promote a fundamental shift in engineering education to make possible the formulation of more holistically conceived engineering solutions.

The challenge for the education of professional engineers is both to higher education and to the profession itself. At international level, there have been calls for the engineering community to contribute to sustainable development since as early as the 1990s. The first policy statement to make explicit such role of the engineers is the one on Consulting Engineers and the Environment published by the International Federation of Consulting Engineers (FIDIC) in 1990, which states that "Engineers should provide leadership in achieving sustainable development" (Thom, 1998). Following the movement, during the last decade of the twentieth century, international

organisations joined forces to lay the groundwork for many programmes to kick-start and in support of engineering for sustainable development. Examples of those efforts include the World Engineering Partnership for Sustainable Development (WEPSD) - the collaboration formed among the World Federation of Engineering Organisations (WFEO), the FIDIC and the International Union of Technical Associations and Organisations (UATI) in 1992, which has since promoted a new vision of engineering as one which befits the challenges of the twenty first century (Ridley & Yee-Chong, 2002); the 1996 World Congress of Engineering Educators and Industry Leaders organised by UNESCO, UNIDO, WFEO and UATI which draws attention to education and sustainable development concerns (Byrne, Desha, Fitzpatrick, & Hargroves, 2010); and the WFEO's publication "The Engineer's Response to Sustainable Development" in 1997 (UNESCO, 2010). Since the year 2000, efforts have been put in the realisation of those initial visions, resulting in international declarations and policies such as the WFEO Code of Ethics with the central view that "Engineers shall strive to [...] promote the principles of Sustainable Development", which serves as the model for all the professional engineering institutions (WFEO, 2001), and the Shanghai Declaration on Engineering and the Sustainable Future at the World Engineers' Convention in 2004; as well as various programmes under the support of the World Engineering Partnership for Sustainable Development and the UN organisations for example the 2006 UNESCO workshop on Engineering Education for Sustainable Development in Beijing, China. More significantly, on the turn of the new century, the global visions for engineering for sustainable development have been turned into policies and action plans in many nations across the world.

Australia is one of the first countries to respond to the international calls for sustainable development considerations in the engineering profession. In 1994, Engineers Australia developed a policy on sustainability which states that "members, in their practice of engineering, shall act in a manner that accelerates achievements of sustainability" (Carew & Mitchell, 2006). The institution later on launched a formal sustainability charter in 2007 which proposes that "sustainable development should be at the heart of mainstream policy and administration in all areas of human endeavour" (Engineers Australia, 2007). It particularly emphasises on the social aspect of sustainability where engineering has traditionally been weakest (Byrne, Desha, Fitzpatrick, & Hargroves, 2010). In the US, the National Academy of Engineering (2005) suggested that the future engineering curriculum should be built around developing skills and not around teaching knowledge, and that future engineers must be taught

to be creative and flexible, to be curious and imaginative, "with due recognition of the rapid pace of change in the world and its intrinsic lack of predictability". In the UK, the Engineering Council in 2005 produced the "UK Standard for Professional Engineering Competence" that explicitly included sustainable development. In the same year, the Royal Academy of Engineering published a document providing a set of guiding principles for Engineering for Sustainable Development (2005). The document states that '[Engineers must be] key players in sustainable development, and have an obligation as citizens not just to act as isolated technical experts', and that 'achieving sustainability through sustainable development will require some significant shifts in behaviour and consumption patterns' (The Royal Academy of Engineering, 2005, p. 8). Similar visions could be found in the policy statements and code of ethics of the national engineering associations in countries such as Canada, New Zealand, Japan, Denmark, Sweden, Ireland, Spain and The Netherlands, as well as the engineering institutions of specific disciplines, such as the Institution of Chemical Engineers[62].

Country	Key documents with specifications on engineers for sustainable development
The UK	The Royal Academy of Engineering published a set of twelve Guiding principles for Engineering for Sustainable Development (The Royal Academy of Engineering, 2005) including: 1. Look beyond your own locality and the immediate future 2. Innovate and be creative 3. Seek a balanced solution 4. Seek engagement from all stakeholders 5. Make sure you know the needs and wants 6. Plan and manage effectively 7. Give sustainability the benefit of any doubt 8. If polluters must pollute... then they must pay as well

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[62] The review found no similar statements being made specifically to the engineering profession or engineering education in the emerging or developing world such as India, Africa, or Latin America.

Country	Key documents with specifications on engineers for sustainable development
	9. Adopt a holistic, "cradle to grave" approach 10. Do things right, having decided on the right thing to do 11. Beware of cost reductions that masquerade as value engineering 12. Practice what you preach Engineering Council UK provided six guidance principles on sustainability for the engineering profession as (ECUK, 2009): 1. Contribute to building a sustainable society, present and future 2. Apply professional and responsible judgement and take a leadership role 3. Do more than just comply with legislation and codes 4. Use resources efficiently and effectively 5. Seek multiple views to solve sustainability challenges 6. Manage risks to minimise adverse impact to people or the environment The guidance also emphasises that "the leadership and influencing role of engineers in achieving sustainability should not be under-estimated. Increasingly this will be as part of multi-disciplinary teams that include non-engineers, and through work that crosses national boundaries"
The US	National Academy of Engineering formulated its vision of the Engineer of 2020 in its report published in 2004. This report defines the role of engineers in the society including facilitating design through "a solid grounding in humanities, social sciences and economics", and embracing new fields that require "openness to interdisciplinary efforts with non-engineering disciplines". The report calls for engineers to be informed leaders in sustainable development and suggests that this should "begin in [the] educational institutions and be founded in the basic tenets of the engineering profession and its actions". (National Academy of Engineering, 2004)

Country	Key documents with specifications on engineers for sustainable development
Canada	The National Guideline on Environment and Sustainability published by the Canadian Council of Professional Engineers in 2006 outlines nine tenets which require that professional engineers should: 1. Develop and maintain a reasonable level of understanding, awareness, and a system of monitoring environmental and sustainability issues related to their field of expertise 2. Use appropriate expertise of specialists in areas where the professional engineer's knowledge alone is not adequate to address environmental and sustainability issues 3. Apply professional and responsible judgement in their environmental and sustainability considerations 4. Ensure that environmental planning and management is integrated into all their activities which are likely to have any adverse effects 5. Include the costs of environmental protection among the essential factors used for evaluating the economic viability of projects for which they are responsible 6. Recognise the value of environmental efficiency and sustainability, consider full life-cycle assessment to determine the benefits and costs of additional environmental stewardship, and endeavour to implement efficient, sustainable solutions 7. Engage and solicit input from stakeholders in an open manner, and strive to respond to environmental concerns in a timely fashion 8. Comply with regulatory requirements and endeavour to exceed or better them by striving toward the application of best available, cost-effective technologies and procedures. Disclose information necessary to protect public safety to appropriate authorities 9. Actively work with others to improve environmental

Country	Key documents with specifications on engineers for sustainable development
	understanding and sustainability practices.
Australia	Engineers Australia Sustainability Charter in 2007 notes that achieving sustainability "requires a fundamental change [in engineering practices] in the ways that resources are used and in the way that social decisions are made" (Engineers Australia, 2007). It asserts that engineers must play the normative and multi-disciplinary role in helping achieve a sustainable society, as well as take the lead in finding solutions to sustainable development issues.\n\nIn line with the Code of Ethics formulated by the WFEO in 2001, Engineers Australia's Code of Ethics requires that "members shall, where relevant, take reasonable steps to inform themselves, their clients and employers, of the social, environmental, economic and other possible consequences which may arise from their actions".

Table 5. Key documents on Engineering for Sustainable Development

In addition to the declarations, policies and codes of ethics, the accreditation process is believed to be a powerful instrument in directing the education of engineers and the capacity of the engineering profession towards sustainable development (Byrne, Desha, Fitzpatrick, & Hargroves, 2010; Desha, Hargroves, & Smith, 2009). In countries namely Australia, the UK, Canada, Germany, Ireland, France, the US, Japan, India, Taiwan and Hongkong in China, accreditation agencies have incorporated sustainable development aspects into the requirements. Some common aspects in the current professional engineering institution accreditation guidelines include the knowledge of sustainable development themes such as environmental issues, social and economic considerations, and professional and ethical responsibility; and the specific skills that contribute to sustainable development such as the ability to work in multidisciplinary team, and the skills of solving complex problems and recognising future problems in the changing context of technologies and scientific developments.

In response to these new expectations and requirements, within the engineering education community, there has been an emerging strand of activities that focuses on the rethinking, design and implementation of engineering education practice towards sustainable development. The next section seeks to provide an overall picture of these efforts including the actions, the current state and some challenges being faced.

3.3.2. The Engineering Education for Sustainable Development movements

Alongside the increasing attention paid to ESD in the international arena, Engineering Education for Sustainable Development (EESD) has recently been commonly adopted among the community as the term which implies the new paradigm of educating engineers. In 1997, the report of the Joint Conference between UNEP, WFEO, WBCSD and ENPC on Engineering Education and Training for Sustainable Development in Paris first calls for sustainable development to be "integrated into engineering education, at all levels from foundations courses to ongoing projects and research" (JCEETSD, 1997). The conference also suggests that engineering organisations adopt "accreditation policies that require the integration of sustainability in engineering teaching". Most significantly at global level, the bi-annual conference on Engineering Education in Sustainable Development, the first of which was held in 2002 in Delft, The Netherlands, marks the continuous global awareness and commitment to EESD. In 2004, at the conference in Barcelona, the Barcelona Declaration on Engineering Education in Sustainable Development (EESD, 2004) was established emphasising that engineering education at all levels should be oriented towards sustainable development, and engineers must be able to (pp. 1-2):

- understand how their work interacts with society and the environment, locally and globally, in order to identify potential challenges, risks and impacts;
- understand the contribution of their work in different cultural, social and political contexts and take those differences into account;
- work in multidisciplinary teams, in order to adapt current technology to the demands imposed by sustainable lifestyles, resource efficiency, pollution prevention and waste management;
- apply a holistic and systemic approach to solving problems and the ability to move beyond the tradition of breaking reality down into disconnected part;

- participate actively in the discussion and definition of economic, social and technological policies, to help redirect society towards more sustainable development;

- apply professional knowledge according to deontological principles and universal values and ethics; and

- listen closely to the demands of citizens and other stakeholders and let them have a say in the development of new technologies and infrastructures.

The Declaration has also stressed the responsibility of universities to re-orient the traditional functions of teaching and research, by generating ideas and new knowledge, and called for their commitment to responding creatively and imaginatively to social problems. The Barcelona Declaration was sought to lay a foundation for understanding what fundamental elements constitute a transformation in EESD in engineering education institutions.

Over the last two decades, there have been different approaches to introducing Sustainable Development principles into the engineering curriculum of universities, from teaching about sustainable development, specific courses on sustainable development, specialisations on sustainable development, to embedding the principles in all 'conventional' engineering courses in many universities (Desha, Hargroves, & Smith, 2009; The Alliance for Global Sustainability, 2006; Mulder, Segalas, & Cruz, Training Engineers for Sustainable Development, Teaching experiences from Three engineering institutions, 2005) (see also section 3.4). Among the engineering education institutions where such initiatives are taking place, there is a recognised acceptance that engineering education for sustainable development should embrace a number of key themes, many of which have already been identified at the first EESD Conference in 2002, including:

- a more integrated multi-disciplinary style to develop bridges between the technical and physical sciences and the humanities;

- the need to take a systems approach with the ability to deal with complexity through a recognition of wider system boundaries;

- an appreciation that there are limits to what can be achieved through technology alone, and that singular prescribed technical solutions may not be capable of addressing real needs; and

- an acceptance that value judgements play an important role, and that engineering education should not be exclusively about facts and empiricism, but should embrace ethics, creativity and social responsibility.

Despite the effort, reports and studies, especially from the global point of view, reveal that little progress has been made in addressing the call for EESD (The Alliance for Global Sustainability, 2009; Azapagic, Perdan, & Shallcross, 2005; Forum for the Future, 2003; UNEP, WFEO, WBCSD & ENPC, 1997). During the last decade, there have been at least eight large-scale surveys on the current status of EESD in mostly European, Australian and North American regions. Some notable examples include the international survey by Azapagic, Perdan and Shallcross (2005), the 2006 and 2008 observatory publications on European efforts towards EESD (The Alliance for Global Sustainability, 2006; 2009), the Royal Melbourne Institute of Technology survey of Australian universities in 2002 (Thomas & Nicita, Sustainability Education in Australian Universities, 2002), the 2007 Forum for the Future's study on engineering graduates in the UK (Meddings & Thorne, 2008), and the Report on Benchmarking Sustainability Engineering Education by the US Centre for Sustainable Engineering in 2008 (Allen, et al., 2008). These surveys reveal a certain level of achievement in EESD with a growing number of institutions being engaged in activities for sustainable development. However, the general conclusions are that there is no consistent and strategic approach to sustainable development in engineering education, and the state of EESD worldwide has not been any close to meeting the expectation.

Similar to the process of embedding sustainable development into higher education in general, the major barriers to success in EESD include overcrowded curriculum; perceived irrelevance by academic staff; limited staff awareness and expertise; and limited institutional drive and commitment (Holmberg & Samuelsson, 2006; Hopkinson & James, 2010). For engineering education communities specifically, resistance to change also come from scepticism, disciplinarity and specialisation, autonomy, the desire to quantify problems, and the reluctance to considering the 'soft' sides of problems (Holmberg, Svanstrom, Peet, Mulder, Ferrer-Balas, & Segalas, 2008; Wormley, 2004).

Whilst there have been a number of case studies in which success factors are discussed, and several attempts to develop models for engineering education for sustainable development, it is clear that there remains a great challenge to transform the pedagogical practice of educating engineers – "a practice that has been relatively static and wed to the didactic teaching styles of

the first universities established over 800 years ago" (Haghighi, Smith, Olds, Fortenberry, & Bond, 2008, p. 119).

3.4. UNDERSTANDING TRANSFORMATION OF ENGINEERING CURRICULUM FOR SUSTAINABLE DEVELOPMENT

Terms such as "embedding Sustainable Development in the curriculum" (Fenner, Ainger, Cruickshank, & Guthrie, 2005; Hopkinson & James, 2010; Holmberg, Svanstrom, Peet, Mulder, Ferrer-Balas, & Segalas, 2008), "integrating Sustainable Development in the curriculum" (Van Berkel, 2000; Peet & Mulder, 2004; Sukumaran, Chen, Mehta, Mirchandani, & Hollar, 2004), "curriculum design for sustainable futures" (Mihelcic, et al., 2008), "curriculum renewal for Sustainable Development" (Desha, Hargroves, & Smith, 2009), "problem-based learning" (Lehmann, Christensen, Du, & Thrane, 2008), "multi- and inter-disciplinary approach" (Ashford, 2004; Tomkinson, Tomkinson, Dobson, & Engel, 2008), and "teaching for ethical responsibility" (Svanstrom, 2011; Herkert, 2005) are widely used in the literature of EESD promoting a change in the design of engineering curriculum[63]. The aims of such change are to direct engineering education towards sustainable development and/or to empower engineering students to address sustainable development challenges. However, despite the widespread use, at an international conference on 'Engineering Education for Sustainable Development'[64] it was apparent that there is little consensus regarding what could be understood as engineering curriculum for sustainable development.

This section aims to generate a better understanding of a transformation of engineering curriculum for sustainable development. This is done by providing a model for understanding the different approaches currently being taken in the extant literature on the basis of their nature of change rather than their labelling. To achieve this, a literature review was undertaken to identify the changes that are typically implemented aimed at curriculum for sustainable development in the engineering community.

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[63] All these terms imply an effort to change the engineering curriculum towards sustainable development through innovation in either content, method, strategic management or a combination of those. The application of these terms in the literature of EESD are being studied in detail in the sub-sections of section 3.4

[64] At the International Conference on Engineering Education for Sustainable Development, Chalmers University of Technology, Gothenburg, Sweden, September 2010.

A desk-based review of scientific publications on the topic of EESD[65] was undertaken which covered established approaches and practices that claimed to change engineering curriculum towards sustainable development. It reveals curriculum changes which converged under three main categories, namely the degree to which:

- Sustainable development themes are covered in the curriculum ("Coverage of sustainable development themes")
- The curriculum seeks to empower students with both knowledge and skills for sustainable development ("Emphasis on sustainable development knowledge and skills ")
- The curriculum change is approached and managed in a strategic manner ("Strategic approach to curriculum change")

In *Figure 6*, these categories are used to form the axes of a three-dimensional space illustrating the conceptual model of engineering curriculum transformation for sustainable development. Within the model, various approaches to curriculum design for sustainable development could be located. Since proponents of engineering curriculum transformation towards sustainable development promote varying degrees of movement along one or more of the axes, the conceptual model could be used to understand or compare different approaches by considering the features that are described rather than the terminology used. In chapter 6, the model is used to provide lenses for understanding the desired change in engineering curriculum in Vietnam aiming at a transformation towards sustainable development envisioned by the Vietnamese engineering universities and other stakeholder groups (see section 6.4).

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[65] This is based on a literature review of over 60 publications on the topic of EESD which have been sourced from journals including the International Journal of Sustainability in Higher Education, the European Journal of Engineering Education, the Australasian Journal of Engineering Education, Engineering Education: Journal of the Higher Education Academy Engineering Subject Centre (HEA UK), Global Journal of Engineering Education, The Journal of Engineering Education (American Society for Engineering Education), International Journal of Continuing Engineering Education and Life-long Learning (UNESCO), International Journal of Engineering Education, Journal of Cleaner Production, Engineering Sustainability, Science and Engineering Ethics, Civil Engineering and Environmental Systems and others during the period of October 2010 to May 2012.

Engineering curriculum
transformation for
sustainable development

Focus on values,
knowledge and skills/
Action oriented

Strategic vision/
Partnership/
Inter-disciplinarity

**Emphasis on sustainable
development knowledge
and skills**

**Strategic approach to
curriculum change**

Focus on knowledge/
Intellectual oriented

Individual actions/
Discipline-specific

Purely technical
knowledge

All sustainable
development themes

**Coverage of sustainable development
themes**

Figure 6. Conceptual model of engineering curriculum transformation for sustainable

development

The following sections provide details of each of the model's dimensions generated from the literature review.

3.4.1. Coverage of sustainable development themes

The change that is almost universally promoted in the literature of engineering curriculum for sustainable development is extending the coverage beyond the purely technical knowledge of the specific discipline of interest. The motivations for the more comprehensive coverage include the demand from the community and industry[66] (Sukumaran, Chen, Mehta, Mirchandani, & Hollar, 2004; Van Berkel, 2000; Kumar, et al., 2005; Chau, 2007); calling messages from the engineering profession organisations (Paten, Palousis, Hargroves, & Smith, 2005); governmental education for sustainable development initiatives (Fenner, Ainger, Cruickshank, & Guthrie, 2005;

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[66] An example includes the establishment of the Ellen MacArthur Foundation which is supported by a number of international engineering corporations such as Renault, Kingfisher, Cisco, Philips. The Foundation, with its focus on the cradle-to-cradle philosophy, advocates for and seeks to engage higher education institutions including engineering universities in finding solutions and educating future leaders to address emerging sustainable development issues (for further information, see http://www.ellenmacarthurfoundation.org/)

Paten, Palousis, Hargroves, & Smith, 2005; Holmberg, Svanstrom, Peet, Mulder, Ferrer-Balas, & Segalas, 2008), for example the visiting professors scheme in the UK sponsored by the Royal Academy of Engineering to "embed the topic of engineering for sustainable development into engineering course" from 1998; individual academic staff's awareness on sustainable development and the need for education about sustainable development (Desha, Hargroves, & Smith, 2009); and rapid development of some new industries, for example renewable resources industry, which requires new knowledge related to sustainable development (Jennings & Lund, 2001; Kumar, et al., 2005).

Consideration of what themes to be included or reinforced is influenced by the perceived relevance of the sustainable development themes in the particular engineering discipline and context. The current areas of concern include environmental management (Segalas, Ferrer-Balas, & Mulder, 2010), resource management and resource efficiency (Paten, Palousis, Hargroves, & Smith, 2005), social responsibility and ethics (Herkert, 2005; Boyle, 2004; Johnston, Caswell, & Armitage, 2007), and general sustainable development issues and challenges (Sukumaran, Chen, Mehta, Mirchandani, & Hollar, 2004; Fenner, Ainger, Cruickshank, & Guthrie, 2005; Azapagic, Perdan, & Shallcross, 2005) . Some research stresses the specific or neglected issues of sustainable development in engineering community such as economic security and social equity (Sukumaran, Chen, Mehta, Mirchandani, & Hollar, 2004), health (Wang, 2009; Mihelcic, et al., 2008), human development especially with consideration for developing countries (Perez-Foguet, Oliete-Josa, & Saz-Carranza, 2005; Wang, 2009; Johnston, Caswell, & Armitage, 2007), and global perspectives of sustainable development, for example social justice and cultural traditions (Mihelcic, et al., 2008).

The most pronounced aspect of sustainable development being focused in the engineering curriculum change efforts is environmental sustainability, as engineering activities typically involve consumption of materials, energy and resources, and create changes in the biophysical environment (Hopkinson & James, 2010). Environmental issues being touched are: environmental pollution and impacts (Abdul-Wahab, Abdulraheem, & Hutchinson, 2003; Boyle, 2004), renewable energy (Jennings & Lund, 2001), environmental legislation and standards (Azapagic, Perdan, & Shallcross, 2005), environmental certification (Wang, 2009) and other international and large-scale environmental issues such as climate change and ozone layer depletion (Boyle, 2004). In the last two decades, some research acknowledges the increasing

integration of economic and industrial aspects resulting in themes such as cleaner consumption and production (Van Berkel, 2000; Wang, 2009), and resource efficiency and productivity (Mihelcic, et al., 2008). Specifically to the engineering discipline, the focus is also made to the concepts of and techniques for sustainable development currently being labelled as "engineering for sustainable development", e.g. life-cycle analysis, sustainable design, sustainability assessment, back-casting, cradle-to-cradle approach/design, etc. (Azapagic, Perdan, & Shallcross, 2005; Mihelcic, et al., 2008; Venselaar, Roorda, & Severijn, 2002; Boyle, 2004; Quist, Rammelt, Overschie, & de Werk, 2006; Uwasu, Yabar, Hara, Simoda, & Saijo, 2009)

Whilst social, cultural and institutional aspects have gradually attracted more attention, they are considered as sustainable development themes that are less focused in the engineering curriculum for sustainable development. Abdul-Wahab, Abdulraheem and Hutchinson (2003) observe that whilst engineers are facing more complex problems beyond environmental concerns, many students still believe that it is only technical factors and market demand that determine the choice and success of particular technologies. Similarly, a five-year project undertaken with 500 engineering students in five European technological universities reveals that students perceive sustainability as mainly related to environmental problems which could be solved by technologies, and see little relevance in the social and attitudinal aspects of sustainable development (Segalas, Ferrer-Balas, & Mulder, 2010). A Delphi study in which thirty UK experts joined in a consultation panel discussing issues and implications for engineering education in sustainable development also points at gaps related to societal sustainability as the main challenge in curriculum change (Tomkinson & Engel, 2008).
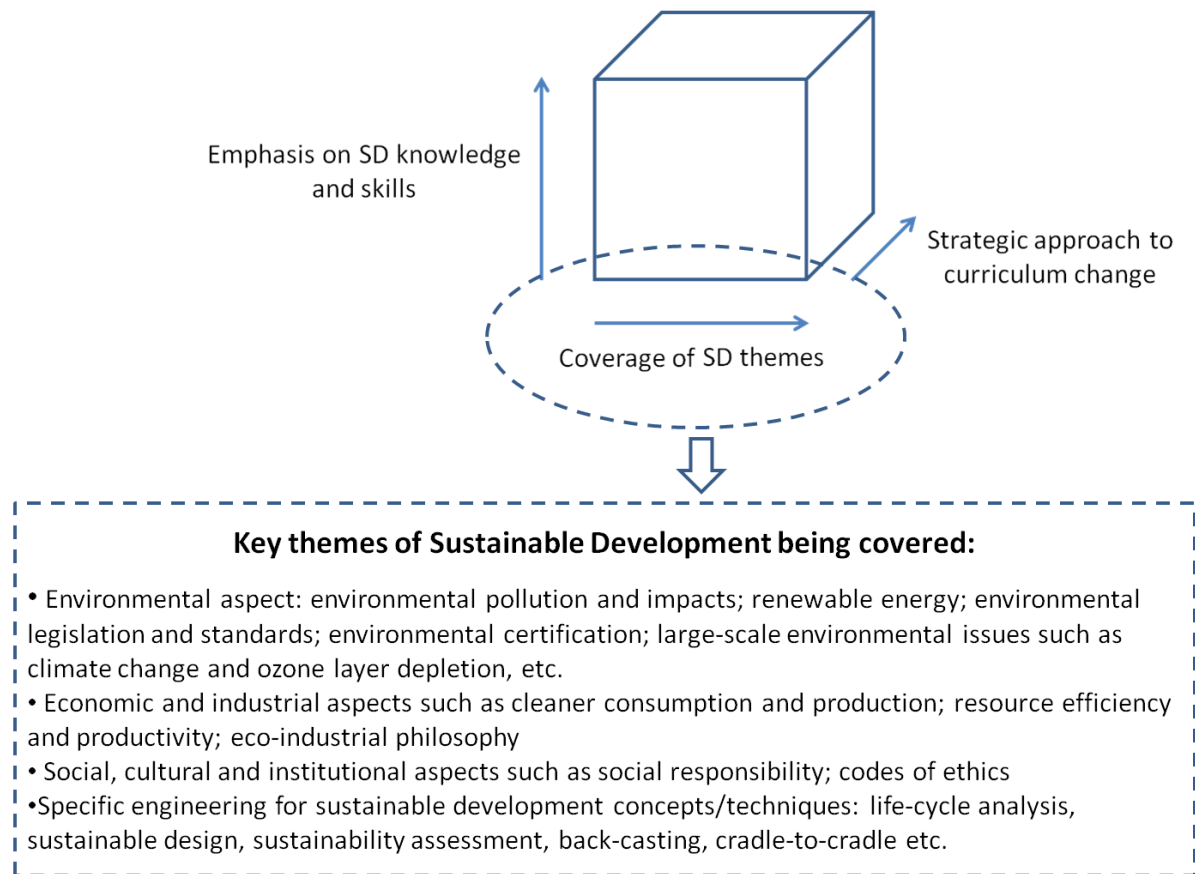
Figure 7. Key sustainable development themes being covered in the current engineering curriculum

3.4.2. Emphasis on sustainable development knowledge and skills

Interwoven with calls for more comprehensive coverage of sustainable development themes are arguments for changes in the engineering curriculum that emphasise on both the knowledge of sustainable development (i.e. those discussed in section 3.4.1) and the attitudes and skills to turn the knowledge into actions to help address sustainable development challenges, for example critical thinking, systemic or whole-systems thinking, participation, interdisciplinary, communication, and value judgement etc. (Svanstrom, 2011; Siller, 2001; Blizzard, Klotz, Pradhan, & Dukes, 2012; Fenner R. , Ainger, Cruickshank, & Guthrie, 2006; Sukumaran, Chen, Mehta, Mirchandani, & Hollar, 2004) (see also section 3.3.2).

(i) Improving engineering students' knowledge on sustainable development

Understanding the need for curriculum design that provide engineering students with knowledge on sustainable development, engineering institutions in higher education are seeking ways to address this rather new demand. In some cases, whilst awareness has been improved, initiatives are still in their proposal and planning stage, and actual change has yet taken place (Kumar, et al., 2005). At the universities which have started the change process, inclusion of sustainable development in the curriculum is being accommodated by different strategies, taking forms of relatively minor amendments to the lecture content to a typical curriculum pattern of providing a grounding in core knowledge, across a wide variety of domains. With the increasing consensus that content should be embedded rather than bolted-on, the current approaches being taken include adding the concepts of sustainable development into the lectures or textbooks of existing courses and modules (Abdul-Wahab, Abdulraheem, & Hutchinson, 2003; Kamp, 2006); offering compulsory or optional modules (Chau, 2007; Kamp, 2006; Uwasu, Yabar, Hara, Simoda, & Saijo, 2009); providing and encouraging choices of dissertation topics (Jennings & Lund, 2001); introducing new courses at both undergraduate and postgraduate levels (Jennings & Lund, 2001; Sukumaran, Chen, Mehta, Mirchandani, & Hollar, 2004; Fenner, Ainger, Cruickshank, & Guthrie, 2005; Meyer & Jacobs, 2000; Onuki & Mino, 2009).

Specific curricular activities aiming at EESD which are highlighted by different engineering education institutions are occasional special lectures (Fenner, Ainger, Cruickshank, & Guthrie, 2005); organising field trips for students to showcase the best practices of sustainable development concepts being implemented in real-life (Sukumaran, Chen, Mehta, Mirchandani, & Hollar, 2004); using examples and case-studies to demonstrate sustainable development consideration in planning and implementation (Van Berkel, 2000; Tomkinson, Tomkinson, Dobson, & Engel, 2008; Paten, Palousis, Hargroves, & Smith, 2005); involving the students in projects, activities, workshops or assignments which fosters learning-by-doing (Perez-Foguet, Oliete-Josa, & Saz-Carranza, 2005; Paten, Palousis, Hargroves, & Smith, 2005; Eyto, Mc Mahon, Hadfield, & Hutchings, 2008; Chau, 2007; Lehmann, Christensen, Du, & Thrane, 2008); and using online interactive resources (Herkert, 2005; Paten, Palousis, Hargroves, & Smith, 2005). For example, the Department of Engineering at the University of Cambridge in the UK establishes a series of distinguished lectures in which visiting professionals are invited to come and share

their knowledge and experiences on a wide range of issues concerning sustainable development. The Faculty in Civil Engineering at Rowan University in the US, meanwhile, seeks to enhance the students' knowledge on mitigating environmental impacts of engineering practices by offering field trips to a greening building in the nearby area, which is constructed with various recycled materials and employs some of the latest technology to reduce greenhouse gas emissions and conserve resources (Sukumaran, Chen, Mehta, Mirchandani, & Hollar, 2004). The School of Environmental Engineering within Griffith University in Australia, although only undertook EESD on a trial basis, acknowledges the importance of course material including a list of key references on sustainable development knowledge related to the student's specialised discipline (Paten, Palousis, Hargroves, & Smith, 2005). Examples of institutions which use case-studies and real-life projects to enhance the student's knowledge can be found in various engineering disciplines (e.g. mechanical, manufacturing, energy, civil engineering, etc.) across different regions around the globe.

The integration of sustainable development themes in the content of engineering courses is believed to, at the same time, enhance the students' ability to apply the knowledge in practices, especially the knowledge on engineering for sustainable development (Azapagic, Perdan, & Shallcross, 2005; Mihelcic, et al., 2008; Sukumaran, Chen, Mehta, Mirchandani, & Hollar, 2004; Quist, Rammelt, Overschie, & de Werk, 2006; Hopkinson & James, 2010) . For example, through the implementation and assessment of the engineering for sustainable futures programmes at Michigan Technological University in the US, Mihelcic et al (2008) observe that students engaged in these programmes are capable of solving problems concerning sustainable development after being taught engineering related sustainability concepts. The Aalborg model developed by Aalborg University of Denmark utilises, as part of their innovative strategy for sustainable development in engineering education, the link with local industry to provide students with opportunities to work with the companies on some environmental projects involving environmental planning, environmental management and life cycle assessment (Lehmann, Christensen, Du, & Thrane, 2008). Similarly, students at the Department of Engineering, University of Cambridge, UK are given chances to join in projects with estate development companies to learn about sustainable development planning and sustainability assessment (Fenner, Ainger, Cruickshank, & Guthrie, 2005).

Whilst institutions are still looking for best innovative ways to deliver the teaching outcomes, research shows that the approach to curriculum change in which community-oriented and constructive, active learning pedagogical approach is central appears to effectively increase the student's knowledge of sustainable development (Segalas, Ferrer-Balas, & Mulder, 2010; Eyto, Mc Mahon, Hadfield, & Hutchings, 2008).

(ii) Empowering engineering students with skills and attitudes for sustainable development

As discussed in section 3.3.2, engineering students are now facing new expectations of skills and attitudes needed for the achievement of sustainability. The skills most common sought after include critical thinking (Siller, 2001), systemic thinking (Venselaar, Roorda, & Severijn, 2002; Blizzard, Klotz, Pradhan, & Dukes, 2012), futures thinking and process thinking which emphasises the understanding of change over time (Emblemsvag & Bras, 2000); leadership (Boyle, 2004), communication and teamwork skills (Sukumaran, Chen, Mehta, Mirchandani, & Hollar, 2004; Johnston, Caswell, & Armitage, 2007). In addition, values and attitudes are highlighted in the literature as the credentials expected for the new generation of graduate engineers (Venselaar, Roorda, & Severijn, 2002; Fenner R. , Ainger, Cruickshank, & Guthrie, 2006; Mulder, 2006). This set of EESD skills derived from the literature is aligned to the general competences in ESD, notably those being constructed by the UNECE experts in ESD (UNECE, 2012). It emphasises (i) the need for a more holistic approach in thinking and practice, (ii) the importance of understanding the past failures, critical reflection of the present as well as future envisioning, and (iii) the quest for transformation in the mind and ways of doing of the engineering graduates.

Strategies for empowering engineering students with these skills range from providing case studies and real-life projects as examples during lectures to engaging students in class-activities and assignments. The use of real-world examples is being viewed as an effective method to illustrate the links between the practice of engineering and the ideals of sustainability and to emphasise on the skills required for solving complex problems of sustainable development, which usually involve different stakeholder perspectives (Johnston, Caswell, & Armitage, 2007; Schafer, 2007; Segalas, Ferrer-Balas, & Mulder, 2010). According to Blizzard et al (2012) and Siller (2001), through providing students with practical illustrations and well-designed action-oriented activities during lectures, important skills for sustainable development namely critical thinking and whole-systems thinking could be developed and enhanced.

Proposals for achieving engineering student empowerment also put emphasis on the role of equipping students with hands-on experiences of sustainable development challenges and solutions in the curricula design. Project-based learning is the pedagogical strategy in which students are involved in complex and interdisciplinary projects which happen in real-world scenarios. These projects are helpful in developing sustainable development knowledge and skills for students as they build the mutual understanding between engineering and other sustainability aspects (Mulder, 2006; Lehmann, Christensen, Du, & Thrane, 2008; McKay & Raffo, 2007). Another similar approach is to focus on solving a chosen type of problem that serves certain learning goals. Students are organised into tutorial groups and through investigating and solving problems, exercise their knowledge and skills as well as reflect on their own beliefs, values and ethics (Huntzinger, Hutchins, Gierke, & Sutherland, 2007; McKay & Raffo, 2007; Hopkinson & James, 2010; Dobson, Allman, Styles, & Tomkinson, 2011; Uwasu, Yabar, Hara, Simoda, & Saijo, 2009). In addition to the above, the use of role play is recommended for enhancing a wide variety of skills for sustainable development including critical thinking, communication and justice through participation, and orienting students towards actions for change. In role play simulations, students take part as participants in a group of different stakeholders working in actual complex situations, and are given autonomy to act towards meeting particular sustainable development objectives (Maier, Baron, & McLaughlan, 2007; Dieleman & Huisingh, 2006). Shifting away from the teaching – learning activities in the university settings, working in cooperation with engineering businesses in the real-world is another popular approach to improving the student's "soft" skills. Students are involved with either projects or daily manufacturing and business activities in engineering related companies, in different forms ranging from a one-time visit to long-period traineeships (Lehmann, Christensen, Du, & Thrane, 2008).

Figure 8. Current strategies that emphasise sustainable development knowledge and skills in engineering curriculum

3.4.3. Strategic approach to curriculum change

When studying the EESD literature, the spectrum represented by the "coverage of sustainable development themes" and "emphasis on sustainable development knowledge and skills" axes could, in principle, be applied to most case studies of engineering curriculum change. In comparison to these two dimensions, the strategic perspective is probably the least covered feature found in the literature of engineering curriculum change for sustainable development.

From the desk-based review, it could be observed that initiatives on engineering curriculum for sustainable development occur mainly at a single engineering department or faculty within the universities, or at a smaller subject group within one department; some only exist on a trial basis and serve as pilot-studies. The happening of many change initiatives could be credited mainly to

the commitment of individuals, expertise and financial supports from outsiders, and the one-off given opportunity. Even at the universities or departments renowned as successful stories, strategic management of change remains as most challenging, and strategically related factors being the most critical constraints to the sustained success of the effort (Holmberg, Svanstrom, Peet, Mulder, Ferrer-Balas, & Segalas, 2008; Lehmann, Christensen, Du, & Thrane, 2008; Fenner, Ainger, Cruickshank, & Guthrie, 2005; Sukumaran, Chen, Mehta, Mirchandani, & Hollar, 2004; Mihelcic, et al., 2008; Paten, Palousis, Hargroves, & Smith, 2005; Byrne, Desha, Fitzpatrick, & Hargroves, 2010). It is evident that there is a lack of a strategic management of change in EESD.
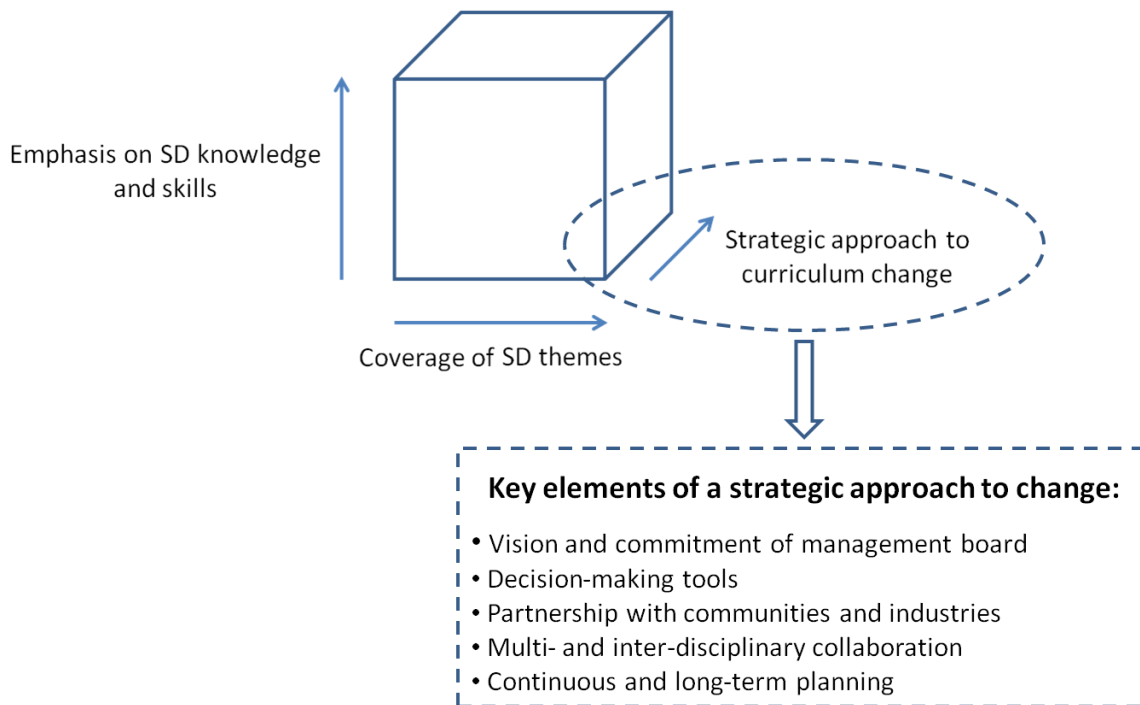
Figure 9. Strategic approach to engineering curriculum change for sustainable development

From studying the cases in the literature which could be viewed as taking a more strategic approach to change, the key elements that determine the strategic approach to EESD were identified as: vision and commitment from management board (Holmberg, Svanstrom, Peet, Mulder, Ferrer-Balas, & Segalas, 2008; Hopkinson & James, 2010; Desha, Hargroves, & Smith, 2009); tools for decision-making (Ferrer-Balas, Bruno, de Mingo, & Sans, 2004); partnership with communities and industries (Lehmann, Christensen, Du, & Thrane, 2008; Sukumaran, Chen, Mehta, Mirchandani, & Hollar, 2004; Paten, Palousis, Hargroves, & Smith, 2005; Johnston, Caswell, & Armitage, 2007; Desha, Hargroves, & Smith, 2009; Mihelcic, et al., 2008); multi- and

inter-disciplinary collaboration (Sukumaran, Chen, Mehta, Mirchandani, & Hollar, 2004; Ferrer-Balas, Bruno, de Mingo, & Sans, 2004; Mihelcic, et al., 2008; Uwasu, Yabar, Hara, Simoda, & Saijo, 2009); and continuous and long-term planning (Holmberg, Svanstrom, Peet, Mulder, Ferrer-Balas, & Segalas, 2008; Ferrer-Balas, Bruno, de Mingo, & Sans, 2004; Desha, Hargroves, & Smith, 2009). Some examples of these elements being taken into account in different cases are presented in *Table 6*. In some cases, the engineering curriculum change for sustainable development was underpinned by a collective implementation of these key elements, for example at the Chalmers University of Technology, Sweden (Holmberg, 2012). The review, however, noted a missing of a whole-institution approach to curriculum change in engineering universities in the literature. Whilst this approach has been advocated in the literature of ESD (Barlett & Chase, 2004; Wright & Elliot, 2012; Clugston & Calder, 2000), the review could not find a documented example where an engineering university looked to make sustainability an integral part of operations, planning, facility design and so on, and linked these elements to the formal engineering curriculum.

Strategic elements	Examples in the literature of EESD
Vision and commitment of management board	- Specific institutional policy on making sustainable development a core part in the curriculum at Chalmers University of Technology, Sweden - Platform for sustainable development in Delft University of Technology, The Netherlands with the rector being chair of the Platform - Strategy on ESD at top-level management, a full-time vice rector in charge of sustainable development and a coordination office for environment and sustainability at the University of Technology in Catalonia, Spain (Holmberg, Svanstrom, Peet, Mulder, Ferrer-Balas, & Segalas, 2008; Holmberg & Samuelsson, 2006; Segalas, Ferrer-Balas, & Mulder, 2010)
Decision-making tools	The University of Technology in Catalonia, Spain developed a set of 27 strategic planning indicators based on its EESD objectives which help to

	prioritise actions towards the achievement of their teaching and learning for sustainable development targets (Ferrer-Balas, Bruno, de Mingo, & Sans, 2004).
Partnership with communities and industries	• With engineering businesses: Rowan University, US (Sukumaran, Chen, Mehta, Mirchandani, & Hollar, 2004); Cambridge University Engineering Department, UK (Fenner, Ainger, Cruickshank, & Guthrie, 2005); Aalborg University, Denmark (Lehmann, Christensen, Du, & Thrane, 2008) • With NGOs (e.g. Engineers without Borders): University of Calgary, Canada (Johnston, Caswell, & Armitage, 2007) • With engineering associations and bodies: Griffith University in Australia in cooperation with Engineers Australia in a project aimed at incorporating sustainability literacy in the engineering curricula (Paten, Palousis, Hargroves, & Smith, 2005)
Multi- and inter-disciplinary collaboration	Cooperation among departments, faculties and colleges: Courses are team-taught by faculties from the College of Communication and the College of Engineering at Rowan University in the US (Sukumaran, Chen, Mehta, Mirchandani, & Hollar, 2004); Compulsory and elective modules of the Sustainability course are taught by different schools at Osaka University in Japan including economics, engineering, law, human science, etc. (Uwasu, Yabar, Hara, Simoda, & Saijo, 2009)
Continuous and long-term planning	The considered success in some European technical universities namely Chalmers, Delft and Catalonia are results from a long period of planning and implementation starting from as early as the 1990s, with an evolving, continuous and forward looking strategic plan (Holmberg, Svanstrom, Peet, Mulder, Ferrer-Balas, & Segalas, 2008; Mulder, Segalas, & Cruz, 2005)

Table 6. Examples of strategic approach to engineering curriculum change for sustainable development

In researching engineering curriculum change towards EESD, Desha, Hargroves and Smith (2009) warn that the usual or "standard" curriculum renewal approach to embed new knowledge and skills for sustainable development might take too long, resulting in a "time lag dilemma" in comparison with the industry, regulatory and accreditation shifts. To avoid this shortcoming they promote a process of curriculum renewal that involves a number of components along with examples believed to inform a strategic approach to curriculum renewal. These components include awareness raising and developing a common understanding; graduate attribute mapping; curriculum audit; course development and renewal; bridging and outreach; and campus integration. The authors assert that in the "absence of immediate and broad institutional reform" towards EESD, the proposed components would be helpful in suggesting how to plan for and undertake a rapid transition of curriculum for EESD (p. 194). However, they also admit that more studies need to be done on the practicalities of implementation in the engineering universities.

One important finding of this review on current examples of engineering curriculum change for sustainable development is that since successful change could be initiated and managed with no single formula approach, either top-down (Venselaar, Roorda, & Severijn, 2002; Hopkinson & James, 2010), middle-out (Fenner, Ainger, Cruickshank, & Guthrie, 2005) or bottom-up (Peet & Mulder, 2004), success in the design and implementation of curriculum change in EESD depends on each institution's characteristics and circumstances, and on the wider context and culture in which it exists and functions. This observation is aligned to those views on the general efforts in Education for Sustainable Development in higher education including criticisms of the approach that looks for universal models (Corcoran, Walker, & Wals, 2004), and proposals for consideration of contextual relevance and cultural appropriateness (Fien, 2002). This finding has strengthened the fundamental assumption upon which this research was based (see sections 1.5 and 4.2.1). It has also confirmed the suitability of the research paradigm and methodological approach being chosen for conducting this research which seeks a transformation of the curriculum for sustainable development in engineering universities in Vietnam (see chapter 4).

3.5. SUMMARY

This chapter has underlined the problems and prospects, and highlighted the current movements of higher education institutions in the context of sustainable development. It has

also examined the implications for engineering education in particular, and contrasted these public intentions and expectations with the current movements in education for sustainable development in the engineering education community. Through a review of different approaches in engineering curriculum change for sustainable development, the chapter has deepened the understanding of a transformation of the engineering curriculum towards sustainable development. The key points drawn from this chapter include:

1) There is a wide affirmation that the sustainability quest has challenged but also given the opportunities for universities and colleges around the world to rethink their missions and goals, restructure their courses, research programmes, life on campus and relationships with the community so that they could fulfil their leading role in the attainment of sustainable development.

2) Evidence of effort aimed at ESD in higher education has been found in the areas of curricula and learning, research, modelling practice, partnerships and outreach for sustainability, and leadership and strategy. However, the progress being made has been very limited. Innovation for sustainable development in higher education requires strong leadership, and this challenge is believed to be the factor that hampers the reorientation of education towards sustainable development in universities and colleges around the world.

3) Within the higher education community, the role of engineering in the sustainability agenda has been acknowledged due to its potential contribution to sustainable development. Current practice of engineering education, however, is being seen as out-dated and no longer fit for addressing the complex and multi-faceted sustainability problems. There is a need for a transformation of engineering education to meet the new requirements and expectations of society including businesses and communities.

4) In response to international, national and professional calls for a new generation of graduate engineers for sustainable development, the engineering education community has shown significant commitment and action through the establishment of declarations, and the rethinking and redesign of engineering courses towards sustainable development. Whilst the commitment is rather strong, the efforts in putting into practice are limited to small pilot and case study scale. The barriers to success in engineering education for sustainable development

(EESD) include the general challenges faced in ESD and those specific in the engineering discipline.

5) Most worthy of attention in EESD is the area of curriculum. Universities around the world are taking different approaches in curriculum change with the aim of reorienting engineering education towards sustainable development. Case studies that attempt to progress this agenda can be found in the literature, but little consensus has been made on what should be understood as a transformation of engineering curriculum for sustainable development.

6) Through a desk-based review of the literature on EESD, a conceptual model of engineering curriculum transformation for sustainable development was developed. The review suggests that in order to progress education for sustainable development, the engineering curriculum should be transformed towards sustainable development literacy, sustainable development competence and a strategic approach to change. The model was used to provide lenses for understanding the desired change in engineering curriculum in Vietnam aiming at a transformation towards sustainable development envisioned by the Vietnamese engineering universities and other stakeholder groups (see chapter 6).

7) The chapter concluded that change for education for sustainable development, especially in the area of the engineering curriculum does not follow a single universal model. The uniqueness of each case namely the contextual and cultural characteristics is critical in the design and planning for change in the engineering curriculum for sustainable development. This conclusion has strengthened the fundamental assumption upon which this research is based (see chapter 1), and confirmed the suitability of the research paradigm and methodological approach being chosen for conducting this research (see chapter 4).

PART II. RESEARCH METHODOLOGY AND PROCESSES

This part presents the research methodology and research processes that underpin this study on engineering curriculum for sustainable development in Vietnamese universities. First, it offers a discussion on the philosophical and theoretical foundations upon which the research is based. The key features of the grounded approach that guided the research methodology are unpacked. This part describes the research techniques being employed and the various strategies used to manage the quality and validity of the research.

Part II also reports on the research design and the processes which have enabled the research aims and objectives of this study to be met. It highlights the key issues related to data analysis and research ethics, and offers some reflections on the research processes .

Part II contains the following two chapters:

Chapter 4. Research Methodology

Chapter 5. Research Design and Processes

CHAPTER 4. RESEARCH METHODOLOGY

4.1. INTRODUCTION

Worldview assumptions, paradigms and theoretical frameworks are the foundations that shape and strengthen the qualitative research. Making explicit the philosophical and methodological stances and being aware of their influences over the conduct of inquiry therefore is the important requirement of a good research (Creswell, 2007; Guba & Lincoln, 1994; Seale, 2004; Denzin & Lincoln, 2003). This chapter seeks to address this task in three main parts: the research paradigm, the theoretical framework, and the approach that underpin the research.

Being grounded in the specific context of Vietnam and emphasising the importance of culturally appropriateness, this research is located in the interpretivist paradigm. Viewing reality as socially constructed and fluid and knowledge as negotiated within cultures, social settings and relationships with other people, interpretivism offers valuable philosophical grounds upon which this research is based. The chapter starts with a brief introduction to the paradigm, and makes explicit the research's underlying assumptions and characteristics being guided by the interpretivist approach. The section then provides some background and critiques to interpretivism as a research paradigm, and focuses on how these limitations have been sought to overcome.

The second part of this chapter unpacks the notion and theory of culture provided by Ward Goodenough, one of the early leading scholars in culture within cognitive anthropology. This study chooses to utilise the concept of culture as developed in cognitive anthropology because of the paradigmatic alignments of this tradition to interpretivism. These include the view over the social reality of culture, and the epistemological device it offers in understanding culture and its influences. In this part, the underlying theoretical assumptions of this research are clarified as well as the application of Goodenough's culture theory in the study discussed. Special emphasis is given to the theoretical concepts being used to provide ontological and epistemological lenses for understanding and exploring culturally appropriate ways for change towards sustainable development in Vietnamese engineering universities.

The chapter then examines the grounded approach that guides the research methodology. It explains how key features of the grounded theory approach have been adopted to shape sample selection, data collection and data analysis. It also describes the various research techniques being utilised. The chapter ends by providing a discussion on trust-worthiness and validity of the research. This includes the way to manage research subjectivity, as well as a number of strategies being deployed to address the validity threats and enhance the research trust-worthiness.

4.2. INTERPRETIVISM AS THE RESEARCH PARADIGM

4.2.1. Interpretivism: Background, key thinkers and key concepts

Interpretivism represents a theoretical stance of which many characterisations begin with a critique of the positivist paradigm. Guba (1990), for example, asserts that interpretivist philosophy believes that both positivist and postpositivist paradigms which use the empiric/analytic approach are flawed and must be entirely replaced.

Interpretivism is often traced back to the thought of Max Weber (1864-1920). He suggested that 'in the human sciences we are concerned with *Verstehen* (understanding)', and contrasted the interpretative approach (*Verstehen*, understanding) needed in the human and social sciences with the explicative approach (*Erklaren*, explaining) which focuses on causality being found in the natural sciences (Delanty & Strydom, 2003). Around that time in the late 19th and early 20th centuries, there were similar thoughts over the distinction between natural reality and social reality. Those thoughts ranged from a clear agreement with Weber on the contrast of the two kinds of reality, for example that of Wilhelm Dilthey (1833-1911), to the acceptance of only a logical distinction, one posited by the mind, between the two realms of being, for example those of Wilhelm Windelband (1848-1915) and Heinrich Rickert (1863-1936). Whilst Weber expressed the need to focus social inquiry on the meanings and values of acting and interacting human beings and therefore on their subjective 'meaning-complex of action' (Gerth & Mills, 1970, p. 55), he defined sociology as a science 'which attempts the interpretive understanding of social action in order thereby to arrive at a causal explanation of its course and effects' (Crotty, 1998, p. 69). By saying this, Weber implied that *Verstehen* has to be substantiated by scientifically valid evidence. Following Weber, a number of scholars from different schools of thought, for example Schutz (1967) from phenomenology, Gadamer from hermeneutics and Garfinkel from ethno-

methodology, have accepted the call for "understanding" and "interpretation" as well as his methodology to seek empirical verification of social data (Delanty & Strydom, 2003).

In more recent times, interpretivist paradigm seems to have moved away from these "traditional moorings" (Crotty, 1998, p. 71). Modern interpretivism continues to accept the *Verstehen* approach, agreeing that what distinguishes human (social) action from the physical objects' movement is that the former is inherently meaningful (Denzin & Lincoln, 2003). However, thinkers in interpretivism suggest that to understand a particular social action requires that one interpret in a particular way the meanings that constitute that action (Schwandt, 2000). Interpretative researchers now widely accept that the human and social sciences require methods essentially different from those of the natural sciences (Crotty, 1998; Denzin & Lincoln, 2003; Creswell, 2007). While the basic belief system of positivism (and postpositivism) can be characterised as a naive realist ontology, interpretivism is based on an entirely different set of assumptions about the world and how we know it, that is, on a relativist ontology (Creswell, 2007). Social reality is not independent but regarded as the product of processes by which social actors together negotiate the meanings for actions and situations, thus, is a complex of socially constructed meanings (Guba, 1990). Human experience is characterised as a process of interpretation rather than "sensory, material apprehension of the external physical world", and human behaviour depends on how individuals interpret the conditions in which they find themselves (Blaikie, 1993, p. 96). The main sources for data generation are people's understandings, interpretations, experiences, and interactions (Denzin & Lincoln, 2003).

The role of the social researcher is, therefore, to enter the everyday social world in order to grasp these socially constructed meanings and interpretations, and then reconstructs them in social scientific language (Smith, 2000). From an epistemological point of view, interpretivism emphasises the contribution of human intention, that is, subjectivity to knowledge. The reality of meanings (i.e. intents and purposes) is found in interpretation thatis influenced subjectively by the values and purposes of the researcher (interpreter) (Delanty & Strydom, 2003).

4.2.2. Locating the research in the interpretivist paradigm

The employment of an interpretivist approach in this research was chosen because the philosophies (i.e. notions and features) of interpretivism are aligned to the principles of this

study. Framing the research under three research questions (see section 1.3), the research assumes that:

- Each country or society and each group of stakeholders perceives sustainable development issues and associated challenges differently depending on their socio-economic-political context and culture. These perceptions and interpretations shape their beliefs, concerns and behaviours as well as guide their decisions and actions in responding to the challenges of sustainable development.

- During the change process aimed at sustainable development, the beliefs, concerns, behaviours and actions of the stakeholders contribute to the construction and negotiation of how the change initiatives would look like and how they would be implemented.

- Understanding of the contextual factors (i.e. current status, societal expectation, availability of resources) and cultural factors (i.e. worldviews, values, beliefs, attitudes and behavioural repertoires) that hamper or support the needed changes is critical for exploring strategies to make change successful. Such strategies need to be grounded in the specific context and not simply adopted from elsewhere. They are to be co-constructed, critiqued, revised and renewed by the stakeholders based on their own understandings and experiences.

To address the research questions and achieve the research aims, the study follows the philosophical assumptions of the interpretivist paradigm and being featured as:

- ***interactive and field-based inductive*** (Crotty, 1998; Robottom & Hart, 1993). The study takes a grounded approach in which no presuppositions and constructions were imposed on the data. By using interviews, and questionnaires which include only open-ended questions, the study has sought to collect data from which constructs or themes could emerge. Interviews and focus groups are designed as unstructured or semi-structured to ensure understandings are produced through dialogue, and meanings negotiated mutually between the informants and the researcher in the act of interpretation;

- ***embedded in practice and within a context*** (Schwandt, 2000; Patton, 1990; Geertz, 1973). Interpretivist epistemologies are believed to be in one sense characterised as hermeneutic. They emphasise that one must grasp the situation in which human actions

make (or acquire) meaning in order to say one has an understanding of the particular action. Through in-depth interviews and focus groups, and direct observation, the researcher has attempted to collect data which are embedded in the particular context to ensure the reality is truly understood and interpreted;

- ***aimed to construct holistic patterns or webs of influence*** (Robottom & Hart, 1993; Schwandt, 2000). This research seeks the perspectives and meanings of participants, both propositional and tacit, which result in thick description. The study aims to grasp the whole complex of intentions, beliefs, desires as well as the institutional and cultural context, practice, and so on; and,

- ***sought transferability rather than generalisability*** (Crotty, 1998; Robottom & Hart, 1993; Corcoran, Walker, & Wals, 2004). As discussed previously in the research approach, at the centre of this study is the belief in the importance of locally relevance and culturally appropriateness in change. The study does not seek to provide a prescription or formula for carrying out future change efforts in other institutions or national contexts, but to inform change initiatives elsewhere aimed at a transition towards education for sustainable development in general and in engineering education in particular beyond the context under study.

Emphasising on understanding and interpretation, locating the research in the interpretivist paradigm for this study could be viewed as a straight-forward decision. It is through studying and taking into account the critiques of the interpretivist philosophies that the research methodology has been shaped and the research processes designed. The following section examines the critiques and clarifies how the researcher attempted to overcome those limitations.

4.2.3. Critiques of the interpretivist paradigm

The critics of the interpretivist paradigm include thinkers from within the paradigm as well as representatives from other paradigmatic traditions (Blaikie, 1993; Delanty & Strydom, 2003).

Within the interpretivist paradigm, representatives from different schools of thought have raised concerns over the approach used by their interpretivist fellows. First, there is a common critique over the view that the interpretivist approach to discover the meaningful nature of social reality requires the use of a method similar to that advocated by positivism (Smith, 1984).

For example, Blaikie (1993) cites Albert (1969) when arguing that the process of gaining direct pre-theoretical access to the unique meanings used by people in particular situations in interpretivist research is analogous to the positivist aim of achieving direct experience of the world. In this study, grounded approach has been taken in which there is no presuppositions and constructions being imposed on the data prior to the research processes including data collection. Categories of data and key constructs are allowed to emerge in the process of data review to ensure that the understandings made through interpretations of the social actions are not influenced by or aimed at verifying predetermined theories (see section 4.3).

Second, although considering themselves within the tradition, Giddens (1984) and Rex (1974), among others, point out some limitations of the interpretivist approach. For Giddens (1984), the central concepts of interpretivism, namely "intention", "reason", "motives" might misleadingly imply that competent social actors engage in a continuous monitoring of their conduct (i.e. reflection), and are thus aware of both their intentions and the reasons for their actions. Because "routine is the predominant form of day-to-day social activity" which most of the time happens without reflective monitoring, Giddens yr argues that the act of reflection occurring by the researcher's inquiry would disturb the social situation and make it impossible for it to continue in a taken-for-granted manner (p. 282). Rex and others, on the other hand, are critical of the position held by many interpretivists that they should not meddle in or seek to alter the account given by the social actors to their actions (Rex, 1974; Blaikie, 1993). Rex also raises further concern about interpretivist social scientists' failure to acknowledge the role of institutional structures, particularly power relations. Instead of dissociating themselves from structural analysis, the researchers should as well rely on "actual historical structures as they appear to the sociologist and not merely the structures which actors believe to exist, or believe that they make, in the process of thinking them to exist" (Rex, 1974, p. 50).

Critiques of the paradigm also come from thinkers with a realist point of view. Bhaskar (1979) refers to the interpretivist view which denies the ability of social scientist to criticise social actors' concepts and meanings, and argues that this view is based on a failure to recognise that there is more to reality than is expressed in the language of social actors. According to Bhaskar, social actors' accounts are susceptible to critique, and "social science always and necessarily consists in a semantic, moral and political intervention in the life of the society under study" (1979, p. 199). Building from this argument, Outhwaite (1987) goes on to argue that whilst the

researcher's "access to the social world is necessarily via the understanding of the interpretive processes, it does not follow that this is all that exists, or can be known to exist" (p. 76). The realists believe that there is a domain of reality independent of the observer, of which social actors may be unaware and thus "unlikely to be obvious to the social scientist" (Blaikie, 1993, p. 112).

To address these limitations, the study seeks to broaden the sample range of informants to include different perspectives (see section 5.2), which make possible the formation of the understandings of institutional structures including the divisions of interest and relations of power. It is also assumed that by doing so, the understandings made available through a systemic collection of interpretivist processes would reflect the reality more accurately. The study also utilises a wide range of research techniques for data generation (see section 4.4) to ensure the meanings and accounts attached to one action or phenomenon are constructed through different viewpoints, from various angles and in both active and passive form of participant engagement. For example, when carrying out case studies at the Vietnamese universities, the researcher has sought to identify the issues and the cultural influences not only through interviewing a number of participants but also from observation of participants' interactions during group work and in their daily practices.

Outside of the interpretivism tradition, critiques over the use of the research paradigm come from representatives of neopragmatism, social theory and feminism, and mainly lie in the possibility of emancipation and political transformation (Schwandt, 2000; Howe, 1998; Robottom & Hart, 1993). Interpretive approaches are criticised for their limitation of participation through development of outside researcher accounts. With these accounts, participants can then 'take or leave without necessarily reflecting on their beliefs and assumptions' (Robottom & Hart, 1993, p. 10). Critics of interpretivism also argue that there is no way of recognising ideological distortions in relativist epistemology. Furthermore, by seeing understandings that result from interpretation only as participation in meaning and dialogue, they are sceptical of the full happening of critical emancipation (Schwandt, 2000).

This research acknowledges the intrinsic limitation of the interpretivism paradigm. These critiques have been taken into consideration in the proposal for future research building upon the finding of this research in chapter 8. Within the scope of this research, methodology and activities have been designed with a central view, that is, to allow for the opportunity of

emancipation and transformation. At the centre of the research methodology and design lies the intention of providing opportunities for the informants, either on individual or group basis or both, to critically reflect and appraise the constructed interpretive accounts (Robottom & Hart, 1993) (see sections 4.4 and 5.2). As argued by Gallagher (1992), interpretivist research (in education) does not deny the possibility of emancipation and subsequent transformation, because emancipation 'is an ongoing process within educational experience, rather than the end result of critical reflection' (p. 272). Especially with the focus of the research, that is to seek transformation for sustainable development, it was assumed and intended that the cyclical process of critical questioning and reflection could lead to change in the participants' perception and, eventually, in their actions beyond the research process.

One example of the emancipative effect of the research is the highlight of one informant during a group meeting on her intention to make change after the deliberations. She acknowledged,

> 'I don't think it is difficult at all in my case. I know how I can improve my lecture content to ensure that aim of empowering student with systemic approach. I have an experience from my last project with [name of a Vietnamese textile company] which can be used as an example and I will do it starting with my lecture tomorrow morning'. (FG2)

4.3. THEORETICAL FRAMEWORK OF THE RESEARCH

Advocating an interpretivist approach to research, this study bases its theoretical perspective on the cultural work developed by cognitive anthropologists. Schein (1992, pp. 3-4) supports such approach in studies of culture in opposition to the positivist approach and argues that "we must avoid the superficial models of culture and build on the deeper, more complex anthropological models" as it helps in better understanding of the hidden and complex aspects of life. It is found particularly meaningful to this study the notion and theory of culture provided by Ward Goodenough (1971), one of the early leading scholars in culture within cognitive anthropology. Goodenough's theory of culture not only guided and clarified how data was collected for the research (i.e. interview agendas and observation strategies), but also helped provide basis for data analysis.

This section starts with a brief review of the theoretical perspectives in the study of culture, and makes explicit the underlying theoretical assumptions of this research by advocating the approach proposed by cognitive anthropologists. The section then provides an introduction to

the culture theory developed by Goodenough with a focus on the key concepts being central to his theoretical perspective. It then discusses how Goodenough's theory of culture was applied in the study. Emphasis is made to the theoretical concepts being utilised to provide ontological and epistemological lenses for understanding and exploring culturally appropriate ways for change towards sustainable development in Vietnamese engineering universities.

4.3.1. Theoretical perspective of the research

In studying the literature of cultural influences in social settings, Smircich (1983) investigates different culture theories and traces the ways culture has been developed: as a critical variable and as a root metaphor. The differences in approach to studies in this area, according to Smircich, are derived from differences in the basic assumptions that underlie the ways the concept of culture has been used. The ones who regard culture as a variable, either dependent or independent, according to Alvesson (2002), approach the concept of culture with the technical interest. This approach proceeds from the assumption that culture is in some way related to organisational and societal performance, and that it is vital to uncover linkages or causal relationships between forms of culture and performance to produce knowledge that increases the chance of affecting specific phenomena or systems to attain certain outcomes (Alvesson, 2002; Ouchi & Wilkins, 1988; Smircich, 1983). Researchers who see culture as a variable draw upon a more traditional, objectivist, and functionalist view of social reality (Lowe, Moore, & Carr, 2007; Alvesson, 2002). In the literature of culture studies, this technical interest has been the dominant approach, resulting in many popular works (Schultz & Hatch, 1996; Collins, 1998). Those studies seek to define an analytical framework prior to entering the social groups (in either organisational or societal forms) to be studied, for example (Schein, 1985) and (Deal & Kennedy, 1982), and analyses by filling in predefined variables and mapping the causal relations between them, for example (Hofstede, 1991).

In contrast, researchers who see culture as a root metaphor approach social groups as cultures or rather, as if they were cultures and draw upon anthropology in developing radically new theories or paradigms (Trice & Beyer, 1993; Morgan, 1986). The research agenda is to explore any social group of people as a socially shared experience and the mode of thought that underlies the idea of culture as a root metaphor is interpretivist. The social world is seen not as objective, tangible and measurable but as constructed by people and reproduced by the networks of meanings that people share and make shared action possible (Putnam, 1983). For

researchers with interpretivist approach to cultural understanding, the analytical framework being used follows an emergent development, in which the constructs most useful to describing culture are suggested by the analysis (Schultz & Hatch, 1996). In contrast to the causal mode of functionalist analysis, interpretive analysis is associative as researchers explore the active creation of meaning and the ways in which meanings are associated in organisations, leading to the emergence of particular cultural themes, images, and metaphors (Smircich, 1983; Lakoff & Johnson, 1980).

Among the disciplinary families of social science that have strong influence on studies of culture, besides social psychology and sociology, anthropology has been regarded as providing the point of view and method utilised in studies with a cultural perspective (Ouchi & Wilkins, 1988). For example, those studies aforementioned as works of culture research with technical interest draw upon the spirit if not the details of the functionalist tradition in anthropology (Schultz & Hatch, 1996; Smircich, 1983; Lowe, Moore, & Carr, 2007; Ouchi & Wilkins, 1988). This school of thought in anthropology which is represented by Radcliffe-Brown (1952) and Malinowski (1961) encourages the scholar to consider a group or society as a whole and to see how its practices, beliefs, and other cultural elements function to maintain social structure. Another influential school of thought in anthropology presented by more contemporary anthropologists namely Geertz, Goodenough and Levi-Strauss emphasises the importance of discovering "the native's point of view" (Geertz, 1973; Turner S. , 1983; Goodenough, 1971). This approach has been called "semiotic" for the focus on language and symbols as the principal tools for apprehending the native's perspective (Keesing, 1974). However, whilst the aim is similar within this school of thought, culture is conceptualised in diverse ways in different anthropologist traditions namely symbolic anthropology and cognitive anthropology, resulting in different perspectives in the study of culture in groups and in societies (Smircich, 1983). Guided by the interpretivist philosophical assumptions (see section 4.2), this study chose to utilise the concept of culture as developed in cognitive anthropology because of the paradigmatic alignments of this tradition to interpretivism. These include the view over the social reality of culture, and the epistemological device it offers in understanding culture and its influences.

Tyler (1969) observes that cognitive anthropology, also referred to as ethnoscience, "focuses on discovering how different peoples organize and use their culture" and perceives that culture resides in the minds of people rather than in the material phenomena of the system. When

studying a culture, cognitive anthropologists seek to "understand the organising principles underlying behaviour". They ask, "What material phenomena are significant for the people" and "How do they organise these phenomena". They are also interested in both differences between cultures and differences within cultures (p. 3). And they take language as "the point of departure" for understanding groups and their cultures (Goodenough, 1963; Agar, 1987). A common underlying assumption of the cognitive orientation to culture and social group is that thought is linked to action and thus, members in a social group are seen as thinking as well as behaving (Smircich, 1983). Viewing social groups as knowledge systems provides the epistemological basis for understanding the phenomenon of organised activity, the "principles" and "standards" that guide action (Goodenough, 1971).

Cultural theory proposed by cognitive anthropologists is argued to tackle the limitations of the structural and functional theories of culture developed previously by anthropologists and sociologists such as Durkheim and Radcliff-Brown who focus on societal forces and whole social structure, or Weber and Malinowski who focus on social functions of individuals (Henstrand, 2006; Schultz & Hatch, 1996; Ouchi & Wilkins, 1988; Smircich, 1983). Focusing on the phenomenal world rather than the belief systems of the members and using single unit of analysis, such approaches are criticised for disregarding many aspects of culture and lacking constructs for talking about change as they emphasise primarily on continuity (Alvesson, 2002; Henstrand, 2006). Within the semiotic school of thought, it is also observed that researchers who engage in empirical work have the tendency to follow the cognitive anthropologist tradition because the methods are more systematic and easier to learn, especially when compared to Geertz's symbolic anthropologist tradition (Ouchi & Wilkins, 1988; Sanday, 1979). In choosing to follow the cognitive tradition, the PhD researcher agreed with Bate (1994) who argues for avoidance of the "seductive siren call of the simplifiers" and the development and utilisation of "a framework, sufficiently complex to embrace the complexity within the subject matter it is seeking to describe, but not so complex and life-size as to be as confusing as the 'real thing'" (pp. 4-5).

The next section introduces in more detail the theory developed by Goodenough, the leading scholar within this tradition, which provides theoretical foundations for this study.

4.3.2. Goodenough's theory of culture

In enabling the development of culturally appropriate strategies, it is necessary to understand and make explicit what *culture* is, in this particular study. Goodenough describes "culture" as an idealised systematisation of an individual cognitive world, one that could enable an outsider to produce culturally appropriate responses in the range of social situations a native actor would encounter. According to Goodenough (1963), culture 'consists of standards for deciding what can be, standards for deciding how one feels about it, standards for deciding what to do about it, and standards for deciding how to go about doing it' (pp. 258-259). Culture is not the material artefacts or observed traditions, rather, it is 'what is learned', and 'the things one needs to know in order to meet the standards of others' (Goodenough, 1981, p. 50). Public culture is not taken as 'a given simply to be described' but as 'a phenomenon to be explained' (Goodenough, 1981, p. 59). Goodenough's theory, like other anthropologist theories in his tradition, has been strongly influenced by linguists; language, therefore is viewed as the primary vehicle for learning (Ouchi & Wilkins, 1988).

According to Goodenough, because what is shared is reduced to an idealised individual actor's point of view, his cognitive model would thus be a composite of the cultural knowledge of individuals in different social niches (1971). Whilst focusing on individuals, Goodenough is by no means a cognitive reductionist as being criticised by symbolic anthropologists namely Geertz (Keesing, 1974). He distinguishes seven related ideational senses of "culture" that systematically relate the cognitive worlds of individuals to the collective ideas and behaviour of populations.

Goodenough's seven senses of culture

1. Culture in the general sense of systems of standards for perceiving, believing, evaluating, and acting. We deal with this sense of culture when we consider the content of culture and its relationship to man's biological, psychological, and behavioural constitution, and when we speak of culture as a pan-human attribute.

2. The culture of a group, seen subjectively as the system or systems of standards a person attributes to a set of other persons. A person's propriospect may contain several such cultures. We deal with this sense of culture when we consider specific

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cultures as products of human learning and when we try to describe specific cultures in "in the field" research, such descriptions being products of researchers' learning.

3. A person's operating culture, being the particular systems of standards in his propriospect that he uses to interpret the behaviour of others or to guide his own behaviour on a given occasion. We deal with this sense of the term when we try to understand the role of culture in social interaction and the processes by which people can be said to come to share a culture.

4. A group's public culture, being all the individual versions of the system or systems of standards that a group's members expect one another to use as their operating cultures in the various activities in which they have mutual dealings. Each individual's own version of the public culture corresponds to the second sense of the term culture above. Viewed objectively, a public culture is a category or class consisting of all the individual versions of it, the variance among these versions being contained within limits by the process of normative selection[67]. A public culture may consist of several discrete systems of standards, each forming a distinct tradition within it. This sense of the term culture becomes relevant when we consider cultures as the property of a social group and when we become concerned with the maintenance of traditions over time in association with groups.

5. Culture as a particular level in a taxonomic hierarchy of public cultures. It consists of a set of public cultures that are functionally equivalent and mutually comprehensible. Each public culture in the set is a subculture, culture now standing to subculture as language stands to dialect. So employed, the term culture, along with subculture, pertains to the classification of groups according to degrees of similarity and difference in their respective public cultures (or specific traditions within them).

6. A society's Culture (with a capital C), being the overall system of mutually ordered

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[67] Normative selection is defined by Goodenough as the process of selective adjustment which holds within limits the variance among individual versions of a group's public culture, being similar to the process of natural selection of a biological species in the natural world (Goodenough, 1971).

public cultures pertaining to all activities within the society. Here we are concerned with culture as it relates to the organisation of human societies in all their complexity.

7. A society's culture pool, being the sum of the contents of all of the propriospects of all of the society's members, including every system of standards of which any member happens to have knowledge. This sense of the term pertains to culture as a reservoir of resources in knowledge and skills carried by the membership of a society. It is especially relevant for understanding the process of change in a society's Culture.

Source: (Goodenough, 1971, pp. 41-42)

Table 7. Goodenough's Senses of Culture

Goodenough's model of culture which includes the Culture of the entire society, the subculture of smaller groups or clusters and the individuals' propriospect suggests a means to understand the complexities of the social system. Culture (with a capital C) includes the values and traditions that are known to all members of the society. Subcultures share the values and traditions of the Culture, but also have values and traditions unique to the members of the group. Individuals have their own versions of the shared Culture which partially overlap but were not identical because the individual outlook, being labelled "*propriospect*", grows out of "his own experience as each individual develops his private, subjective view of the world and of its contents" (Goodenough, 1981, p. 98).

4.3.3. The use of Goodenough's theory of culture in this study

The previous section has presented Goodenough's theory of culture including the key concepts and cognitive perspective. In this study, Goodenough's theoretical framework is utilised to guide how data has been collected and also provides the basis for data analysis. The study uses the definition of culture as a system of shared cognitions or shared knowledge proposed by cognitive anthropologists to refer to cultural standards that guide the behaviours of members within an organisation or a wider societal context, and enable individuals or groups to produce culturally appropriate responses in the range of social situations being encountered.

In particular, Goodenough's theory of culture provides ontological and epistemological lenses for this study on the transformation of engineering curriculum for sustainable development in

Vietnamese universities. The ultimate goal of the study is to develop a framework which assists in building culturally appropriate strategies for change. The practical ontological implications of Goodenough's definition of culture for understanding cultural influences over the change process include:

a) Identifying the issues underpinning change towards ESD in Vietnamese engineering universities

The research seeks to identify the issues underpinning a transformation of the engineering curriculum for sustainable development that exist at the Vietnamese engineering universities. Identifying such issues within Goodenough's definition of culture which centres around the questions of "what is?", "what can be?", "how one feels about it?", what to do about it?", and "how to go about doing it?" enables one to make distinct analyses of the concepts, beliefs, values and "grammatical" principles of action. This has the potential of illuminating the different cultural factors pre-existed at the institutions which influence the possibilities for transforming the engineering curriculum for sustainable development in Vietnam.

b) Delineating and reifying the identified cultural influences

The research delineates the cultural influences identified from the processes of identifying issues with a view to reify those influences in the strategic responses which constitute the framework.

Building such a framework of strategic responses involves exploring "how to know the culturally appropriate ways for change?". This epistemological question is addressed using Goodenough's cognitive model which involves the use of the concepts of Culture, culture pool and propriospect in the processes of:

a) Organising the case studies into three major categories: the social group of Vietnamese engineering universities as a whole, smaller subgroups of participating engineering universities, and the individual informants (i.e. managers and key academic staff) operating within the universities.

b) Choosing the informants to help reveal the propriospects, each of which, based on Goodenough's theory, shares characteristics with the Culture and with subgroups to

which it belongs, and also possesses characteristics that are unique to itself. Because propriospect is a collection of individual's experiences, it is a tool for understanding how the operating culture of the informants influenced their ideas and behaviours in the change effort aimed at curriculum for sustainable development at the participating Vietnamese universities. In addition, propriospect is an aid in understanding informants' individual and collective response to the change.

c) Gathering data by utilising different research techniques such as interviews, group discussions and observation etc. (see section 4.4) through a series of research activities (see section 5.4) to reveal characteristics that are common to all informants. These are standards that cut across all cases and were present in individual propriospects.

Chapter 7 describes the culture pool, and the framework was constructed based on the findings on Culture (with the capital C) - the shared standards that are understood by members of the culture pool.

4.4. RESEARCH METHODOLOGY

Being guided by the philosophical framework of interpretivism and theoretical framework of cognitive anthropology, this study takes the form of a qualitative empirical research. Whilst there are a number of defining characteristics that locate a research in the 'qualitative domain' (Cassell & Symon, 1994, p. 5), this research bases itself on four methodological criteria in the planning of the methodology. First, qualitative research is only valid if it examines everyday activities and takes place in the naturalistic setting (Denzin & Lincoln, 2003; Miles & Huberman, 1994). Second, it should take a holistic view of the research subject (Miles & Huberman, 1994; Patton, 1990). Third, the research should concern itself with the perception of individuals from the inside (Miles & Huberman, 1994; Rubin & Rubin, 1995; Schwandt, 2000). Fourth, the research process should be reflexive (Schwandt, 2000; Cassell & Symon, 1994; Silverman, 2006).

The ultimate goal of the research is to develop a framework identifying ways of building culturally appropriate strategies to transform the engineering curriculum in response to the challenges of sustainable development in Vietnam. To achieve this, the research seeks to address different aims through three research stages: survey, case study and framework development. The participants in this study are drawn from two distinguished groups with

participation occurring at two levels. The first group of participants covers stakeholders from different sectors and different levels of governance including the international development agencies and non-governmental organisations, national authorities, engineering universities and, engineering corporations and companies. This first group participates in the research as informants of stage one whose contribution represents the breadth of information. The second group of participants are drawn from selective Vietnamese engineering universities who participate in stage two providing in-depth information and critical reflection through more prolonged and intensive form of research interactions. *Figure 10* illustrates the overall methodology of the research.

The research adopts a grounded approach that guides data sampling, generation and analysis and uses different research techniques to address these tasks.

Literature review

Stage 1 - Survey

Purpose
Map the current movements towards sustainable development in Vietnam and the implications for engineering education

Identify informants
Informants: from key stakeholder groups including governmental authorities, international development agencies and non-governmental organisations; engineering businesses and universities

Conduct survey
Methods: questionnaires, interviews, direct observation and documentary analysis

Survey Findings
Data are analysed using constant comparison method and findings validated through face and construct validity

Stage 2 – Case study

Purposes
- Explore the issues and possibilities for change in EESD in Vietnamese universities
- Review critically contextual and cultural factors to understand the influences over transformation of the engineering curriculum for sustainable development in Vietnamese universities

Select cases and informants
Cases: three Vietnamese universities which offer undergraduate engineering programmes
Informants: key members of academic staff and other stakeholders (4-5 key informants per case)

Conduct case study
Methods: semi-structured interview, informal conversation, group discussion, observation and documentary analysis

Case study Findings
Data are analysed using constant comparison method and findings validated through face, respondent and construct validity

Stage 3 – Framework Development

Purposes
Construct a framework for building culturally appropriate strategies for transforming the engineering curriculum towards sustainable development

Construct framework
Based on the findings of stage 1 and stage 2

Assess the value of the framework
Informants: academic staff, universities' managers and other stakeholders including key informants from the previous stages
Methods: interviews and email communication

Figure 10. Research Methodology

4.4.1. Grounded approach to research

Aiming at building culturally appropriate strategies for engineering curriculum transformation towards sustainable development in Vietnamese universities, this research has taken a grounded approach which utilises some important features of the grounded theory framework to guide the methods of inquiry[68]. This choice of approach has been widely justified and advocated for in the literature of social research inquiry, for example by Denscombe (2007), Goulding (2002) and Layder (1998) who propose that researchers would selectively adapt the grounded theory by incorporate elements of the approach to suit their specific needs.

The key features associated with grounded theory being adopted as core tenets of the research approach include (Denscombe, 2007):

- The study used *empirical field research* as its starting point:

    This is a core feature of the grounded research approach: data collected are not shaped by prior concepts or theories, and the goal of data analysis was to look for themes that recur in the data that appear to be crucial for addressing the research questions (Glaser & Strauss, 1967). One does not begin with a theory, then proves it. Rather, one begins with an area of study and what is relevant to that area is allowed to emerge (Strauss & Corbin, 1990, p. 23). In this study, the researcher started the field work research early in the investigation without any presuppositions and constructions being imposed on the data. Being guided by the research questions, the researcher first conducted a survey research to establish the research context and identify key themes to investigate further (see section 6.2). During the following field trips to conduct the case study research, the researcher developed loose a

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[68] The grounded theory approach uses a systematic set of procedures to develop an inductively derived theory about a phenomenon. Through this methodology, concepts and categories and the relationships between them are generated and provisionally tested. Grounded theory is widely accepted as a good design to use when a theory is not available to explain a process (Creswell, 2007). There might be models available in the literature, but they are developed and tested on samples and populations other than those of interest to the qualitative researcher (Parry, 1998). Also, theories may be present, but they are incompetent as they do not address potentially valuable variables that the researcher looks for (Kezar, 2005). On the practical side, a theory may be needed to explain how people are experiencing a phenomenon, and the grounded theory developed by the researcher provides such a general explanatory framework (Eaves, 2001). Strauss and Corbin (1990) assert that if carried out correctly and methodically, grounded theory meets the criteria for "good" scientific research. Those criteria are significance, theory-observation compatibility, generalisability, reproducibility, precision, rigor, and verification.

priori interview and focus groups agendas to guide the data collection activities (see section 6.3). These agendas were constructed based on the research questions and were altered and made more detailed as the research progressed.

- The study developed its ***analysis with constant reference to fieldwork data***:

Eisenhardt (1989) observes that a striking feature of the grounded approach to research is the frequent overlap of data analysis with data collection. Such overlap allows for adjustments during the fieldwork process which means flexible data collection, resulting in better grounding of the finding results. In this research, data analysis was carried out in an iterative process which intertwined with data collection, especially at the beginning of the data collection process, based on the method of constant comparison (Silverman, 2006). For example during stage two, at the end of each day during the field work, the researcher carried out a brief analysis of the data collected which include coding and preliminary categorising. Any new codes and categories were compared and contrasted, as they emerged, against existing versions. Such comparison helped the researcher to refine the codes and categories by highlighting the similarities and differences that existed. It allowed the researcher to search for further data to verify if needed during her next visit to the sites. This further helped the researcher to integrate categories and codes under common headings (i.e. themes and constructs) during later-stage analysis (Denscombe, 2007).

- The study produced ***explanations that are recognisable to the subjects of research***, which are the opportunities for change, the issues underpinning change and the contextual and cultural influences over the change processes (see chapter 7)
- The study was geared to ***modest localised explanations*** based on the immediate evidence gained through a number of case studies being carried out in different Vietnamese engineering university settings (see section 5.4)
- The study adopted ***an emergent design***:

In this research, an emergent design is defined as being based on theoretical sampling and an opportunistic and flexible data collection strategy. In conducting the research stage two, the researcher chose participants in the case studies according to the process of theoretical sampling based on two key features (Silverman, 2006; Glaser & Strauss, 1967; Strauss & Corbin, 1990): Selecting informants whose information was more likely to develop and test emergent analytical ideas; and recruiting more informants during the research until

achieving sufficient data (see section 5.4.1). Committed to using theoretical sampling, the researcher also follows the guide of Strauss and Corbin as they draw attention to the other features of theoretical sampling including depth of focus (Strauss & Corbin, 1990). The researcher has started the data collection and analysis processes aiming at generating a large number of categories related to the phenomenon being studied. However, as the study progressed, the researcher refined the codes and categories, identified the key ones and sought to probe and investigate them in more depth in the subsequent research activities. Data collection strategy therefore was kept flexible to adjust to the emergent needs for data, changes during the research process and any opportunities related to the research that arose.

4.4.2. Research techniques

According to Denzin and Lincoln (2003), qualitative researchers nowadays employ a variety of techniques to generate empirical materials grounded in the everyday world, which can be categorised in four general types: interviews, observations, documents, and visual images.

In this study, a number of techniques are drawn on to access empirical data and evidence that helped address the research questions during the research stages reported in chapter 5 (see sections 5.3, 5.4 and 5.5). This section discusses the research techniques being employed to generate such data and the rationales behind the choice of these techniques. They are semi-structured and unstructured interviews, qualitative questionnaires, focus groups and group discussions, research diary, participant observations, informal interactions, telephone and email communication and document review. Semi-structured Interviews and qualitative questionnaires are the main techniques for generating data for stage one which related to the first research question concerning the current scenario of sustainable development in Vietnam. Meanwhile, interviews of all forms and focus groups were central in stage two on accessing social reality of culturally appropriateness of change towards engineering curriculum for sustainable development in Vietnamese universities, which provides answers to the second and third research questions.

a) Interviews

Interviews, in all forms, are the most substantive mode of data collection for this study. Holstein and Gubrium (1995) have noted interview as a 'universal mode of systematic inquiry' (p. 1) with

the emphasis that it is a means of data gathering to be used by the whole research community. The most common form of interviewing involves individual or group, face-to-face verbal interchange, as well as telephone surveys (Fontana & Frey, 2000).

Individual face-to-face interviews have been chosen to be the main techniques for data generation in stages one and two of this research due to the exploratory nature of the research questions. Robson suggests qualitative interviewing is most appropriate where individual perceptions of processes within a social unit such as work group or department are to be studied (2002, p. 271). Interviews are particularly good at producing data that deal with topics in depth and detail, and the researcher is likely to gain valuable insights based on the depth of the information gathered and the wisdom of key informants (Fontana & Frey, 2000). In addition, interviews require only simple equipment but compared to other simple techniques such as questionnaires and observations, offer the advantages of depth of information and flexibility, and the opportunities for informants to expand their ideas and views based on their priorities (Denscombe, 2007). Interviews can also be a rewarding experience for the informant since there is a more personal element to the method in comparison with questionnaires, observations or experiments. Taking an interpretive approach to inquiry (see section 4.2.1), this study utilises semi-structured, unstructured and informal forms of interviewing, thus allow for flexibility in setting. Unstructured interview allows a great breadth of data by not imposing any a priori categorisation that may limit the field of inquiry. Semi-structured interviews come with open-ended questions and a loosely prepared agenda but flexibility is still priority. The interviewer can seek clarification and/or elaboration and may enter into a dialogue with the interviewee (May, 2001).

In conducting stage one of the research, the researcher has relied on semi-structured interviews, alongside questionnaires, to generate data on commitments of different stakeholder groups towards sustainable development, and the implications for engineering education in Vietnam. A total of 32 interviews, each lasting approximately one hour, were undertaken during the course of stage one (see section 5.3). For each group of stakeholders, an interview agenda with main themes and some questions was prepared in advance to guide the flow of the interviews, but the participants were allowed to lead the interview sessions when possible, and to elaborate on any issues as they wished (see Appendix 5 for an example of the interview agendas). In the research stage two, interviews (both unstructured and semi-structured) were

organised throughout the course of the stage in the three cases: from the start with exploratory purposes to the later stage towards more in-depth deliberations on identified topics. Each informant was involved in one to two interviews, resulting in a total of 21 sessions (plus 9 informal interviews being described below), which began with identifying the issues and possibilities for change, followed by a critical assessment of the contextual and cultural factors with a view to understanding the influences over the desired change.

Unstructured interviews are also sometimes referred to in the literature as informal interviews although in this study, the researcher chooses to distinguish these two types of interview and follow Robson's definition when he designates informal interviews as times when the researcher "takes an opportunity that arises to have a (usually short) chat with someone in the research setting about anything which seems relevant" (2002, p. 282). As Fetterman (1989) puts it: 'An informal interview is different from a conversation, but it typically merges with one, forming a mixture of conversation and embedded questions. The questions typically emerge from the conversation. In some cases, they are serendipitous and a result from comments by the participant... In most cases, [the researcher] has a series of questions to ask the participant and will wait for the most appropriate time to ask them during the conversation (if possible)'. Informal interviews were, in some occasions, used in stage one when the researcher participated in conferences and seminars on sustainable development and education for sustainable development in Vietnam (see section 5.3.3) and had chances to meet the informants or potential informants in more social settings. This technique has, however, played a more important role in stage two, in which the research would seize any opportunities to talk to the informants during the time she spent at the universities being studied. This technique, being used in 9 documented occasions, was preferred by some informants who could not agree on a fixed time for interview but were still willing to participate in the research. For example, one informant proposed at the beginning of the research process:

> "I can't promise you a time slot for interview because this is the busiest time of the year for me. But if you plan to spend time here at the office, I will try to sit down and talk to you in between my errands. It's much easier for me to do so, and will also prevent you from disappointment". (Research diary, 10/11/2010)

b) Focus groups and group discussions

Focus groups have been used as a research technique since as early as the 1920s by social scientists, and, in recent years, have received increasing attention as an important qualitative research technique (Morgan, 1998). Focus groups possess elements of both individual interviews (allow the researcher access to participants' ideas, beliefs and attitudes through communication) and participant observation (provide a "natural" setting environment for the research participants), while maintaining their own uniqueness as a distinctive research method. Due to their flexibility, focus groups render the research process more accessible, thereby allowing the generation of a large amount of data within a short time (Madriz, 2000), especially in comparison with individual interviews.

Tonkiss (2004) observes that focus groups have become a popular method in the interpretive study on a range of issues, and are relevant to theoretical research that seeks to explore social and cultural meanings and knowledge (p. 195). Moreover, according to Stringer (2007), the most successful and productive research occurs where research participants are provided with opportunities to deliberate extensively about their experiences and perceptions. Therefore, the focus groups method has been chosen as the main research technique for stage two, in conjunction with interviews (see section 5.4), since it offers a social context for meaning-making and shifting the balance of power from the researcher towards the participants (Madriz, 2000).

Reflection of the researcher from the early stage of inquiry indicated a possible difficulty in organising focus groups due to the research culture in Vietnam (see sections 5.3.4 and 5.7.4). It forced the researcher to rethink the data collection strategy and implement a more flexible approach to data generation. That was the main reason for the utilisation of a different form of group interview which is called, in this particular study, group discussion. Group discussion has the interactive feature of focus groups but is less structured and does not require a fixed schedule. Whilst focus groups were organised with more careful preparation following an agenda, group discussions happened rather opportunistic. The research would utilise any opportunities, for example, after a departmental meeting or in an out-of-hour gathering, to ask the participants to join in the discussion. Group discussions helped to improve data accessibility and credibility by providing additional chances for data generation and complementing focus groups and other techniques. In one case study, group discussions even replaced focus groups in

generating data in group context because it was impossible to arrange focus group meeting in between the participants' tight schedules.

The use of focus groups may be appropriate at different points in the progression of the study (Hansen, Cottle, Negrine, & Newbold, 1998). Whilst for some research, especially those in business and marketing subjects, they may be used at a very early stage for exploratory purposes, to explore issues and topics of concern within a particular domain or field, and how people talk about these issues (Denscombe, 2007), focus groups were used in this research at a later stage, towards the end of the case studies process. The aim was to examine further a number of topics or themes to which attention had been drawn from previous interviews and observations. Another the reason for the focus groups technique not being used earlier was that certain amount of time was needed for the researcher to build rapport with the informants, and at the same time, for the informants to get familiarised with the research to be more comfortable with sharing opinions and ideas.

In each case, the researcher sought to hold two group meetings: a combination of one focus group lasting approximately two hours and one group discussion lasting between 45 minutes to one and a half hour, or two group discussion in one case study as explained above. These group meetings were organised towards the later stage of the research process when each informant had gone through at least the first interview (see section 5.4.1). In the focus group meetings, participants were issued with an agenda covering the main themes whereas in the group discussions, the research would propose some key points to discuss at the beginning of the session. During these sessions, participants were expected to envision a transformation of curriculum for sustainable development in their institution, and reflect upon and critically interpret their understandings of the contextual and cultural factors as influences over the change effort towards the transformation.

One important component of the focus group discussion is the facilitator role. In practice, the degree to which the facilitator plays an active steering role is 'a sliding scale from continuous active intervention to a much less active, opaque background role' (Hansen et al., 1998, p. 272). When conducting focus groups and group discussions, the researcher sought to lessen the steering role as the sessions went on. In the beginning of each session, the researcher took a more focal point of interactions by posing key questions and encouraging participation from all members. Later, the role of the researcher was mainly to keep the discussions on track and

focused around the topics. Bearing in mind that group interactions and deliberations are dependent on the skills of the facilitator (Morgan, 1998), the researcher actively collected, mostly during socialising activities, and acted on feedback and suggestion from the participants regarding how they saw the role of the researcher as facilitator and the possible ways for improvement.

Focus groups and group discussions in this study are meaningful for the participants since they opened up possibilities for out-of-normal-routine gathering, opinion sharing and collaboration amongst participants who, so often, only communicate when there are technical problems or during university and department formal meetings. They are also practical in the sense that they helped the researcher to elicit information and explore attitudes that were not easily accessible through observation alone (Seale, 2004).

c) Qualitative questionnaires

Questionnaire is one of the two main methods of data generation in stage one of the research. Together with interview, this method was used in the survey to collect baseline data for the mapping task (see section 1.3.1). Although interviews are believed to provide better insights into complex and subtle phenomena compared to questionnaires, questionnaires have been chosen to collect data from one particular stakeholder group which is the engineering corporations and companies. The rationale for this choice lies in its advantage of reaching out to a large number of respondents over a wide geographical area (Bloch, 2004; Denscombe, 2007).

The questionnaire takes a qualitative form consisted of open-ended questions in which the respondents formulate their own answers. The questionnaire has been designed to capture data from engineering companies by asking questions under two broad sections: The company's commitment to sustainable development, and the expectation and satisfaction of the company's manager regarding the employees' knowledge, understanding and skills concerning sustainable development. Following Bloch's guidance on designing the content and wording of the questionnaire, the researcher paid attention to the question topics and terms being used in the questionnaire. To ensure all the respondents had the same understanding and interpretation of the questions, the questionnaire was designed into different main sections, each focusing on one theme, and under each section, the questions being asked were accompanied by further explanations or contextual information. Two pilot studies were also

conducted prior to the research process to examine if the questions being asked actually "work" (see section 5.3.2). An example of the questionnaire is provided in Appendix 4.

Request for research were sent to over thirty engineering corporations and companies of various industries (such as textile, food processing, electronics, oil and gas, and consumer goods), among which nine agreed to participate in the research, resulting in eight completed questionnaires. In one case, the company's manager proposed a face-to-face meeting where he provided verbal responses to the questions and the researcher helped fill in the form in his presence.

d) Research diary

Research diary, or research journal, is viewed as one research technique that enables critical reflection and enhances reflexivity during the field work and the whole research process (Nadin & Cassell, 2006; Coghlan & Brannick, 2005). In addition, the use of field notes and memos is considered essential in studies that take a grounded approach since it provides important data for analysis and also sources for validation (Corbin & Strauss, 2008; Patton, 2002). Therefore, throughout the course of the research, the researcher kept a research diary in which she constantly recorded the activities related to the research, as well as wrote down field notes, memos and personal reflections.

When entering the field, in both stage one and stage two, the researcher recorded all field-related data, especially observational data, in the field notes which consist of fairly concrete descriptions of the research and social processes and their contexts. Walsh (2004) asserts that the central issues for making good field notes concern the questions of What, How, and When to write the field notes. The researcher follows Eisenhardt's advice on writing useful field notes which includes writing down whatever impressions occur, that is, to react rather than sift out what may seem important; and pushing thinking in the notes by asking questions (Eisenhardt, 1989). Seeking to produce field notes that were meticulous, the researcher tried to record key parts of speech verbatim and non-verbal behaviour in precise terms, along with the context of the speech and action. The field notes were written as soon as possible, and in many cases instead of writing down, the researcher audio-recorded her own voice as she verbally recalled the events observed.

Ideas that arose in the process of data collection and analysis were also recorded in the research diary in the form of memos. These analytic memos identified emergent ideas and sketched out research strategy. They provided a reflexive monitoring of the research and how ideas were generated (Walsh, 2004; Patton, 2002).

Moreover, it was proved important and meaningful for the researcher to note down her own reflections on the research activities including thoughts and feelings as there had been many meetings and conversations that were not recorded. The research diary allowed the researcher to reflect on the intellectual biases and the contextual factors affecting the research process and the choices being made.

e) Participant observation

Participant observation, with its interactive nature, is considered to be the method popular in the study of organisations and groups in social and cultural research (Angrosino, 2005). Sharing a number of practical and methodological features with focus groups, participant observation emphasises social meanings and communicative dynamics. As Becker and Geer (1957) put it: "By participant observation we mean the method in which the observer participate in the daily life of the people under study, either openly in the role of researcher or covertly in some disguised role, observing things that happen, listening to what is said, and questioning people, over some length of time." (p. 28)

In this research, the researcher undertook participant observation in both stage one and two, with a different balance between being a participant and being an observer. Following the definition proposed by Junker (1960) on different roles in participant observation, the researcher considered herself as participant observer (emphasising on participation) in stage one and observer participant (emphasising on observation) in stage two. In stage one, when attending conferences and seminars on topics related to sustainable development and education for sustainable development (see section 5.3), the researcher looked for data that reveal the movements towards sustainable development in Vietnam in the forms of speeches, presentations, debates and documents which provide source of validation. Moreover, the researcher sought social interaction with other participants at the events who were the informants or potential informants in order to produce a relationship of rapport and trust (Walsh, 2004). In stage two, the researcher spent time at different cases, where the researcher's

identity as a researcher was openly recognised, to gain trust and establish rapport with informants and most importantly, to foster insights through observing participants' daily activities and interactions in the normal natural setting (see section 5.4). This technique also enabled the researcher to observe non-verbal expressions of participants during research activities (i.e focus groups and group discussions).

f) Informal interactions with informants

Informal interaction with informants or naturally occurring talks (Silverman, 2006) was one valuable addition to the repertoire of methods that the researcher drew on during field research.

The informal interactions in this research happened on both individual and group bases. Whilst individual interactions served as either method for "breaking the ice" with potential informants or to follow-up after an interview, group interactions focused on building trust and rapport with the informants and also provided opportunities for observation. Interactions in the informal form usually happened during coffee breaks in between the daily routine or during out-of-hour social activities (see section 5.4).

g) Telephone and email communications

One of the challenges being faced in this study was that the research activities were carried out in both the UK and Vietnam. Telephone and email, therefore, became important means of communication between the researcher and the participants.

Before each research stage, the researcher contacted gatekeepers and potential informants through email and sometimes, telephone calls. During the fieldwork in Vietnam, initial communications and follow-up activities were also made using this technique. In stage one, email communications proved to be a useful method and were preferred by the engineering companies group. The researcher sent the questionnaire forms to participating companies as an email attachment and received the completed questionnaires via the same route.

In stage three, the researcher also relied mainly on email communication when conducting the value-test of the framework. Email exchanges with the informants enabled the researcher to keep in touch, and gain comments and feedbacks from the participants.

h) Document reviews

Considered as one research technique that can yield valuable data for researchers (Patton, 2002; Denscombe, 2007; Stringer, 2007), document review was used in this study to help contextualise the stories emerged from the research activities, and as an additional source for validation.

For stage one, the main documentary data came from government publications and official statistics concerning the Vietnamese context, sustainable development, higher education, and education for sustainable development in Vietnam. Data were also drawn from proceedings and other documentation collected when the researcher attended conferences and seminars. For stage two, key documents being reviewed included publications which explained the context of the engineering universities and departments, strategic and action plans, and records of communication and other documents related to teaching and learning for sustainable development in the institutions.

4.5. RESEARCH TRUST-WORTHINESS AND VALIDITY

This section attempts to clarify the strategies being used throughout the course of the research to enhance the trust-worthiness and ensure the validity of the research. Within the academic community, issue of quality and validity in research has initiated many studies and sustained an interesting discussion among researchers. Some significant names in the qualitative domain include LeCompte and Goetz (1982), Lincoln and Guba (1985), Eisner (1991), Lather (1991), Johnson (1997), Seale (1999), Angen (2000) and Creswell (2007). As a result, in the literature of validation in qualitative research, there exist many perspectives and terms with regards to how to define and describe validation, as well as the procedures for establishing validation.

Drawing from the current studies and debates on research quality and validity, in this section, the researcher discusses the elements being viewed as important to the research. This section aims to outline the different strategies being used in order to manage the researcher's subjectivity, strengthen the research trust-worthiness and ensure the research validity, which contributed to the enhancement of the overall research quality.

4.5.1. Managing subjectivity through reflexivity

In the introduction chapter, the researcher has acknowledged the unavoidable subjectivity that shapes the research and influences the findings of the study (Creswell, 2007; Lincoln Y. , 1995) (see section 1.5). As Cheater (1987) puts it: 'We cannot rid ourselves of this subjectivity, nor should we wish to; but we ought, perhaps, to pay it very much more attention' (p. 172). This view over the need for acknowledgements and assertions, and more importantly, systematic management of subjectivity throughout the research process has been argued for within the interpretive research community (Dowling, 2005; LeCompte, 1987; Peshkin, 1988). Alan Peshkin, in studying his own subjectivity when doing the research entailing a one-year fieldwork in a multiethnic high school, proposes that all researchers should use a formal systematic monitoring of self in order to enhance the awareness of their subjectivity and its possible impacts on the research (1988).

In this research, reflexivity has been used as the strategy to manage the researcher's subjectivity. Reflexivity in qualitative research is perceived as a way of ensuring rigor (Finlay, 1998; Koch & Harrington, 1998; Bourdieu, 2004). Reflexivity involves critical reflection of how the researcher constructs knowledge from the research process – what sorts of factors influence the researcher's construction of knowledge and how these influences are revealed in the planning, conduct, and writing up of the research. A reflexive researcher is one who is aware of all these potential influences and is able to step back and take a critical look at his or her own role in the research process (Lincoln Y. , 1995). Being reflexive means the researcher recognises that social research is itself a form of intervention in the social and cultural world (Seale, 2004).

Research diary has been used as a mechanism for reflecting on and gaining insights into the researcher's pre-understandings, predispositions and her personal involvement in the study , making reflexivity an integral part of the study (see section 4.4.2). When writing the thesis, the researcher reports on her own reflections where possible (see sections 5.3.4, 5.4.4 and 5.5.3), and provides 'thick descriptions' (see chapters 6 and 7) which allows the readers to form their own understandings and interpretations, and to interrogate the researcher's subjectivity in the handling and undertaking of the research.

4.5.2. Strengthening the research trust-worthiness

Lincoln and Guba (1985; 1989; 1994) propose a four-point criterion list for trust-worthiness in qualitative and interpretive research that include credibility, transferability, dependability and confirmability, and later on add one more criterion named authenticity. In contrast to the conventional view similar to those of quantitative inquiry which put reliability at the heart of quality criteria, for example the view of LeCompte and Goetz (1982), qualitative and interpretive researchers recently view trustworthiness as being negotiable and open-ended, not a matter of final proof whereby readers are compelled to accept an account (Seale C. , 1999; Lincoln & Guba, 1985). By making reflexivity an integral part of the research through the use of research diary (see section 5.5.1 above), the research's trust-worthiness has been enhanced through the procedure of confirmability. The procedures of credibility, transferability and dependability in this research have been carried out by using the strategies of face and respondent validation, comparison, and thick description respectively, which are presented in detail in the following section. This section sets out to focus on how the criterion of authenticity was fulfilled in the research design and processes.

Authenticity, as proposed by Guba and Lincoln, is based on the relativist view of the interpretivist paradigm that research accounts represent a sophisticated but temporary consensus of views about what is to be considered true (Guba & Lincoln, 1994). Based on the authors' list of components for authenticity, the researcher seeks to strengthen the research trust-worthiness through the research processes that ensures:

- *Fairness:* data collected and findings generated were drawn from a range of different realities as being understood and interpreted by a number of participants from different stakeholder groups (in stage one) and different positions and institutions (in stage two).
- *Ontological authenticity:* the research processes were designed in a way to help participants develop "more sophisticated" understanding of the phenomenon (i.e. engineering education and engineering curriculum for sustainable development) through critical questioning and deliberations.
- *Educative authenticity:* the research sought to help participants appreciate others' viewpoints by providing platforms and opportunities for opinion sharing and intellectual interactions (i.e. focus groups and group discussions)

- ***Catalytic and tactical authenticity:*** seeking to stimulate and empower the participants, the research was designed with the intention that the cyclical process of critical questioning and reflection could lead to change in the participants' perception and, eventually, in their actions beyond the research process.

4.5.3. Strategies to ensure research validity

Validity, in the most commonsense way, can be referred to as the 'correctness or credibility of a description, conclusion, explanation, interpretation, or other sort of account' (Maxwell, 2005, p. 106). A key concept for validity is the validity threats of being wrong. First, researcher bias is the selection of data that fit the researcher's existing theory or preconceptions and the selection of data that stand out to the researcher (Miles & Huberman, 1994). Second, reactivity is the influence of the researcher on the setting or individuals being studied (Maxwell, 2005).

While quantitative and experimental researchers generally attempt to design controls to deal with threats to validity prior to the research, it is widely argued that qualitative researchers must try to rule out most validity threats after the research has begun, 'using evidence collected during the research itself to make these "alternative hypotheses" implausible' (Maxwell, 2005, p. 107). Among the qualitative research community, Lather (1991) observed a reconceptualising of validation due to the paradigmatic uncertainty of the human sciences and called for 'new techniques and concepts for obtaining and defining trustworthy data which avoids the pitfalls of orthodox notions of validation" (p. 66). Lather identifies four types of validation: triangulation (the use of multiple data sources and methods), construct validation (recognising rather than imposing theories/constructs on informants or the context), face validation (whether the data/methods "look valid" to the informants and the researcher), and catalytic validation (which energises participants to transform the reality when they get to know it). While there are many types of qualitative validation (Johnson, 1997; Maxwell, 1998), Creswell (2007) describes his view on the term "validation" as a process rather than "verification" or other historical words which has 'quantitative over tones' (p. 207). He also suggests that authors choose the types and terms in which they are comfortable, and reference their validation terms and strategies.

Strategies to avoid the validity threats have been discussed by many authors such as Miles and Huberman (1994), Maxwell (2005), and Lincoln and Guba (1985). Within this research, the researcher has sought to ensure validity of data through a variety of strategies including:

- ***intensive and relatively long-term involvement with the participants throughout the research*** (through individual and group communication, and participant observation): During the field trips to Vietnam, taking place between May 2010 to January 2011, in which the researcher sought to collect data for the mapping exercise, because the fields of sustainable development and education for sustainable development in Vietnam were emergent and the concerning community relatively small, there were chances for the researcher to meet and interact with informants outside the pre-arranged interview sessions, i.e. on occasions of conferences and seminars (see section 5.3). In the fieldwork for stage two, over the period of seven weeks, the researcher spent time everyday at different case-study universities, not only during working hours but also in the participants' out-of-hour activities (see section 5.4).

- ***rich data and thick description:*** the researcher aimed to provide detailed and varied data recorded in different forms (i.e. transcript of the interviews, field notes, audio recording). In the chapters on research findings (see chapters 6 and 7), when presenting the finding statements, the researcher provided many examples in the form of narrative accounts taken from interview transcripts and observation notes. Consciously seeking to provide "thick description" in order to support the interpretation, the researcher wanted to provide enough description for the readers to be able to form independent understanding and interpretations.

- ***face validation and respondent validation:*** data and emergent constructs being generated from the research activities were communicated to the participants in the subsequent meetings or interactions to obtain feedbacks and to check for any misinterpretation. The framework developed in stage three was value-tested with key informants to validate the data and check the usability.

- ***construct validation:*** by taking the grounded approach to research, the researcher sought to ensure the themes and constructs were recognised through the cycles of data collection, analysis and interpretation rather than imposed on the informants or the context. Interviews, questionnaires, focus groups and group discussions were only guided by a loose list of main topics which allowed for free deliberations.

- *triangulation:* using both data triangulation and methods triangulation. Data were drawn from diverse sources (from a number of participants in different universities, through interactions, observation and also review of documentation), and collected through a variety of methods (including semi-structured and unstructured interviews, focus groups and group discussions, and participant observation).

- *comparison:* being a multiple case study research, there were opportunities for comparisons aimed at testing emerging key constructs which helped increase the validity of the data. The use of constant comparison method of data analysis also contributed to ensuring the research validity (see section 5.3.2).

4.6. SUMMARY

This chapter has discussed the different building blocks of the research methodology. These include the philosophical and theoretical foundations on which the research has been constructed; the approach to research that shapes data collection and analysis; the different techniques being deployed and the various strategies which help to ensure the validity of the research.

1) The chapter has located the study in the interpretivist paradigm and made explicit the underlying research assumptions. By closely examining the critiques of the interpretivist approach, it has pointed out how the research has been designed in order to overcome those limitations.

2) The chapter has stressed the role of the theory of culture by cognitive anthropology in offering theoretical guides for the research. Particularly, the theory developed by Ward Goodenough has provided the ontological and epistemological lenses for understanding the cultural influences of the change process toward EESD, which is central to this research.

3) The chapter has also described the methodology and provided the rationales for the use of grounded approach to research. It has highlighted the key features of the grounded theory framework being adopted to help address the research questions.

4) The chapter has documented a discussion on the particular choices of technique for data collection. These research techniques include interviews in different forms, focus groups and group discussions, qualitative questionnaire, participant observation, research diary and others.

5) The chapter ended with a section in which issues related to trust-worthiness and validity of the research were discussed. It has presented the different strategies and procedures being put in place to manage the researcher's subjectivity, enhance the trust-worthiness and ensure the validity.

Next, chapter 5 presents the research design and processes in which the study was conducted to generate data following the research methodology discussed in this chapter.

CHAPTER 5. RESEARCH DESIGN AND PROCESSES

5.1. INTRODUCTION

This chapter centres on research design and defines the research processes that have enabled the research aims and objectives of this study to be met.

First, it outlines the research design following the research methodology as discussed in chapter 4. Located in the interpretivist tradition and taking a grounded approach, the research have been designed into three stages: stage one documenting the current sustainable development movements in Vietnam and the implications for engineering education; stage two identifying the issues and possibilities for engineering curriculum change for sustainable development in Vietnamese universities, as well as exploring the contextual and cultural influences on change; stage three seeking to develop a framework which assists in building culturally appropriate strategies for transforming the engineering curriculum towards sustainable development in Vietnam. The two main data collection stages one and two take forms of: (i) a qualitative survey; and (ii) case studies.

The chapter then reports on how the study has been conducted and describes the design and implementation of the research to achieve the research aims and objectives set out in the introduction chapter (see chapter 1) through the use of the research methodology discussed in the previous chapter (see chapter 4).

The chapter documents how data was collected, managed, analysed and interpreted. It also provides some reflections of the researcher on the challenges encountered at different stages of the research, and reports on how ethical considerations were addressed during the research processes.

5.2. RESEARCH DESIGN

Research design is described as a plan that 'guides the investigator in the process of collecting, analysing, and interpreting observations. It is a logical model of proof that allows the researcher

to draw inferences concerning causal relations among the variables under investigation.' (Nachmias & Nachmias, 1992, pp. 77-78). This research was designed into three stages:

(i) Stage one was informed by a qualitative survey that sought to collect information regarding developments and scenarios in Vietnam with regards to engineering education for sustainable development.

Survey approach was utilised as research strategy for this stage since it sought to capture baseline data collected through a large group of stakeholders from different sectors and different levels of governance. According to Denscombe (2007), surveys have emerged in recent times as one of the most popular and commonplace approaches to social research which represent the act of "obtaining data for mapping" aiming at a wide and inclusive coverage, at the specific point in time, and involving empirical research methods (pp. 7-8).

The focus of this research is on engineering universities, however, the survey has been designed to reach to a range of stakeholder groups including the international development agencies and non-governmental organisations (NGOs), national authorities and, engineering corporations and companies. There are two reasons for this. Firstly, the current status and issues surrounding Sustainable Development movements in Vietnam may provide the contextual implications for engineering education, which help identify the contextual and 'real' needs for change instead of imposing the universally perceived ones. Secondly, since the ultimate objective of the research is to seek culturally appropriate ways for change towards Sustainable Development in engineering universities, it has been decided that it would be amiss to not establish an understanding of the wider context and culture related to Sustainable Development efforts.

Stage one utilised various research techniques to generate data: interviews, qualitative questionnaires, direct observation/participation and documentary review.

(ii) Stage two used a case study approach to assess the opportunities for change and explore the contextual and cultural influences over the change processes.

Among research communities, case studies have become one of the most common ways to do qualitative inquiry (Stake, 2000). The approach to conducting this stage was taken with the view advocated by Stake (2000) that case-study 'is not a methodological choice but a choice of what is to be studied' (p. 435). A case study approach offers the opportunity to investigate issues

where they occur, which results in descriptive and interpretive accounts that allow rich understandings (Cousin, 2009). Yin (2009) defines the case study as 'an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident' (p.18). According to Yin, deciding what research methods are to be used depends on three factors: the type of research question asked, the investigator's extent of control over actual behavioural events, and the degree of focus on contemporary or historical events.

The choice of case study as the design of this stage was based on Stake's definition of "collective case study" in which a researcher studies a number of cases in order to investigate a phenomenon, population or general condition (Stake, 2000), Yin's view over the "exploratory" purpose of case study (Yin, 2009), and Bassey's note on theory-generating as one possible aim when conducting case study research (Bassey, 1999). Stage two was conducted at three engineering universities in Vietnam to generate data on: the issues and possibilities for change in engineering curriculum for sustainable development in Vietnam; and the contextual and cultural factors influencing the change processes.

In each case study, informants being chosen were key members of the management board and academic staff. The main data collection techniques included interviews and informal talks; focus groups and group discussions; participant observation; and documentary review.

(iii) Stage three involved the development of a framework for building culturally appropriate strategies for engineering curriculum transformation towards sustainable development.

It is important to note that this research does not aim to define in detail a curriculum transformation for sustainable development in any particular context, nor does it attempt to describe all the requirements that must be satisfied for engineering universities to successfully implement change towards sustainable development. It aims to develop a framework necessary for realising the vision for ESD in Engineering Education in Vietnam, and build culturally appropriate strategies for curriculum transformation for sustainable development in Vietnamese engineering universities. By way of analogy, this is similar to the distinction between exploring the features of a telescope that can be used to view other planets versus describing the features of the planets themselves. Key features of the planets have to be considered in the

design of the telescope, but the planets' features are not elaborated in detail in the plan for the telescope.

Based on the findings of the previous two stages, a framework was constructed and value-tested through a series of one-to-one communication in the forms of interview and email. Key academic staff, universities' managers and other stakeholders including key persons in the ESD field who were key participants in stage one of the research, were involved in reviewing and shaping the final form of the framework.

The following sections report in more detail processes that took place in the two main data collection stages (i.e. stages one and two). The framework development and validation processes are explained in chapter 8.

5.3. STAGE ONE: MAPPING THE CURRENT SCENARIO

The data collection of the first stage formally took place between May 2010 and January 2011 with a realisation of various informal meetings and a series of research activities as detailed in *Table 8*.

<table>
<tr><td colspan="3">Stage One – Mapping the current scenario

Method: Survey

Time: May 2010 – January 2011</td></tr>
<tr><td>Research activity</td><td>Informant group/
Information source</td><td>Details[69]</td></tr>
<tr><td>Interview</td><td>Governmental authorities; international and local NGOs; engineering universities; engineering businesses</td><td>- 19 interviews with 14 organisations;
- 12 interviews with 9 engineering universities;
- 1 interview with 1 engineering</td></tr>
</table>

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[69] Please see Appendix 7 for a detailed record of the research activities during stage one.

		corporation
Questionnaire	Engineering businesses	- 8 questionnaires from eight engineering corporations and companies
Participant observation	Conferences and Forums on Sustainable Development and Education for Sustainable Development	The significant ones included: - The Conference on Education for Sustainable Development in Higher Education (Hung Yen, 13th May 2010); - The Workshop 'ASEAN Pattern Laboratory: Education for Sustainable Development' (Ha Long, 19th – 21st October 2010); - The Forum on Sustainable Development for Vietnamese Businesses (Hanoi, 17th December 2010); - The 3rd National Conference on Sustainable Development (Hanoi, 6th January 2011) and its sessional Forum on Education for Sustainable Development (Hanoi, 6th January 2011).
Documentary review	Key documents on sustainable development, engineering and higher education for sustainable development in Vietnam	

Table 8. Research Stage One

The following section reports on the processes of planning, data generation and some personal reflection on the data collection period for stage one. It describes how the different stakeholder groups and informants were approached and gained consent to participate, and how various research activities were undertaken throughout the course of the first field trips in Vietnam.

5.3.1. Initial planning and sample selection

Data collection for stage one mainly involved the distribution of qualitative questionnaires and semi-structured interviews . Documentary analysis and participant observation were carried out alongside to verify and complement data.

The data collection method which included questionnaire and interview was essentially qualitative. It sought data to construct an understanding of the current context and processes of sustainable development in Vietnam, as well as an understanding of different stakeholders' perspectives and experiences in this area. The questionnaires consisted of a set of open-ended questions which should have taken no longer than 30 minutes to complete. The interviews were designed as semi-structured with an interview guide identifying key themes for the inquiry. The average interview lasted approximately one hour.

The approach to selecting participating individuals for this research stage (i.e. for the questionnaires and interviews) was purposeful sampling. In order to address the research objectives, the target sample comprised senior managers of the organisations (i.e. national authorities, NGOs, engineering businesses and engineering universities), and also key lecturers in the case of engineering universities, who could provide information from more strategic and authoritative perspectives.

For the groups of international development agencies, non-governmental organisations and national authorities, an initial list of possible participating organisations in the interviews had been identified before the start of the data collection period. This was based on the literature review on Sustainable Development in Vietnam, with a focus on either industry and engineering, or education. During the research, the researcher continuously sought to include more organisations and informants using the technique of snowball sampling. With snowballing, the sample emerged through the process of reference from other persons working in the field. This strategy worked well in this case, especially with helping to find the right people to talk to in an organisation.

For engineering companies, the researcher sought to target companies which were named in the top two hundred Vietnam's largest firms in a report produced by the United Nations Development Programme (UNDP) in 2007[70]. The rationale behind this choice of large firms was because, whilst being named as big compared to other firms in Vietnam, according to the report, in global terms they are more like small and medium sized enterprises. These largest firms accounted for a sizable share of labour and compared to smaller sized firms, employed a more significant level of engineering. Therefore, they were believed to be able to provide more representative and relevant answers to the research questions posed.

The list of engineering universities was derived from the list of Vietnamese universities on the official website of the Vietnam Ministry of Education and Training (accessed during September 2010) with the selection criterion of providing engineering courses at undergraduate level.

5.3.2. Initial communication and gaining access

Initially, the decision was made that the research used interview as the technique to collect data from the governmental authorities and NGOs groups, and questionnaire to collect data from the engineering businesses and engineering universities. The rationale for this choice lay in the advantage of questionnaire in reaching out to a large number of respondents over a wide geographical area (Denscombe, 2007). Pilot tests, for both interview and questionnaire, were undertaken in the beginning of stage one.

An early meeting with a governmental official from the Vietnam Ministry of Natural Resources and Environment, being held on 25th October 2010, served to be the pilot test for the interview. From the meeting, the informant suggested possible informants be contacted to arrange an informal meeting first. During the informal meeting, an introduction to the research and a set of key themes for the interview should be presented. This way of approach was more appropriate since it helped build trust and the sense of comfort for the informants. When feeling prepared and being in control, the person as possible informant would be more willing to participate and provide information.

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[70] United Nations Development Programme. Top 200. Industrial Strategies of Vietnam's Largest Firms. Vietnam, September 2007.

Most initial meetings with individuals and organisations were made possible through referrals or initiated during casual talks between the possible informants and the researcher at conferences and seminars. The researcher found it crucial to gain trust and maintain the relaxing atmosphere with the informants. Bringing out confidentiality matters early in the getting-to-know process proved to create an adverse effect. Therefore, the researcher chose to touch the subject later in the initial meetings, after having a chance to explain the research and the participant got used to the idea of 'a required research procedure'.

Pilot tests for the questionnaires were also undertaken in the first week of data collection period. The feedback implied a change to how the survey of engineering universities should be done. While questionnaire appeared to work for engineering companies, it was suggested that interviews were more appropriate for engineering universities. Within a company, there is likely a designated department for environmental and sustainable development associated issues and a manager in charge who could be approached for information via questionnaire. For a university, interview as the method of survey would help increase the number of participants and provided an opportunity to explore the subject further, especially when initial feedback indicated that ESD had not been widely recognised and understood among higher education institutions in Vietnam. The decision therefore was made that interview was to be used as data collection technique for this group, instead of questionnaire.

With the hope to achieve a high response rate for the survey, institutional support was sought from the Ministry of Industry and Trade (MOIT) (for survey of engineering companies), and the Ministry of Education and Training (MOET) (for survey of engineering universities). Informal meetings were held with the directors of the departments associated with Sustainable Development in both ministries to explain the research and these directors were sought for advice on the best way to contact the informants. The directors were very keen to help but at the same time suggested that it would be very difficult to persuade them to participate. Both directors even offered to provide an official cover letter to accompany the questionnaire and the request for interview letter/email. However, since it would take a long time for the official letters to be approved and the procedures entailed were quite complicated, the researcher decided to approach the organisations in a more conventional way: making initial contact via telephone, email or informal meetings. In some cases, with the prior approval of the directors,

their names were mentioned as referring persons when starting the conversations to break the ice[71].

5.3.3. Data generation

Sample \ Data collection method	Interview	Questionnaire	Documentary Analysis	Direct observation/ Participation + Research Diary
International agencies/NGOs	√		√	√
Governmental agencies	√		√	√
Engineering companies		√	√	
Engineering universities	√		√	√

Table 9. Sample groups and the methods of data collection.

Various informal meetings had to be made before interviews were confirmed. In the instances where the informants were not available for face-to-face interview, or there were technical difficulties (e.g., long distance to travel), interviews were conducted via telephone. There were a number of informal talks in which the individuals only shared information and thoughts but did not want to be identified as participants and did not sign the consent form. In these cases, the given information was not explicitly used as data.

To generate data for the first stage, three main research activities were implemented: questionnaires for engineering businesses[72], interviews for engineering universities, and

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[71] During the research processes, the researcher made sure to record all these situations and experience in the research diary in the form of field notes. This helped the researcher to reflect on the contextual and cultural issues that influenced the research processes. Further reflection is provided in section 5.3.4 (for stage one) and 5.4.4 (for stage two).

interviews for other stakeholder groups including international and local NGOs and national authorities. *Table 10, Table 11* and *Table 12* summarise and give relevant information on each research activity[73].

<table>
<tr><td colspan="2" align="center">**Activity 1**

Research technique: Qualitative questionnaire

Stakeholder group: Engineering businesses</td></tr>
<tr><td align="center">**Main theme of study**</td><td align="center">**Main data being generated**</td></tr>
<tr><td>The company's commitment to sustainable development</td><td>- Sustainable development awareness and business policy for sustainable development at strategic level.</td></tr>
<tr><td>Implication for engineering education</td><td>- The expectation of the company's manager regarding the employees' knowledge, understanding and skills concerning sustainable development, and how they could contribute to the company's vision for sustainable development, and improve the company's products and services;

- Level of the employer's satisfaction towards their current employees.</td></tr>
</table>

[72] Exception was made to one engineering corporation in which the manager indicated a preference for one-one-one interview instead of questionnaire. The questionnaire was, in that case, used as interview agenda to guide the inquiry process.
[73] See Appendix 4 and Appendix 5 for examples of the interview agenda and questionnaire.

Additional data collected through the questionnaire:

- Spaces were provided for general information about the company and the informant at the beginning and for further comment and feedback in the end of the questionnaire.

- The questionnaire also included an additional question concerning the specific knowledge and skills for sustainable development, which were derived from the literature, that the company considered to be most important to its business. The aim of this additional question was not to rank but to help clarify and provide source of validation.

Table 10. Main research activity of stage one – Questionnaire to engineering businesses

Activity 2
Research technique: Interview
Stakeholder group: Engineering universities

Main theme of study	Main data being generated
The university's commitment to sustainable development	- Sustainable development awareness, and vision and policy for sustainable development and ESD at strategic level.
Teaching and learning for sustainable development in the institution	- The current practice of teaching and learning about sustainable development in engineering departments and faculties including the approach and the content; - The role of teaching staff in integrating sustainable development in the curriculum and the opportunities to link real-life engineering practices with curriculum development.

Current activities and the challenges	- The activities related to ESD in the engineering departments which currently exist across the university and the opportunities that they offer; - The difficulties and challenges being faced. Ways to support the enhancement of ESD in the curriculum.

Table 11. Main research activity of stage one – Interview with engineering universities

Activity 3 Research technique: Interview Stakeholder group: National authorities, International and local NGOs
Main theme of study
- The organisation's vision for Sustainable Development in Vietnam and the current movements; - Practicalities of decision making and implementation of sustainable development activities/projects; - The challenges and envisioning future; - Implications for engineering education and the influencing factors.

Table 12. Main research activity of stage one – Interview with national authorities, international and local NGOs

During the data collection period of stage one, the researcher attended a number of conferences and seminars on Sustainable Development and Education for Sustainable Development which provided her invaluable chances to meet a wide range of organisations and individuals working within the field, and gain an overall view over the current Sustainable

Development movements in Vietnam[74]. When attending these events, the researcher assumed her role as a participant observer. The researcher actively looked for data that reveal the movements towards sustainable development in Vietnam in the forms of speeches, presentations, debates and documents which provide sources of validation. Moreover, the researcher sought social interaction with other participants at the events who were the informants or potential informants in order to produce a relationship of rapport and trust (Walsh, 2004).

5.3.4. Personal reflections on the experience and challenges of stage one

As mentioned in the section 4.4.4, the researcher used a research diary to enable critical reflection and enhance reflexivity during the field work. It proved important and meaningful to note the experience, thoughts and feelings throughout the research processes as there had been many meetings and conversations that were not recorded. The research diary allowed the researcher to reflect on her intellectual biases and the contextual factors affecting the research processes and the choices being made.

The first big challenge the researcher faced was to secure an interview with a possible informant. The common means of communication such as telephone and email did not prove to be effective. After a number of request-for-interview emails sent out without any response or being declined, the researcher had to change the strategy to initially arranging an informal meeting (mostly through referral) to engage and gain trust from the informants. The researcher recognised and confirmed the importance of this face-to-face first meeting in the research diary as follows:

> "It is such a relief that the meeting went well and that I will have my first interview. Now I know I will have to continue arranging getting-to-know meeting with the possible informants if I ever want them to agree on participating in the research. I could see how behaving professionally and confidently change the way [a governmental official] looked at me and the research. He took me seriously and he trusted me." (Research diary, 25/10/2010)

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[74] See Table 8 for list of events that the researcher attended during stage one.

Throughout the field trips, the researcher undertook numerous meetings. During the meetings, the researcher endeavoured to establish and nurture trust and supportive relationships between herself and the participants. It was from many meetings that the researcher either got referral for the next possible informant or gained access to documentation, which was considered to be an additional success.

The researcher tried to ensure the interviewees were comfortable and feeling respected to allow authentic and rich data. However, as an interviewer, the researcher sought to stay alerted in maintaining her professional integrity as a researcher by being true to herself and raising critical questions, when needed, even though it might challenge the informants' assumptions or beliefs. The researcher has to admit it was a struggle finding a way to balance this ethical dilemma, and there are reflections in the research journal which attests to this struggle.

Difficulty in securing interviews and the sensitivity of the informants whilst expressing their ideas and sharing their thoughts have made the researcher rethink the research design for the stage two that followed. An extract from the research journal captures this thought:

> "After the meeting today with [an official from the Ministry of Education and Training], and after calling those people from the universities, I am losing hope of securing any interviews with them. They all said they are busy or they are not the one for such and such information. [The official] told me there is no research culture in Vietnam and people are not used to be approached by a PhD researcher, and to spend time out of the busy schedule talking about something considered not important to their current job. Why? University people are supposed to be the ones who are used to research, right? Now, I am experiencing the challenges of getting an interview, especially with the 'important people'. Also, if they are that sensitive about expressing their own thoughts (like he said), I don't know if focus groups is a feasible research technique in this case. I don't think focus groups work for stage 2" (Research diary, 10/11/2010)

The political context of Vietnam at the specific moment when this field trip was undertaken was also considered to bring some effect to the research. Data collection for the first stage was carried out from mid October 2010 to the beginning of January 2011, just before the Eleventh Congress of the Vietnam Communist Party, the most significant political milestone of the country, which was held from the 11th to the 20th January 2011. The benefit was that in preparation for the Congress, governmental authorities had organised a series of conferences to report on the performance and implementation of action plans in all aspects. The researcher

was fortunate to be able to attend a number of conferences and meetings related to environmental management and sustainable development, which helped shape her understanding of the broad context and gain access to possible informants. Furthermore, the organisation of conferences resulted in the availability of documentation which was more systemically collated and rich in content. However, the situation made the research questions sensitive to some informants. It was acknowledged by an individual engaged in a talk with the researcher that at that moment:

> "people, especially senior management officials, was more cautious in, and reluctant to giving any remarks or statements about the current status." (Research diary, 25/10/2010)

This might be one reason to explain the challenge of arranging interviews, and to verify the fact that there were individuals who agreed to talk and share ideas but did not want to be identified as informants. Taking the situation into account whilst carrying out the interviews, through reflexivity, the researcher remained aware of, and sensitive to the participant social positions, intellectual biases, and the organisation's and the wider country's context.

5.4. STAGE TWO: CASE STUDIES

The main objectives of stage two are: 1) to explore the issues and identify the possibilities for change in engineering education for sustainable development (EESD) in Vietnamese universities; and 2) to critically review contextual and cultural factors with a view to understanding the influences over transformation of the engineering curriculum for sustainable development at Vietnamese universities. The aim is to identify the different features of the strategies needed for such change, with adequate attention paid to ensure the contextual and cultural relevance in the specific cases of Vietnam universities. In conducting this stage, the research adopts a grounded approach to assist with processes of data collection and data analysis (see section 4.3). Case-study method has been chosen for this stage to address the research objectives and different techniques including semi-structured interview and informal conversation; focus groups and group discussion; casual chat; and participant observation have been deployed for data collection.

	Stage two – Case studies	
Time: 9 May 2011 – 24 June 2011		
Research activity	**Informant group/ Information source**	**Details**[75]
Interview/Conversation	- University 1: 4 informants; - University 2: 5 informants; - University 3: 5 informants	- 12 interviews and conversations with informants of university 1; - 16 interviews and conversations with informants of university 2; - 16 interviews and conversations with informants of university 3
Focus groups/Group discussion	- University 1: 4 informants; - University 2: 5 informants; - University 3: 5 informants	- Two group discussions of the informants of university 1; - One group discussion and one focus groups of the informants of university 2; - One group discussion and one focus groups of the informants of university 3;

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[75] Please see Appendix 9 for a detailed record of the research activities during stage two.

Participant observation	- Events such as Student research conferences; - Regular activities such as Department meetings and lectures; - Normal working days	- One student research conference at university 1 and one student research conference at university 2; - One department meeting at the Faculty of Environmental Ecology and Technology in university 2; - Two lectures at university 1; one lecture at university 2 and one lecture at university 3 - 33 full-days spent at the three universities
Documentary review	Key documents of the institutions including institution's code of conduct, strategic documents, annual reports, 'record of decision' documents, and other relating documents; teaching materials related to sustainable development topic.	

Table 13. Research Stage Two

The following section reports on the processes of planning, data generation and some personal reflection on the data collection period for stage two.

5.4.1. Selection of case studies and identification of key informants

Cases and key informants for this research were selected using Corbin and Strauss' guidance on theoretical sampling (Corbin & Strauss, 2008). In this research, case studies were selected on the basis of being engineering departments or faculties in Vietnamese universities that offer four-year or five-year undergraduate engineering programmes. Three cases were studied in three Vietnamese universities.

The three universities chosen are located in Hanoi, the capital and second biggest city of Vietnam. Hanoi presents the characteristics of big and urban cities in the country with high population and active socio-economic activities. In total, there are currently twenty-six universities in Vietnam which offer undergraduate engineering programmes. Among these universities, nine are located in Hanoi making it the city with largest number of engineering universities in Vietnam. The case studies are at public universities which represent those of the largest and most distinguished higher education institutions in the country. They were chosen from the list of universities that participated in the first stage of the research, and indicated a commitment to teaching and learning for sustainable development.

Studies on decision making and change management within university setting suggest that managers and individual professors are those with highest influences, particularly over the matters concerning teaching and learning (Hardy, Langley, Mintzberg, & Rose, 1988; Tight, Mok, Huisman, & Morphew, 2009) (see section 3.2). Therefore, key informants were initially chosen based on the criterion of being members of key academic staff. In each case, three to four informants who included managers/heads of engineering departments and professors/key lecturers were approached and invited to participate in the research process. However, as the study went on, the researcher continued to look for and recruit more informants when opportunities arose and data analysis during fieldwork indicated the necessity. For example, in the second and third case study, the research processes started with four informants but after the first week, one young lecturer was recruited in each case in order to help generate more insights into the perspective of the young generation of academic staff.

5.4.2. Gaining access and recruiting key informants

Prior to case selection, a number of informal meetings, telephone and email communication took place to identify potential case studies, gain access to documents and identify key informants. The researcher approached relevant universities[76] in Vietnam with requests to carry out the case studies. Three cases were chosen from the positive responses based on the willingness to participate showed by management boards, and the level of support promised with regards to data collection. Once the support was confirmed, potential informants were

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[76] Being identified among the universities that participated in the research stage one.

contacted and recruited. The recruitment was made through a democratic process emphasising voluntary participation and the right of participants to withdraw from the research at anytime (see section 5.6.1). Further details on the research participants are provided in Appendix 8.

5.4.3. Data generation

Grounded approaches and case-study researchers typically combine multiple data collection methods (Corbin & Strauss, 2008; Eisenhardt, 1989; Yin, 2009). The rationale is that the triangulation made possible by multiple data collection methods provides stronger substantiation of constructs and sources for validation. The researcher, therefore during her field trip, sought to utilise as many methods for data collection as possible.

Data for this case study stage were gathered over seven weeks of the researcher's second series of field trips to Vietnam from the 9th May 2011 to the 24th June 2011, representing 33 full-days spent at the three universities and 14 visits to participants' houses for individual meetings, and encapsulating a wide range of qualitative techniques. Due to the working culture in Vietnam, which is rather spontaneous and not research-friendly (see section 5.3.4), and the researcher's experience that even in the educational settings, requests for carrying out research were not always treated favourably, the approach to data generation in this stage could be viewed as opportunistic. There was no fixed timetable for research activities in advance, but rather, the researcher would seize any chances to collect data as the opportunities arose.

The primary data source for this stage was key informant conversations and interviews, group meetings and focus groups, and participant observation of key meetings and interaction contexts (see *Table 13*). In addition, assessment of documents, which include institution's code of conduct, strategic documents, annual reports, 'record of decision' documents, and other relating documents, was carried out when possible to provide an overview of the institution's context and culture. Furthermore, valuable out-of-hour time (e.g. lunch break, after-work drink) was spent with participants and other members of staff to conduct as many informal meetings as possible with the aim to enrich the input data for later analysis, and/or reconfirm the insights that emerged from interviews. Formal conversations, interviews and focus groups were recorded using a digital recorder subjected to the interviewees' consent, or otherwise, by taking note during the sessions. Informal meetings were recorded in the form of field notes.

Corbin and Strauss (2008) advocate that whilst with theoretical sampling, interview and observational guides are not as relevant as they are to structured forms of research, the use of a list of questions or areas of observations might help provide some broad conceptualisation of what is to be studied. For this research, a list of areas/themes of interest was developed based on concepts derived from literature and from previous field work (i.e. stage one of the research). However, such guiding protocols were considered only provisional. When a participant brought up another topic that proved to be important to the investigation, the researcher would follow through on that topic. As the research went along and data began to come in, provisional concepts were deliberately discarded.

Interviewing was considered the most important technique for data generation in stage two as it is advocated as most appropriate where individual perceptions of processes within a social unit such as work group or department are to be studied (Robson, 2002, p. 271) (see section 5.4.1). Semi-structured interviews were undertaken with each informant in the form of conversations as the researcher intended to present herself as a PhD student with an interest in understanding the situation, and not as an outsider making inquiries or seeking to bring about changes. Prior to the interviews, communication was made either via telephone or email, or through one-on-one informal meetings in which the participants were introduced to the research, and explained what participating in the study entails. The researcher sought to build trust and rapport with the key informants and all the people at the institutions where she spent her time. Care was taken to ensure the rapport with informants did not undermine the researcher's neutrality concerning the data generated. "Rapport is a stance vis-à-vis the person being interviewed. Neutrality is a stance vis-à-vis the content of what that person says. [...] Rapport is built on the ability to convey empathy and understanding without judgement" (Patton, 2002, pp. 365-366).

At least two interviews (including formal interviews and conversations) were sought for each informant. The first one began with the identification of opportunities and obstacles to curriculum transformation for sustainable development in the university. These identifications were then be subjected to critical questioning to initially surface the contextual and cultural issues that might influence the desired change. The second conversation aimed to critically assess the contextual and cultural factors with a view to understanding the influences over the transformation. During the latter conversation, initial findings on contextual and cultural issues as influencing factors generated from the first conversation were reviewed in order to engage

the informants in a process of critical reflection. This also allowed the informant to correct any misinterpretations if there were, thus enhanced the research's trustworthiness (see section 4.5.2). The conversation then went on as the informant being asked to deliberate on the issues with a focus on the cultural perspective. The deliberations were guided by a set of questions to enable the informants to deeply read into the complexity of different influences and fully interpret their views over those influences.

Towards the end of the fieldwork, the researcher sought to hold focus groups or group meetings of key informants to provide chances for sharing and communicating emerging findings. It was also expected that group discussions would allow extensive deliberation on the issues and interaction during the meetings provide further meaningful data.

Besides the key informant conversations and group meetings, during the seven weeks of fieldwork, the researcher spent time at different case study universities to undertake participant observation. The researcher visited each case one to two days/week to observe and participate (where possible) in the activities of people and groups in the universities. Examples of such activities are department meeting (one time), lectures (four times), and student research conference (two times)[77].

Everyday's accounts such as participant observation, other research activities and reflections throughout the fieldwork period were recorded in the research diary in the forms of field note and memo. As discussed in section 4.4.2, the use of field notes and memos are essential because it provides important data for analysis and also sources for validation (Corbin & Strauss, 2008; Patton, 2002). The researcher followed Eisenhardt's advice on writing useful field notes which included writing down whatever impressions occurred, that is, to react rather than sift out what may seem important; and pushing thinking in the notes by asking questions (Eisenhardt, 1989). Analytic memos were also useful for the researcher as they captured the emergent ideas which, afterwards, served as a reflexive monitoring of the research and how ideas were generated.

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[77] See appendix 9 for a detailed record of these activities.

5.4.4. Reflections on the experience and the challenges of stage two

Being a Vietnamese who has some experience working in a higher educational setting before, the researcher has certain level of understanding of the Vietnamese mindset and also perception of the influences. Therefore, during the field trip, the researcher constantly reminded herself not to impose any personal opinion (see section 1.5) and to manage her subjectivity (see section 4.5.1). The researcher also paid good attention to the issues of language. Since the researcher communicated with the informants in Vietnamese but presented the finding in English, the researcher believed that it was vitally important that she understood them correctly and conveyed their thoughts and ideas precisely, thus "thick description" was even more meaningful (see sections 5.5.2 and 6.7.3). At the end of each day, the researcher would visit the data and noted down anything that she was unsure about, and checked again with the informants in the following meetings.

Utilising a grounded approach as a guiding framework for data collection and analysis was a challenge for the researcher. Deeply aware that she was a novice, the researcher acknowledged the hesitancy, doubt and lack of confidence in the research diary a few times. For instance, one entry recorded in the research diary stated:

> "My main concern at the moment is determining if I have performed sampling, data collection and analysis the way it is supposed to be conducted as guided by grounded theorists." (Research diary, 06/06/2011)

The researcher questioned herself whether she had conducted certain analytical steps correctly:

> "Did I choose the names or labels for concepts and categories that depicted accurately the situation under study?" (Research diary, 12/06/2011)

> " Did I ask the right questions or adequately facilitate the discussions that help reveal the information needed in full and accurate?" (Research diary, 13/06/2011)

The researcher shared these concerns with the principal supervisor in one teleconference during the fieldwork time, and sought her advice and suggestions on some initial findings to make sure the researcher had done her possible best to assure the quality of the research.

As stated in the previous section, data collection activities were undertaken, in many cases, guided by opportunities rather than schedule. Whilst interviews and focus groups were often

arranged beforehand, informal conversations and informal group discussions were carried out whenever it was possible. Most of the time, informal group discussion did not guarantee full attendance of key informants and the number of participants was difficult to control. Nonetheless, they were particularly meaningful in generating insights into cultural aspects of the institutions. More often, informal meetings proved to be more fruitful and participants were more open and willing to talk about their feelings and understanding. One research journal entry assessed:

> "The discussion today [one happened at a beer gathering after work] actually turned out to be very informative. I secured an interview with one important informant and also identified two more key areas of interest I would like to explore further in the group meeting on Thursday [two days later] and in subsequent interviews." (Research diary, 31/05/2011)

Impression management was another crucial issue in the research. Before entering the field, the researcher was already aware of the Confucian's mindset and the hierarchical working style in Vietnamese institutions in which young researchers might be overlooked and not treated with due respect. The researcher was worried that the informants, many of who were in their late 40s or 50s, would not take her seriously. From the very first communication, the researcher was conscious to act professionally and maturely, even when the people that the researcher contacted were more relaxed and laid back. Moreover, the researcher took the advice of Coffey (1999, p. 65) on "how dressing and personal appearance are crucial to the way we present ourselves when entering the field". He advocates that how we appear often determines the extent to which the participants will trust us and whether they believe we understand the world in which they live. During fieldwork, conscious effort was constantly made on the researcher's comportment. To ensure professional appearance during interviews at informants' private homes or café at weekend, the researcher never wore jeans and always put conscious effort on her etiquette and manner. Only after good rapport had been established, and trust and due respect developed, did the researcher begin to relax deliberately to gather quality information.

5.5. DATA ANALYSIS AND INTERPRETATION

Data analysis is one part of research design that needs to be systemically planned (Coffey & Atkinson, 1996). The process consists of examining, categorising, tabulating, testing, or otherwise recombining evidence, to draw empirically based conclusions. As advocated by Yin

(2009), since there are 'few fixed formulas or cookbook recipes' to guide researchers in data analysis, it is important that researchers employ an appropriate analytic strategy guided by rigorous empirical thinking, sufficient presentation of evidence and careful consideration of alternative interpretations (p. 127). The research processes aligned with a grounded approach which meant that data analysis was conducted as an activity simultaneously with data generation and data interpretation (Glaser & Strauss, 1967). This section attempts to explain the processes related to the handling, analysis and interpretation of data being generated in the research stages described above, which result in the set of research findings presented in the following chapters.

5.5.1. Data management

Initial handling of data, especially those involve audio recording was undertaken using the guide by Branley (2004). As soon as the data from all sources were generated, data were organised into manual folders and computer files. The large quantity of data and the diversity of data sources and forms required a systematic, coherent mechanism of data storage and retrieval. One separate manual folder and one separate electronic folder were created for each stage of inquiry with the electronic ones being backed up on a flask disk on a frequent basis.

Completed questionnaires were saved in manual files and backed up by scanning and storing in computer files. Audio recordings from interviews and focus groups were transcribed and typed into electronic files. Data in the forms of interview and group discussion notes, observational notes, memos and research diary were also stored and backed up in electronic form.

For data generated during stage one, interview data are cited as: Int. [interview number], for example: Int. 2; and questionnaire data cited as: Q. [questionnaire number], for example: Q. 4. In stage two, the informants are named with a letter and a number in which the number indicates the case being studied and the letter is the informant's self, for example: 1B represents the informant B from case 1 (i.e. university 1). For data generated during stage two, interview data are cited as: Int. [informant], for example: Int. 2C; and focus groups or group discussions cited as: FG. [focus group number], for example: FG1.

There were a number of informal talks in which the individuals only shared information and thoughts but did not want to be identified as participants and therefore did not sign the consent form. In these cases, the given information was not explicitly used as data.

5.5.2. Data analysis method

In conducting data analysis, the researcher started with a common qualitative data analysis software (i.e. NVivo) but later on found herself preferring the manual ways as she found more engaging with the data. Moreover, manually dealing with data was more convenient especially for stage two when data analysis was carried out alongside data collection during field work. At the end, manual handling of data was chosen, in which the researcher used different colour stickers, each relating to one or part of the research questions being addressed, to place in the margins of transcripts, notes from documents and memos, adjacent to relevant text and annotated with codes. Once all the data had been coded in this way, codes were grouped according to themes and patterns established.

For this study, data analysis was carried out using the grounded approach following the guides of Miles and Huberman (1994), Corbin and Strauss (2008) and Eisenhardt (1989).

As a starting point, data analysis was undertaken using the set of analytic manipulations described and summarised by Miles and Huberman (1994) which helped put the evidence in some preliminary order including:

- putting information into different arrays;
- making a matrix of categories and placing the evidence within such categories;
- creating data displays – flowcharts and other graphics – for examining the data;
- tabulating the frequency of different events;
- examining the complexity if such tabulations and their relationships by calculating second-order numbers such as means and variances;
- putting information in chronological order or using some other temporal scheme.

Once the researcher identified from the large pile of data a set of themes, concepts, beliefs or behaviours, the next step was to identify how these things were linked to each other in a theoretical model (Miles & Huberman, 1994), that is, a set of abstract constructs and the relationships among them (Bulmer, 1979). A grounded approach to data analysis was adopted in this study using the constant comparison method. This method enables categories of data and key constructs to emerge in the process of data review: the concepts or categories emerging from one stage of the data analysis were compared with concepts emerging from the next. The

researcher looked for relationships between these concepts and categories, by constantly comparing them, to form the emerging constructs. This process of constant comparison went on until so-called "theoretical saturation" was reached (Glaser & Strauss, 1967). Eisenhardt (1989) defines theoretical saturation as the point 'where the addition of further cases or further data would give rise to only incremental learning or improvement in the theory' (p. 545).

5.5.3. Processes of data analysis for stage one

Coding and constant comparison was used for data analysis at stage one. Data generated from data collection activities were first grouped based on the different stakeholder groups to which the informants belonged. The within-group analysis was carried out by coding the qualitative data in relation to the first part of research question 1: *How is Vietnam responding to the challenges of Sustainable Development?* (see section 1.4). Once all the data were coded in this way, codes were grouped according to emerging themes and conceptual categories[78]. To address the second part of research question 1 which focused on *the implications for engineering education*, cross-group analysis was undertaken using the same method as the within-group analysis. Whilst interviews and questionnaires were designed with some guiding questions which indicated some loose *a priori* constructs to the analysis, data were approached with flexibility to allow new constructs to emerge.

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[78] Please see Appendix 10 for example of the data analysis of stage one.
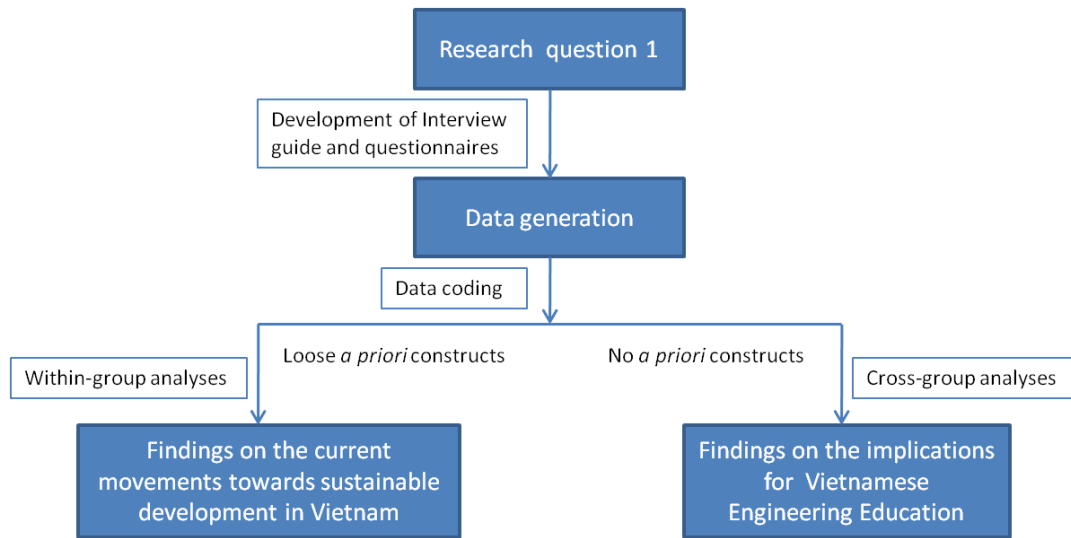
Figure 11. The Processes of data analysis for stage one

5.5.4. Processes of data analysis for stage two

Authors advocating a grounded approach to research suggest that the researcher begins the analysis after completing the first interview or observation ((Glaser & Strauss, 1967; Strauss, 1987). As discussed in section 4.3.1, the overlapping of data collection and data analysis allows for adjustments during the fieldwork process, which means flexible data collection, resulting in better grounding of the resultant constructs.

The researcher, therefore, sought to process and analyse data as collected from informants and observed in the field situations. The researcher reviewed the interview and focus groups recordings and transcripts, and field notes at the end of every day, and asked herself about what had been learnt, what the major categories or constructs were emerging, and how data collection could be more efficient and effective.

The constructs sought after in this stage were those related to the second and third research questions of the study: *contextual and cultural issues underpinning the envisioned transformation of the engineering curriculum for sustainable development*, and *the culturally appropriate strategies needed for such change in Vietnam* (see section 1.4). After coding, the data gathered were assembled in different ways in which central phenomena were identified (i.e. issues underpinning the transformation), causal conditions explored (i.e. categories of conditions that influence the phenomena), actions or interactions (that result from the central

phenomena) specified, and the context and intervening conditions identified (i.e. the contextual and cultural factors that influence those actions and interactions).

Through constant comparison, these constructs and categories were identified and then sharpened. Relationships between these constructs and categories, and between these constructs and those identified in stage one were then verified to shape the development of the framework in stage three.
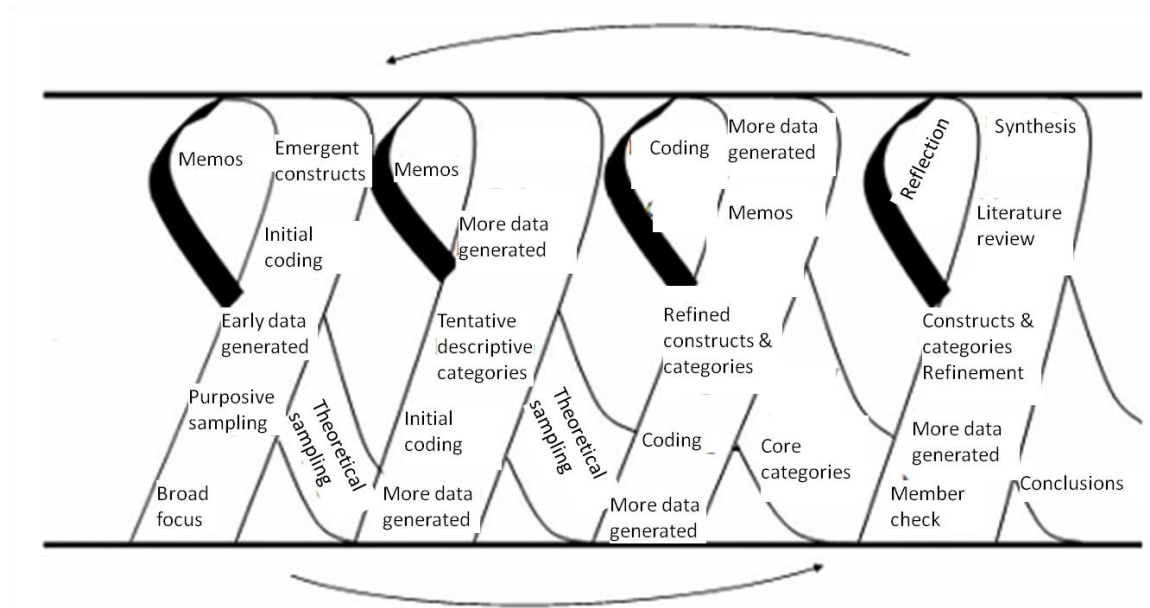
Figure 12. The Process of Data Analysis[79]

5.5.5. Data interpretation and presentation

The process of data analysis discussed in the previous sections which involved cycles of coding and constant comparison contributed to the interpretation of the data. The act of interpretation in this study was also strongly based on the interactions of the research aims and design, and the theoretical frames from which the research was built (chapter 1, 2 and 3). In addition, interpretation process was guided by the researcher's reflexivity as explained in the previous chapter (see section 4.5.1).

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[79] Adapted from (Hutchison, Johnston, & Breckon, 2009, p. 4).

The findings of the research are presented in chapter 6, 7 and 8 of the thesis. Chapter 6 offers findings from stage one. It maps various movements of different stakeholder groups in response to the challenges of sustainable development in Vietnam, and identifies the implications for engineering education. Chapter 7, which reports the findings from the research stage two, explores the issues underpinning as well as the cultural factors influencing the desired transformation. Chapter 8 provides a framework for building culturally appropriate strategies for transforming the engineering curriculum towards sustainable development. Discussion on the value of the framework is also provided.

When reporting the findings, attempts were made to build a discussion that showed how the theme or categories, and constructs emerged from the data. The researcher followed the writing strategies of "thick and rich description" (see section 4.5.2) in which specific quotes and extracts from questionnaires, interviews and focus groups were cited where necessary, multiple items of evidence attained through different sources of data were provided and multiple perspectives from participants presented. Tables, boxes and diagrams were also utilised when appropriate to represent findings.

5.6. ETHICAL, CULTURAL AND POLITICAL CONSIDERATIONS

This section attempts to make clear how ethical, cultural and political issues concerning the research activities was considered. According to Ali and Kelly (2004), all social research involves ethical decision making, and ethical considerations are important to social research because of the common belief that research relationships wherever possible should be characterised by trust and integrity (Israel & Hay, 2006). Bassey (1995, p. 15) identifies three major dimensions of ethics in conducting social research as "respect for persons, respect for truth and respect for democratic values". Within qualitative research, Guillemin and Gillam (2004) look further into the ethical problems that arise in the everyday practice of research, and suggest a framework for thinking through the issue. These authors distinguish two different dimensions of ethics in qualitative research, which they term procedural ethics and "ethics in practice". Procedural ethics involves the ethical considerations the researcher has to take in the early stages of the research process, which has to be approved by the relevant ethics committee before the commencement of the research activities. The latter form of ethics is the day-to-day ethical issues that arise in the doing of research which, as explained by the authors, not usually addressed in research ethics committee applications, nor are they events that are often

anticipated before the actual research activities take place. For this study, considerations of procedural ethics describe issues related to the relationship between the research process and the research participating individuals and organisations, and its impact on the participants. Meanwhile, the discussion on cultural and political context reveal how issues related to "ethics in practice" were considered during the research processes.

This section first discusses the procedural ethics of the research. During the first year of this PhD study and before commencing the research activities, the researcher had to submit an application form called the RD1 to the University of Gloucestershire Research Committee to register for the research degree. The form includes a part in which the research ethical considerations including issues of gaining informed consent, issues of privacy and confidentiality, and issues of culture and language interpretation were explained for ethics approval. The following sections 5.6.1, 5.6.2 and 5.6.3 set out to explain in detail how these pre-determined ethical involvements with participants was managed throughout the research in those three main areas of concern.

The section then goes on to discuss the "ethics in practice" describing how the uniqueness of the Vietnamese research culture and the political and contextual sensitiveness were taken into account.

5.6.1. Voluntary participation and informed consent

All individuals and organisations recruited for research participation were treated with due respect, in which the most fundamental form embodied obtaining consent to participate in research that is informed, rationale and voluntary. First and foremost, participation in this research is voluntary. Participants and participating organisations were free to withdraw from the research process at any time without any implications. Second, free informed consent of participating organisations and participants was assured. At the beginning of the research process, following the ethics guidance from the Research Ethics Handbook of the University of Gloucestershire, the researcher clarified to the participants and the organisations involved in the research: (1) the purpose, duration, and procedures, (2) the right to decline or withdraw from participation, (3) consequences of declining or withdrawing, (4) any prospective benefits to participants or society, and risks and potential discomforts or adverse effects, (5) extent and limits of confidentiality, (6) incentives for participation, (7) who to contact with questions

regarding the research and their research rights, and (8) an opportunity to ask questions . Consent was indicated by signatures of participants in the written form made available in two copies, one for the researcher and one for the participants to keep for record (see Appendix 2 for an example of the consent form). With the questionnaire survey and framework value-test in which communication with participants was conducted via telephone and email, ethical clarification was made in written form as part of the informed consent form being sent during initial communication. For interview survey and case studies, ethical issues and considerations were explained to the participants in person during the first meeting.

During the first stage, there were cases where the mention of the consent form at the beginning created adverse effect to the potential informants' impression of the research. It was suggested by one gatekeeper to the researcher that sometimes in Vietnam, the acknowledgement of confidentiality and the act of signing a consent document might bring the discomfort of "having to talk about bad things" or "taking responsibility", and the scepticism of "true confidentiality". This view was confirmed in cases where the informants told the researcher that they agreed to be interviewed but did not want to sign the consent form, or initially refused to participate on the mention of ethical formality. Taken these into account, the researcher changed her strategy of approaching potential informants, starting to explain the research and ethical clarifications in a more casual tone during the initial communication and only turning to mention the signing of the form once the participants thoroughly understand the research and gain trust with the researcher (see also section 5.3.2).

5.6.2. Confidentiality and Anonymity

All through the research process, there was no secretive use of audio or video recording. Permission to use a voice recorder was asked at the on set of the study. Some informants were uncomfortable with having their voices on tape and in those cases, their wish not to be voice recorded was respected. The interviews were then recorded in the form of written notes by the researcher throughout the courses of the interviews.

The data obtained were stored with all precautions and released without any identifying information. All references were used under pseudonyms. Audio recordings, interview transcripts, and other accounts were handled with precautions following the Data Protection Act.

5.6.3. Culture interpretation and Language translation

Since the research was carried out using both English and Vietnamese languages, care was taken to ensure the highest accuracy possible when translating concepts and phrases between the two languages. When unclear concepts or terms arose, the researcher consulted with experts in the field in both countries and provide detailed explanations.

In designing the questionnaires for the survey, the researcher started with English and then translated into Vietnamese herself. Prior to conducting the survey, two Vietnamese professional interpreters working in the fields of sustainable development, one in engineering and one in education, were asked to back-translate the Vietnamese version of the questionnaires into English to ensure accuracy. Two pilot tests of the questionnaires were also conducted which provided another means to ensure the quality of language translation (see section 5.3.2).

All the questionnaires and interviews were conducted in Vietnamese language, and subsequently translated by the researcher into English. This inevitably means the researcher's own way of understanding and interpreting the meaning entering at the moment of translation could be a factor in the research. The researcher clarified her questions as needed and summarised longer answers to ensure both the respondents and the researcher had the same understanding.

5.6.4. Understanding the research culture

The uniqueness of the research culture in Vietnam in general and in the Vietnamese institutions in particular has been discussed elsewhere in the previous sections in this chapter (see sections 5.3.4, 5.4.4, and 5.7.1). Most significantly, the common unfamiliarity with research formalities (i.e. those related to confidentiality and privacy) was proved to be one barrier to the willingness to participate of the potential informants. In addition, the relatively lack of research professionalism of few participating individuals and organisations brought some inconvenience and challenges to the researcher, especially at the beginning of the research process when the researcher had not had the experience before. For example, some participants asked the researcher to come to their offices and wait for them to find a convenient time to talk without giving any specific indication of possible time slot, resulting in the researcher's having to spend a lot of time and effort coming and waiting and not necessarily gaining anything.

When studying research ethics in social science, Fisher and Anushko (2008) and Silverman (2006) point at the participants' culture as one important factor to ethical considerations. It is argued that failure to recognise and understand the culture would result in inappropriate use of research measures even though proved to be effective in other settings, which eventually, generate ethical dilemmas and affect the quality of the research. Bearing this in mind, the researcher sought to empathise the participant's stances through communication and rapport building, and used a flexible approach to data collection techniques. Reflexivity was used as a strategy to deal with culturally ethical matters.

5.6.5. Political and contextual sensitiveness

The research was undertaken at the time when the Eleventh Congress of the Vietnam Communist Party, the most significant political milestone of the country, took place in early 2011, resulting in a number of fundamental changes in the government and governmental organisations happening in the months afterwards. Moreover, it was widely viewed that the areas of education, especially higher education, environmental management and sustainable development have been currently put at the forefront of public criticism and scepticism. Therefore, the research topic was considered sensitive to the participants.

Again, reflexivity played an important role in the way issues related to political and contextual sensitiveness were addressed in the study. Through reflexivity, the researcher remained aware of, and sensitive to the participant social and political positions, intellectual biases and the general Vietnamese context as well as the specific context of the cases being studied. The complex ethical dilemmas concerning the politics and context which emerged during the research were addressed through the researcher's honest and authentic relationships with the participants as respect for the participants themselves and respect for truth.

5.7. SUMMARY

This chapter has focused on outlining in detail the key research decisions and the processes which underpin the data generation and analysis of this study:

- The chapter presented the design of the research which includes three research stages: (i) survey to map the current scenario of sustainable development movements in Vietnam, (ii) case studies to explore contextual and cultural influences over the change

towards engineering curriculum for sustainable development, and (iii) development of a framework for building culturally appropriate strategies for such change.

- For stages one and two, different research activities that supported the processes of data collection were described in detail. Since the study was approached from a cultural perspective, it was the researcher's intention to reflect on the contextual and cultural factors that influenced the research processes, as well as to expose the challenges experienced throughout the study.

- The chapter also defined the processes of data analysis using coding and constant comparison method that led to interpretation. The different areas of data management and data presentation in association with data analysis and interpretation were outlined.

- The chapter ended by clarifying how ethical considerations, both procedural and in-practice, were addressed in the research using various measures and strategies.

PART III. RESEARCH FINDINGS

This part offers the research findings by drawing upon data generated from the two research stages one and two as being described in chapter 5. It consists of two chapters:

Chapter 6. Mapping the current scenario of sustainable development and engineering higher education in Vietnam

Chapter 7. Exploring culturally appropriate strategies for transforming the engineering curriculum towards sustainable development in Vietnam

The two chapters seek to address the aims of the research as summarised in *Figure 13*.
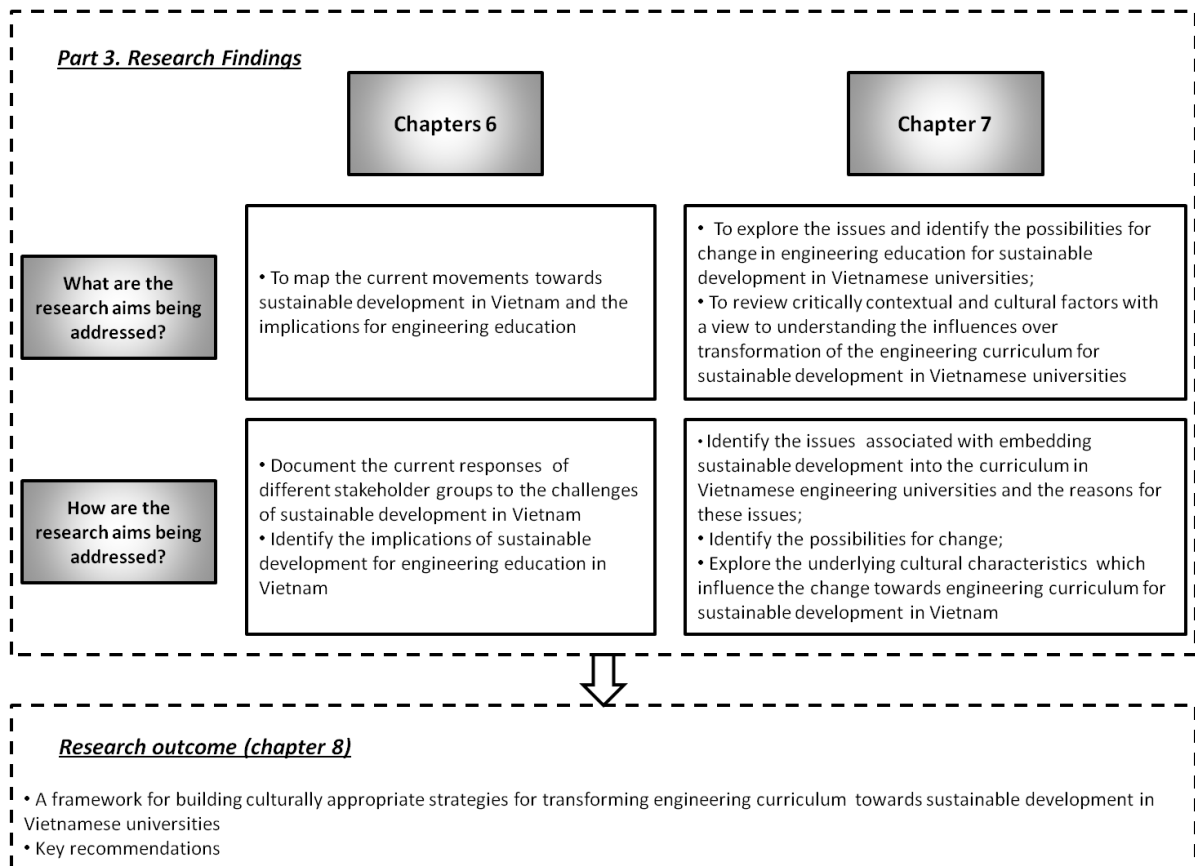
Figure 13. Format of part III

CHAPTER 6. MAPPING THE CURRENT SCENARIO OF SUSTAINABLE DEVELOPMENT AND ENGINEERING HIGHER EDUCATION MOVEMENTS IN VIETNAM

6.1. INTRODUCTION

This chapter addresses the first aim of the research: "*To map the current movements towards sustainable development in Vietnam and the implications for engineering education*". It draws on data from the qualitative survey that captured baseline data collected through a large group of stakeholders from different sectors and various levels of governance.

Initially the chapter maps the current responses to the challenges of sustainable development in Vietnam that centre around the engineering and higher education sectors. The chapter continues with an identification of needs and expectations for change in Vietnamese engineering education towards sustainable development.

6.2. CURRENT RESPONSES TO THE CHALLENGES OF SUSTAINABLE DEVELOPMENT IN VIETNAM

This section offers data on the sustainable development implementation experience in Vietnam. The first aim of the study sought to ascertain what is happening in Vietnam with regard to sustainable development and engineering education. The informants who provided data for this stage come from different groups including the international development agencies and non-governmental organisations, national authorities and, engineering corporations and companies. Survey data analysis revealed differences in the answers of each informant group to the research questions, which steered the researcher towards presenting the findings on a group-by-group basis. Presenting data in this way helps in understanding the needs and expectations for change towards sustainable development in the engineering higher education sector (section 6.3). It also enables recommendations to be generated for each stakeholder groups identifying actions that can contribute to transforming the engineering curriculum towards sustainable development (section 8.3).

The findings in this section are presented under three sub-research questions of **What, Why** and **How**:

- *What are the challenges of sustainable development in Vietnam?*
- *Why is sustainable development important to Vietnam?*
- *How is Vietnam responding to the challenges of sustainable development?*

Under the *"How"* sub-section, attention is also paid to the issues and difficulties being faced when implementing sustainable development to enable the generation of insights into the context and culture related to sustainable development in Vietnam.

For each stakeholder group, the section first offers a table that provides a general description of the group and the key findings. The section follows by presenting in detail the findings together with the supporting evidence.

6.2.1 Governmental authorities

Background of stakeholder group	This group includes civil servants in top management positions in the Vietnamese government with responsibilities in the area of sustainable development. It includes members of : - the Vietnam National Committee on Sustainable Development, - the Vietnam Agenda 21 Office - Departments concerning sustainable development in different ministries: Ministry of Education and Training (MOET), Ministry of Industry and Trade (MOIT), Ministry of Planning and Investment (MPI) and Ministry of Foreign Affairs (MOFA). - In addition, representatives of other governmental organisations linked to higher education and/or engineering were also involved.
What?	This study found that: - Sustainable development was being viewed as the combination of three aspects: economic growth, social development and environmental preservation. - In the governmental engineering sector, there was currently an emphasis

	on environmental issues in the sustainable development understanding.
	- In the governmental higher education sector, ESD was generally viewed as teaching about the concepts related to sustainable development.
Why?	This study identified that:
	- The main driver for the sustainable development movements in the Vietnamese central government was the international calls for sustainable development consideration.
	- The establishment of the Steering Committee on Sustainable Development was seen as the key catalyst for the implementation of sustainable development.
	- For the engineering sector, the Committee is located in the Ministry of Industry and Trade. Quite uniquely, in the area of ESD, - The UN Decade of Education for Sustainable Development (UNDESD) played a key role in catalysing ESD efforts in Vietnam.
	– The launch of the UNDESD resulted in the establishment of the Vietnam National Committee for DESD which is the most influential authoritative actor in ESD in Vietnam.

How?	The study suggested that: - Actions including policies, initiatives and activities have been taken to progress the country towards sustainable development at central government level and in the two areas of engineering and higher education. - In engineering, the key achievements include policies on clean industrialisation, sustainable business initiatives and a number of showcase projects in Vietnamese engineering companies. - In higher education, governmental programmes and initiatives for ESD are rare. The most notable effort was the organisation of conferences, forums and seminars on ESD for Vietnamese universities. The factors hampering sustainable development progress in Vietnam include the understanding of key concepts, expertise for delivering, level of priority, communication, division of responsibility, quality control and assurance, and lack of resources for implementation.

Table 14. Key findings of the governmental authorities group

- ***What are sustainable development or sustainable development challenges in Vietnam as understood by the Vietnamese governmental authorities?***

When being asked what could be understood by sustainable development, interviewees commonly responded that sustainable development was a vague or complex notion, and that there were different interpretations among governmental organisations which varied depending on the sectors/expertises, and scale and level of management (Int. 2, Int. 3, Int. 11, Int. 20, Int. 28, Int. 29). In all cases, the interpretations of sustainable development being acknowledged by the informants were similar to those manifested in the authoritative documents on sustainable development, and align with the Brundtland's definition. The interviews revealed that overall the informants' view over sustainable development subscribed to the government's sustainable development concept: the three pillars of economic, social and environmental sustainability. For example, one interviewee commented:

> "[The team] have a very broad understanding of sustainable development that does embrace three pillars of economics, society and the environment" (Int. 29).

One informant went as far as suggesting that the majority of governmental officials were aware of the concept:

"I don't think there is anyone [in the governmental offices] who has not grasped this concept of economic, social and environmental aspects of sustainable development" (Int. 20)

The words "*balance*" and "*balancing*" were frequently used by the informants in reference to implementing sustainable development principles:

"It's a balance between the three pillars of sustainable development" (Int.1; Int.29; Int.11)

This view was also confirmed by an observation captured when the researcher attended the 3rd National Conference on Sustainable Development (Hanoi, 6th January 2011). One extract from the research diary wrote:

"In all the presentations, they [the speakers] use the Brundtland's definition and the Venn diagram with three circles indicating the three popular elements of sustainable development to introduce the concept" (Research diary, 06/01/2011).

Literature review on the government policies for sustainable development in Vietnam shows a commitment and expectation of the central government to motivate and enhance efforts to progress sustainable development in the country in all aspects (see section 2.3.2). However in practice, especially at the practice level in the engineering sector, several interviewees suggested that environmental aspects be usually given greater emphasis. Some informants assessed that in terms of sustainable development awareness, the current topics which were given priority in the engineering sector only included awareness on environmental protection, energy saving, waste reduce and natural resources efficiency (Int. 11, Int. 20, Int. 28, Int. 29). This emphasis was explained by the informants as a result of an incomplete understanding of the concept by governmental officials (Int. 11, Int. 20, Int. 29).

One critical change in the work on sustainable development at governmental level being captured through the survey was the consideration for stakeholder participation (Int. 20, Int. 28, Int. 29). The informants highlighted that the Vietnamese authorities started to include other stakeholder groups in their work related to sustainable development. Some notable examples to support this remark included:

"Unlike in the past, we have recently included businesses and corporations in the council [for sustainable development] to bring in different perspectives" (Int. 20),

"The development of policy and legislation for sustainable development at different levels of governance has followed the emerging trend of improved stakeholder participation. We seek to ensure a win-win situation for all parties" (Int. 29).

With regard to sustainable development in the higher education sector, the level of awareness was considered by the informants as "low" (Int. 5, Int. 7, Int. 12, Int. 22) even though efforts to promote education for sustainable development (ESD) from the government's point of view were acknowledged (Int. 2, Int. 7, Int. 12). Some informants admitted that the current interpretation of ESD at the governmental authority level was generally limited to:

"teaching about the definition of sustainable development" (Int. 12, Int. 22) or

"the dissemination of the general concept of sustainable development" (Int. 2, Int. 7) whereas

"ESD has to be further and deeper, it has to be based on values not knowledge" (Int. 7) and

"[ESD is] about enhancing skills and ethics for sustainable development" (Int. 29) as well as

"cultivating passions, values and motivations which support sustainable development" (Int. 5)

- ***Why was sustainable development incorporated in the working agendas of the governmental authorities in Vietnam?***

The main driver for the sustainable development movements in the Vietnamese central government was the international calls for sustainable development consideration, most significantly those conveyed in the international summits and conventions on environment and sustainable development over the last few decades (see Chapter 1). Significant events being mentioned throughout the survey included the UN Conference on the Human Environment in 1972, UN Conference in Environment and Development in 1992 and the World Summit on Sustainable Development in 2002. For all interviewees of this group, the most important milestone in the country's commitment to sustainable development was the establishment of the National Council on Sustainable Development (VNCSD) and the Agenda 21 office (see also section 2.3.2).

The management of sustainable development in the Vietnamese government at different levels followed the top-down approach. Actions for implementation of sustainable development strategies, policies and plans were directed and managed by the VNCSD through the official communication to associating sectors, departments and local governments. The key catalyst as viewed by the informants for the implementation of sustainable development in different sectoral governments was the establishment of the Steering Committee on Sustainable Development of the sector in different ministries (Int. 10; Int. 11; Int. 29) (see also section 2.2). In the Ministry of Industry and Trade (MOIT), the MOIT steering committee on sustainable development was considered by the informants as crucial for the emergence and implementation of plans, activities and projects aimed at sustainable development of the engineering industries (Int. 10, Int. 11).

At the time of survey, no similar committee existed at the Ministry of Education and Training (MOET). Instead, in the area of ESD, the UN Decade of Education for Sustainable Development (DESD) played a key role in catalysing ESD efforts in Vietnam (Int. 2, Int. 7; Research diary, 13/05/2010). The launch of the UN DESD in Vietnam resulted in the establishment of the Vietnam National Committee for Decade of Education for Sustainable Development (VNCDESD) in 2005. This committee, which was made a part of the VNCSD and placed in the Ministry of Foreign Affairs (MOFA), played the role of the top governmental body in charge of the implementation of ESD in Vietnam (see section 2.4.2). MOET was identified in the Vietnam ESD Action Plan as one of the key actors in promoting educational reform and reorienting education towards sustainable development. Current activities on ESD in higher education in Vietnam, as suggested by the key informants, were undertaken following the direction of the VNCDESD (Int. 12, Int. 22).

- ***How are the governmental authorities in Vietnam responding to the challenges of sustainable development?***

Although the majority of the informants acknowledged a better awareness of the concept of sustainable development in the governmental organisations[80], it was suggested that the concept remained abstract, and government officials were still struggling to understand its relevance and

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[80] 10 out of 11 informants from governmental organisations shared this view.

interpret how the concept could be applied in their own work (e.g. Int. 20, Int. 28, Int. 29). Some interviewees stressed that the issue was more serious at local and operational level (e.g. Int. 20; Int. 29). Moreover, data drawn from the interviews revealed that higher education and engineering sectors also experienced the same challenges of sustainable development interpretations (Int. 7, Int. 10, Int. 11, Int. 12, Int. 22).

However, the informants confirmed that actions have been taken to progress the country towards sustainable development, specifically in the two areas of engineering and higher education; both of which are of direct interest to this research. *Table 15*[81] presents some notable examples of policies, initiatives and activities of this group obtained through documentary review[82], interviews with the informants[83] and direct observation at different conferences and seminars on sustainable development and engineering and/or higher education   [84]   .

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[81] This table is not an exhaustive and detailed list of the policies and activities for sustainable development in Vietnam. It tries to offer a glimpse of the scopes, types and topics of these movements which were commonly referred to by the informants throughout the survey, in the popular publications on sustainable development in Vietnam and in the conferences and seminars related to sustainable development which the researcher had a chance to participate.

[82] (Vietnam Ministry of Planning and Investment, 2012a); (Vietnam Ministry of Planning and Investment, 2012b); (Vietnam Ministry of Planning and Investment, 2011); (Vietnam Ministry of Industry and Trade, 2010); (Vietnam Ministry of Education and Training, 2010a); (Vietnam Ministry of Education and Training, 2010b) (Vietnam Ministry of Planning and Investment, 2005); (Vietnam Ministry of Planning and Investment, 2006); (Vietnam Ministry of Education and Training, 2006)

[83] Int. 29, Int. 3, Int. 12, Int. 20, Int. 10, Int. 11, Int. 7, Int. 28

[84] These events included The Vietnam 3rd National Conference on Sustainable Development and its four sessional forums; the Forum on Sustainable Development for Vietnamese businesses; and the conference on Education for Sustainable Development in Higher Education in Vietnam. Data were recorded in the form of field notes in the research diary on 13/05/2010, 17/12/2010 and 06/01/2011.

Table 15. Current movements of the governmental authorities to address sustainable development in Vietnam

Level	Central government	Engineering authorities	Education authorities
Policy	- The "Strategic orientation for sustainable development in Vietnam" (Vietnam Agenda 21, published in 2004) - Integration of sustainable development into governmental strategies and development plans (e.g. The Socio-Economic Development Plan for 2006 – 2010; and the Green Growth Strategy 2011-2020) - National Strategy on Climate Change Adaptation (issued in 2008)	- Strategic plan of the MOIT Steering committee on sustainable development (e.g. MOIT's "Action Plan to implement the National Strategy for Sustainable Development in Vietnam in the period 2010 – 2012") - Policy on clean industrialization (e.g. the "Strategy for Cleaner Production in Vietnamese industries towards 2020") - "Sustainable Development strategy for the coal-mineral industry in Vietnam towards 2020"	- Action plan on Education for Sustainable Development with reference to higher education sector (i.e. National Action Plans for Education for Sustainable Development, periods 2006 – 2010 and 2011-2015)

Level	Central government	Engineering authorities	Education authorities
Initiatives and programmes	- Vietnam Environmental Fund (VEF, established in 2003): to supports domestic projects on environmental protection, clean technologies and energy efficiency - Awareness raising and capacity building on sustainable development for governmental officials at central level (e.g. MPI, MONRE, MOIT, Ministry of Construction (MOC), Ministry of Labour, Invalids and Social Affairs (MOLISA)) and provincial level (e.g. provinces of Tay Nguyen, Hai Phong, Nha Trang...) - Sustainable development initiatives at local communities[85] - "National Programme on Climate Change Adaptation"	- The "Energy efficiency and conservation programme for small and medium enterprises in Vietnam" (PECSME)[86] - The programme "Cleaner production in the Vietnamese industries" (CPI)[87] - Sustainable Development for Business (SD4B) initiative (2010) - The "Corporate Social Responsibility initiative"[88] (2010)	- Official document to universities indicating a "Requirement for sustainable development to be included in the curriculum" (issued by the Minister of MOET for the academic year 2008 – 2009 onwards)

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[85] 27 in 63 provinces and cities in Vietnam have developed their own Local Agenda 21
[86] This programme is supported by the Global Environment Fund (GEF) and the UN Development Programme (UNDP).
[87] This programme is a component of the Vietnam-Denmark Development Cooperation in Environment (DCE) Programme.
[88] In cooperation with the Vietnam Chamber of Commerce and Industry and the UNDP.

Level	Central government	Engineering authorities	Education authorities
Activities	- Conferences, training courses, seminars and workshops on implementation of sustainable development and climate change adaptation (e.g. National Conference on Sustainable Development, 01/2011; National Workshop on "Sustainable Development and Climate Change in Planning" in Quy Nhon, 07/2011; Training courses on "Capacity building for Sustainable Development" in different sectors such as construction, fishery, natural resources management, agriculture, forestry throughout 2009 – 2010)	- Case-studies at some state-owned companies to showcase how sustainable development principles could be applied in their business operation (e.g. Tia sang Battery company in 2008) - Project on "Assessment of capacity and training on building sustainable development strategies and plans for engineering businesses" (2010)	- Seminars and workshops on ESD for universities and colleges (e.g. National Conference on Higher Education for Sustainable Development, 05/2010; Seminar on "Climate Change Education: Experiences from the EU", 05/2010; Workshop "Using Pattern Lab as a tool for Education for Sustainable Development", 04/2010)

With regards to engineering for sustainable development, in the interviews, key informants from the engineering authorities highlighted a number of projects that had been carried out in some companies in Vietnam with the main purpose of showcasing for the industries, for example the project at Tiasang Battery Company. The interviewees stressed that whilst these projects were labelled as energy efficiency, clean industrialisation and corporate social responsibility, and not explicitly referring to sustainability or sustainable development, they very much embodied sustainable development (Int. 10, Int. 11, Int. 29). For example, one interviewee noted:

> "Although the word sustainable did not feature in the original project aims statements, the work being done was leading to a sustainable future for all." (Int. 10)

In the design and implementation of these showcase projects, the data revealed that the development of the part related to sustainability of the projects was attributed to the people from the ministry and the involving NGOs, and not from within the companies . The informant mentioned the involvement of a working group of experts from the different departments in the ministry as well as international experts which provided technical support to the companies during the design and implementation phases. S/He said:

> "the team brought with them a huge range of expertise and experience." (Int. 11)

In the area of education, examples of governmental programmes and initiatives to motivate and enhance higher education for sustainable development were rarely found in the survey. Informants of this group admitted that whilst ESD efforts were evidenced at school levels, the Vietnamese education authorities were not particularly active or influential in shaping the activities on ESD in higher education institutions in Vietnam (Int. 5, Int. 7, Int.12, Int. 22). When being asked about the most significant activities on ESD in higher education organised by the Ministry of Foreign Affairs (MOFA) and the Ministry of Education and Training (MOET), the interviewees mentioned conferences, forums and seminars on ESD, for example the Conference on Education for Sustainable Development in Higher Education in 2010 (Int. 2, Int. 7, Int. 12, Int. 22). Conferences and seminars were also cited by the informants as the main channel by which the government's strategies and plans on ESD were communicated to the universities besides the official documents (Int. 2, Int. 7, Int. 12). One informant showed his/her frustration towards

the current way of communicating ESD messages in Vietnam (Int. 7). S/He stressed a few times during the interview, for example:

> "When it comes to ESD and especially DESD which involve the UN, everything has to go through MOFA. The problem is, the ones who are responsible at MOFA do not have either the expertise or the authority over the schools and universities. They ended up organising some events under the name of ESD in which they invite educational institutions and professionals but those events have no depth. They are purely gathering occasions when people come, talk and go away without any substantial changes to either themselves or the current status of ESD." (Int. 7)

From the interviews, the factors that hampered the progress towards sustainable development in Vietnam were identified by the informants through their sharing of the difficulties, dissatisfaction and frustration in the implementation of sustainable development visions in Vietnam (see *Table 16* for examples of evidence obtained from the survey). These issues and challenges included: (i) understanding of the concepts related to sustainable development (Int. 7); (ii) expertise for delivering sustainable development (Int. 3, Int. 20, Int. 29); (iii) sustainable development not being viewed as priority (Int. 20); (iv) communication in general (Int. 29) and communication in sustainable development (Int. 7); (v) division and designation of responsibility (Int. 7, Int. 29); (vi) quality control and assurance (Int. 3, Int. 12, Int. 22, Int. 28); and (vii) lack or inconsistent provision of resources for the implementation of sustainable development, for examples: change in personnel (Int. 10; Int. 20), change in financial support (Int. 2; Int. 20), lack of financial resource (Int. 3, Int. 20), and lack of specific guidance for implementation (Int. 3; Int. 7, Int. 29).

Issues/Challenges	Examples of evidence from the data
Understanding of the concepts related to sustainable development	"I think at MOET, only the one who is in charge knows [about education for sustainable development], people from the higher level of management might hear about it but do not understand it much". (Int. 7)

Issues/Challenges	Examples of evidence from the data
Expertise for delivering sustainable development	"When Mr. X [real name removed by the researcher] died, there was no one who could lead us and so we stayed almost idle for a while" (Int. 20) "Sustainable development has been mentioned in almost all action plans, programmes, orientation or development plans, but only in theory. They [local governmental officials] don't have the expertise to translate the content into actions." (Int. 3) "At the level of management, the awareness on sustainable development has been increased, but the capacity to deliver is below standard. We [top management] have to tell them what specific action to take every time". (Int. 29)
Sustainable development not being viewed as priority	"For us [MOET], education for sustainable development is not as urgent as other tasks of educational change and reform. Just look at the education quality in Vietnam, we are still very much lagging behind other neighbouring countries. We have so many things to focus our effort on now." (From a talk with an informant at The 3rd National Conference on Sustainable Development, Forum on Education for Sustainable Development) (Research diary, 06/01/2011); "For some sectors, they even think that sustainable development is something new which was invented to create more work and is totally separated from what they have been doing. That's why everything that we communicate to them, they tend to ignore or respond only for form's sake". (Int. 20)
Communication	"When it comes to ESD and especially DESD which involve the UN, everything has to go through MOFA." (Int.7) "The interconnection among different ministries is very loose. There is a serious lack of cooperation. Each sector only cares about their work." (Int. 29)

Issues/Challenges	Examples of evidence from the data
Division and designation of responsibility	"The description of function and responsibility for different actors in the management of sustainable development is not clear and effective, lots of overlapping but at the same time, there are parts which are not covered at all... There are parts where too many people are in charge and parts where no one is taking responsibility". (Int. 29) "The one who is assigned the job does not have the expertise, and the ones with expertise and capacity were not involved". (Int. 7)
Quality control and assurance	"There is no monitoring mechanism as far as I know" (Int. 22); "Without evaluation, how can we be sure that the jobs have been done properly?" (Int. 3; Int. 28) "We did send out the guidance and directions but frankly speaking, there were cases, not a few, in which we know they would ignore, but we have no resources to monitor if they actually did it or not, and assess how they did it as well. That's the problem." (Int. 12)

Issues/Challenges	Examples of evidence from the data
Lack or inconsistent provision of resources for implementation of sustainable development	Change in personnel: "There were a few times when people [in the department] were transferred to different positions and we were left with no one to replace." (Int.20); "It is frustrating when a manager being in charge of aspects related to sustainable development left. This sometimes turned the situation up-side-down because the new one might be interested in pursuing different path with regard to sustainable development, or in the worst case, not interested in sustainable development at all. "(Int. 10) Change in financial support: "We only plan short-term, one-off, low-cost activities, for example seminars or workshops, because we don't know if we will have the money next year. It's like chicken and egg, you know, we need money to do things, but we need to show that we are doing things to get money." (Int. 2); Lack of financial resource: "Even when they [local governmental officials] want to do it, they don't have the money. The government's grant is very limited" (Int. 3); "To be honest with you, we [central government] sometimes find it difficult to ask them [local governments] to do more since we understand that they already have a lot to do with a tight budget." (Int. 20) Lack of specific guidance for implementation: "We have the [ESD] action plan but it was developed by foreign experts based on the UNDESD and in my opinion, very abstract. There is no specific reference to different stakeholder groups and there is no specific guidance for implementation." (Int. 7)

Table 16. Issues and challenges identified by informants

6.2.2. Non-governmental organisations (NGOs)

Background of stakeholder group	This group includes representatives from the International Development Agencies (IDAs) in Vietnam. Most of the stakeholders from this group are involved with or employed by the United Nations (UN) agencies. Also included in this group are representatives from local NGOs that are working in sustainable development, higher education and the engineering industry. In addition, this group covers some student-led organisations that were established and operated by students from within one or across a number of engineering universities in Vietnam.
What?	Informants from this group suggested that the challenges of Vietnam fell into two categories related to understanding and action. Whilst the awareness on sustainable development had been increased, the interpretation of the concept in practice lacked clarification. Action for sustainable development in Vietnam was considered as piecemeal and lack of a systemic approach.
Why?	Programmes and actions for sustainable development of the IDAs in Vietnam reflected the goals and missions of the organisations and followed international movements on Engineering for Sustainable Development and Education for Sustainable Development. For the smaller and local NGOs, drivers and influencing factors for sustainable development work being found through the survey included individual's awareness, visions and strategies of the donors, and combination of governmental policies, international movements and the perception of the management board on the need for change.

	For the IDAs, the key channels for the implementation of sustainable development programmes and projects being identified include: working directly with the Vietnamese government, and working in cooperation with other smaller NGOs.
How?	Small NGOs in Vietnam tended to work directly with the public including companies and students, either on their own or in collaboration with each other.
	The NGOs contributed to progressing sustainable development in Vietnam through long-term programmes and projects as well as one-off projects and activities aimed at awareness raising for sustainable development, and implementation of sustainable development in Vietnamese engineering companies and universities.

Table 17. Key findings of Non-governmental Organisations group

- ***What are the challenges of Vietnam in progressing sustainable development as viewed by the NGOs operating in Vietnam?***

In progressing towards sustainable development in the country, informants from NGOs suggested that the challenges of Vietnam fell into two categories related to understanding, and action (see *Table 18* for examples of evidence drawn from the survey).

In terms of understanding, similar to the view of the governmental authorities, informants from NGOs commonly highlighted a certain level of awareness on sustainable development but a vague interpretation of the concept among the engineering and education communities (Int. 1, Int. 6, Int. 8, Int. 9, Int. 15, Int. 16, Int. 26, Int. 27). In the area of engineering, whilst one informant acknowledged the increasing popularity of the term "sustainable development" in governmental authorities and businesses, s/he doubted if the meaning of the term was interpreted correctly (Int. 16). Similarly, one interviewee who represented an NGO operating in the fields of engineering business and sustainable development in Vietnam criticised the abstract term currently being used in the engineering community. S/He suggested that it might help to explain why sustainable development was poorly interpreted in the specific working

situations (Int. 9). With regard to education, the picture was similar with higher education being highlighted by informants for being less aware of sustainable development concept than the school levels (Int. 6, Int. 8, Int. 26). This view was aligned with the criticism over the lack of consideration for ESD in the higher education sector in comparison with other sectors in the education system (Int. 1, Int. 6).

Action for sustainable development in Vietnam was considered by the participating NGOs as piecemeal and lack of a systemic approach (Int. 1, Int. 6, Int. 9, Int. 27). For example, one interview observed:

> "activities [for sustainable development in higher education] are currently limited to one-off projects, randomly organised events as the response to certain important days or calls." (Int. 6)

Informants from this group showed considerable appreciation towards the governmental provision in terms of policy for sustainable development in Vietnam, especially at the top level of governance. Some interview extracts support this view:

> "I think everything [governmental policies for sustainable development] is there..." (Int. 16);

> "The political commitment is quite high. There's the national committee, the steering committees for some key sectors, a number of policies with the strategic plans. All in all, really, not much disparity when comparing Vietnam with other active countries, I mean in terms of top policy, of course." (Int. 26)

Nevertheless, in the specific areas of engineering and higher education, the interviews revealed some specific topics in which suggestions for further policy development were implied by the informants such as corporate social responsibility (Int. 16) and energy (Int. 27) in engineering, and curriculum for sustainable development (Int. 8) and informal education for sustainable development for university students (Int. 6) in higher education. The informants have identified the main challenges in action towards sustainable development of the country as: lack of communication and coordination among authorities (Int. 1, Int. 9); lack of specific and clear guidance for implementation at execution level (Int. 6, Int. 27); and low level of commitment (Int. 6, Int. 9, Int. 27).

Challenges	Areas of concern	Examples of evidence
Understanding	Engineering	"We are getting to the point where everybody is talking about it [sustainable development] but they could also ask 'What does it mean?' all the time." (Int. 16). "I could go as far as suggesting that they [engineering authorities and engineering company managers] have very limited understanding of how sustainable development could be interpreted in their own work. General definition is OK, but it sounds too abstract and not relevant..." (Int. 9) "In many cases, we have to break it [the concept of sustainable development] down into smaller and more specific aspects when communicating because the mention of sustainable development sometimes brings nervousness to the talk. I think it scares people off, it sounds huge and too sophisticated." (Int. 15)
	Education	"Awareness on the need for education for sustainable development is there somehow, but the understanding of the "How" is poor, especially in higher education. Personally, I think people working in education haven't seen their roles yet, you know, the specific role in promoting sustainable development." (Int. 6) "The term Education for Sustainable Development does not sound familiar in university settings. I have the impression that for them [university managers and lecturers] it sounds like it belongs to the top management, those in central government only, it sounds like a term you see in policies." (Int. 8)
Actions	Engineering	"Sustainable development is like that. Everyone started with big promises and high hopes but after a while, the enthusiasm fades. I don't dare to generalise or conclude but from my own experience, not much work has been followed through, especially when it

		comes to implementation." (Int. 9)
	Education	"It is so frustrating sometimes because we need to talk to so many people from different departments in the government to get things done, as some people just don't know what the others are doing, and they don't talk to each other. Coordination is poor." (Int. 1) "The plan is there, it looks impressive. But it really lacks implementation guidance. The actions as results of the plan haven't happened yet." (Int. 6)

Table 18. Challenges of Vietnam in progressing towards Sustainable Development as viewed by NGOs

- ***Why did the NGOs in Vietnam take sustainable development into account?***

Informants from the participating International Development Agencies (IDAs) in Vietnam confirmed that their programmes and actions for sustainable development in Vietnam reflected the goals and missions of the organisations and followed international movements on Engineering for Sustainable Development and Education for Sustainable Development. The specific choices of areas and topics to focus on were decided through key expert consultation, the identified needs of the receiving communities and the feasibility of implementation. (Int. 1, Int. 15, Int. 16, Int. 26)

For the smaller and local NGOs, drivers and influencing factors for taking sustainable development into account as indicated by the informants included (i) individual's awareness (including the managers and staff members of the organisations) (Int. 6, Int. 8, Int. 27); (ii) visions and strategies of the donors (Int. 6); and (iii) combination of governmental policies, international movements and the perception of the management board on the need for change (Int. 9, Int. 27). Whilst in engineering, data from direct observations and the interviews with informants suggested a strong influence of the governmental strategic orientation on the work of the NGOs, it did not seem to be the case in higher education for sustainable development. For examples, an extract from the research diary read:

"At the event today [on sustainable development for Vietnamese businesses], a trend could be observed that all the engineering related NGOs talked about their projects as response to or in alignment with the government's policies and initiatives on sustainable development as examples of their current typical activities for sustainable development. This is quite different to the education NGOs where the informants always provided me with projects which were self-initiated from within the organisations as examples of their work." (Research diary, 17/12/2010)

The following section on the participating NGOs' current actions for sustainable development in Vietnam provides further evidences for this view. Furthermore, a review of the different webpages[89] on initiatives related to ESD in Vietnam also helped confirm this finding, even though the review was not undertaken with a specific focus on higher education but from a general ESD point of view.

- ***How are the NGOs in Vietnam contributing to the country's sustainable development?***

For the international development agencies (IDAs), key channels for the implementation of sustainable development related programmes and projects were identified by the informants as: (i) working directly with governmental authorities and (ii) working in cooperation with other smaller NGOs in Vietnam who understood the Vietnamese working culture and had established relationship with the governmental authorities and communities (Int. 1, Int. 15, Int. 16, Int. 26). Especially in the area of higher education for sustainable development, one informant from IDAs even stressed that:

"we prefer to join forces with other small NGOs working in the similar field in Vietnam because it is quicker and easier for us to reach out to the students than going through the governmental officials". (Int. 1)

The small NGOs who participated in the survey also suggested that the most challenging task was to collaborate with governmental organisations and universities (Int. 9, Int. 6, Int. 8, Int. 27). When undertaking sustainable development projects in engineering and higher education, these

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[89] For examples: http://www.livelearn.org/; http://www.mekongplus.org; http://www.careinternational.org.uk; http://www.fordfound.org/. These NGOs have been contributing to ESD in Vietnam in the topics such as natural resource management; disaster prevention and mitigation; climate change; energy management; citizenship participation and good governance; poverty reduction; indigenous knowledge and ethnic groups; sustainable urbanization; sustainable production and consumption

NGOs tended to work directly with companies and students respectively, either on their own or in collaboration with each other. For example, one interviewee from an NGO on ESD explained:

> "For most of our current activities, we work directly with student-led organisations. We hardly go through the ministries or universities anymore." (Int. 6)

In the area of ESD, the informants highlighted school level and non-formal education as the sectors where actions in ESD have been fruitful and significant, especially in comparison with higher education (Int. 1, Int. 6, Int. 26). One informant admitted:

> "We are very proud of what we do. We have been doing well but only to schools and communities, not universities." (Int. 6)

At higher education level, the participating IDAs acknowledged that their ESD activities which involved universities were mostly limited to conferences, seminars and workshops with the main means of communication being speeches and presentations (Int. 1, Int. 26). Smaller and local NGOs on education, on the other hand, tended to ignite activities using grassroots approach (i.e. student-led and community-based) (Int. 6, Int. 8). **Error! Reference source not found.***Table 19* captures some activities by NGOs being derived from data and findings from interviews with informants[90], documentary review[91] and direct observations at different conferences and seminars on topics related to sustainable development and engineering and/or higher education[92].

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[90] Int.1, Int.6, Int.8, Int.9, Int.15, Int.16, Int.26, and Int.27

[91] (Vietnam Ministry of Planning and Investment, 2012a) (Vietnam Ministry of Planning and Investment, 2012b) (Vietnam Ministry of Planning and Investment, 2011) (Vietnam Ministry of Education and Training, 2010b); (Elias & Sachathep, 2009); http://www.vcci.com.vn/; http://vbcsd.vn/; http://www.fordfound.org/; http://www.livelearn.org/; http://gogreen.com.vn;

[92] These events included The conference on Education for Sustainable Development in Higher Education in Vietnam; the Workshop "ASEAN Patter Laboratory: Education for Sustainable Development"; Forum on Sustainable Development for Vietnamese businesses; and the Vietnam 3rd National Conference on Sustainable Development and its sessional forums. Data were recorded in the form of field notes in the research diary on 13/05/2010, 20/10/2010, 17/12/2010 and 06/01/2011.

Table 19. Non-governmental organisations' actions for sustainable development in Vietnam

Areas	Scope	Engineering	Higher Education
Awareness raising	Long-term programmes and projects	- Promoting corporate social responsibility in small and medium enterprises in Vietnam through activities such as seminars, workshops and training courses for company managers - Organising or participating in conferences and seminars in the fields of sustainable development and/or engineering businesses in Vietnam - Establishing the Vietnam Business Council for Sustainable Development (VBCSD) - Organising training courses on sustainable development related topics such as climate change adaptation, cleaner production and environmental protection including waste management, etc. for Vietnamese companies.	- Organising or participating in conferences and seminars in the fields of sustainable development and/or education in Vietnam

Areas	Scope	Engineering	Higher Education
	One-off projects and activities		- Youth (including university students) engagement in climate change and environmental protection through events such as cycling, running and cleaning the cities
Implementation	Long-term programmes and projects	- Cleaner production in small and medium manufacturing companies in Vietnam - Energy efficiency formedium and large companies in Vietnam in cooperation with MOIT but currently only at policy level	- Workshops and training courses on sustainable development and environmental education for students and young people - Mentoring students on development of volunteer groups, for better program development, networking and leaderships - Developing new Master's programs linking natural resource management and poverty alleviation in Vietnamese agricultural universities
	One-off projects and activities	- Assist the Vietnamese engineering and engineering businesses authorities in developing visions and strategic plans for sustainable development of the sectors	- Case-studies on introducing corporate social responsibility into the curriculum in Vietnamese business universities and colleges

6.2.3. Engineering businesses

Background of stakeholder group	Stakeholders from companies and corporations that participated in this research came from a wide range of industries including textile, chemicals, oil and gas, electronics, automobile, construction materials, food processing, and consumer goods manufacture. The informants were either the companies' general managers or managers who were in charge of sustainability related issues in the companies.
What?	The study found that: - Companies perceived sustainable development and how it relates to their own businesses differently, ranging from viewing sustainable development as environmental management and protection; to environmental consideration coupled with either social or business improvement; to the more comprehensive balance of the three aspects including economic, social and environmental performances; - Business managers' views on their contribution to sustainable development of the country were much influenced by the government's definition and guide; and - The governmental visions, laws, regulations and policies were also the key factor influencing their visions and actions for sustainable development.
Why?	The most important driver which gave rise to the consideration and implementation of sustainable development principles in the businesses was identified as governmental laws and regulation on environmental management and environmental protection. Other drivers have been identified as: strategic orientation and policies of the industrial sector or the specific industry with specifications related to

	sustainable development; the company manager's vision for business development and public relation; and the international management board and the industry's codes of conduct.
How?	This study suggested that: - Environmental aspect was given the most emphasis with actions and activities undertaken in the areas of energy, materials, emissions, waste, and green products and offices; - Social considerations took forms of occupational health and safety, community development and corporate social responsibility; - Economic aspects were taken to be synonymous with cost. Whilst some companies sought to comply with national laws and regulations, others went beyond compliance and initiated programmes and activities aimed at sustainable development.

Table 20. Key findings of the engineering businesses group

- ***What does sustainable development mean for engineering businesses in Vietnam?***

The survey of nine engineering companies suggested that the perception on sustainable development and how it related to their own businesses varies from company to company. These perceptions ranged from viewing sustainable development as environmental management and protection, to environmental consideration coupled with either social or business improvement, to the more comprehensive balance of the three aspects including economic, social and environmental performances. Examples of these views are collated from the questionnaires and interviews in *Table 21* below:

Perception on sustainable development in Vietnamese engineering businesses	Evidence of views captured in the questionnaires and interviews
Sustainable development as environmental management and protection	"[Sustainable development means] ensuring that the business activities do no harm to the environment by conforming to all environmental laws and regulations." (Q1) "Companies have to make sure their operations comply with environmental laws and regulations and continuously seek to progress beyond compliance to conserve the environment and contribute to the long-term sustainability of the biosphere" (Q5)
Sustainable development equals to environmental protection coupled with social considerations	"Sustainable development is the combination of environmental protection and occupational health and safety" (Q6) "Sustainable development means to minimise the use of natural resources and emissions, ensure the safe working environment and the harmony of benefits for the employers, employees and the people from the surrounding community" (Q7) "Sustainable development is achieved through good environmental management and corporate social responsibility" (Q2)
Sustainable development equals to environmental consideration coupled with business improvement	"Sustainable development of our company means improving business while reducing environmental impacts" (Q8) "We seeks to protect the environment and at the same time ensure the economic benefit of the business" (Q4)

	"Sustainable development is balancing the three pillars of economic, social and environmental aspects of business" (Q3)
Sustainable development as balance of three aspects including economic, social and environmental performances	"Companies have to consider not only making profit and reducing cost but also their environmental impacts and their contribution to the society" (Int. 13)

Table 21. Perceptions on sustainable development of engineering businesses in Vietnam

A trend suggested by the survey data was that bigger and internationally related businesses had more comprehensive views on sustainable development that reached beyond the company walls, whilst smaller and local companies had the tendency to associate sustainable development with their operations and employees within the company's boundary.

Except where a manager indicated that s/he was not aware of any national policies or programmes on sustainable development impacting his/her business (Q.1), a strong message being conveyed through the questionnaires and interview was that business managers' views on their contribution to sustainable development of the country was much influenced by the government's definition and guide. With regard to the contribution, all companies cited how their work had been aligned to the government's laws, regulations, programmes and initiatives as examples of their progress towards sustainable development even though some companies suggested that they went beyond these governmental legislative requirements related to sustainable development in their current business operations (Q2, Q3, Int. 13). Apart from the environmental laws and regulations which were mentioned by all participating companies, some notable regulations, programmes and initiatives by the government being referred to, included: Health and safety regulations (Q6); programme and initiative on energy effiency (Q1, Q8); programme on corporate social responsibility (Q2); programme on cleaner production (Q4).

A majority of the companies (seven out of nine) also implied that the governmental visions, laws, regulations and policies had influenced their visions and actions for sustainable development. For examples, some questionnaires responses read:

"We strive to build our business on the spirit of sustainable development set out by the government" (Q8);

"the visions and action plans in our business strategy are built in alignment to the governmental regulations on environment and sustainable development" (Q7); and

"our vision for sustainable development is that we ensure our business operations will comply with all legislative requirements and guidance from the government" (Q5)

Nevertheless, some of the companies representing international corporations acknowledged that besides governmental guidance, their visions and actions for sustainable development were shaped by the international management board (Q3, Int. 13) and international codes of conduct relevant to the industry (Int. 13).

- ***Why did the engineering companies in Vietnam consider and act on sustainable development?***

The most important driver that gave rise to the consideration and implementation of sustainable development principles in the businesses was implied by all the questionnaires and interview as governmental laws and regulation on environmental management and environmental protection. Other drivers that might have contributed to sustainable development agenda of the companies have been identified as:

- strategic orientation and policies of the industrial sector or the specific industry (i.e. cement, electricity, oil and gas, etc.) with specifications related to sustainable development (Q4, Q7, Q8);

- the company manager's vision for business development and public relations (Q5, Q6);

- for international corporations, demand for sustainable development consideration also came from international management boards and the industry's codes of conduct (Q2, Q3, Int. 13).

- ***How are the engineering companies in Vietnam responding to the challenges of sustainable development?***

It could be suggested from the questionnaires and interview with engineering companies that among the companies participated in the research, environmental aspects were given greater

emphasis and social aspects less attention in the companies' actions for sustainable development. Whilst all of the companies mentioned environmental protection and management as their contribution to sustainable development in Vietnam, there was a broad interpretation of environmental aspects including: energy (Q1, Q2, Q6, Q7, Q8); materials (Q2, Q4, Q7, Q8); emission (Q2, Q3, Q6,Q7); waste (Q1, Q2, Q4, Q6, Q8); and green products and offices (Q8). Social considerations were captured in some questionnaires and interview in the forms of: occupational health and safety (Q1, Q2, Q6, Q7); community development activities (Q2, Q3, Int. 13); and corporate social responsibility (Q2). Economic aspects were rarely explained and were generally taken to be synonymous with cost (Q4, Q7, Q8), for example, one questionnaire was noted:

> "the company seeks to deliver high quality products with low cost which contribute to the long-term and sustainable development of the business." (Q8)

whilst another questionnaire captured the benefit of energy and material efficiency:

> "minimise energy and material use but still ensure the product quality will help reduce the production costs and maximise profits." (Q7)

Worthy of attention was the comment from one informant in which he suggested that in the case of his company, even though the understanding of sustainable development was comprehensive, the activities which contributed to sustainable development had been limited to mostly environmental aspect with few examples of one-off socially related projects (Q2).

There existed a gap between participating companies in their views over the means by which the companies contributed to sustainable development. Some companies sought to comply with national laws and regulations related to environmental protection, environmental performance monitoring and control, labour, and occupational health and safety (Q1, Q6, Q7). Other companies went beyond compliance and initiated sustainable development programmes and activities in aspects including environmental initiatives, well-being of employees, business performance, community development, responsible supply chain (see *Table 22* for details).

Environmental initiatives	Minimise raw materials, energy and water consumption (Q4)
	Reuse and recycling within the company (Q4)
	Choose environmentally friendly materials (Q8)
	Design and construct green offices (Q8)
	Design and manufacture green products (Q8)
	Participate in energy efficiency projects (Q8)
	Volunteer to go beyond regulation compliance (Q3, Int. 13)
	Hold seminars on environmental protection for staff and community (Q5, Q4)
Well-being of employees	Ensure employees' benefits and healthy working space (Q2)
	Implement policy on equality and discrimination and harassment (Q2)
Business performance	Continue to improve products and service quality in line with sustainable development (Q4, Q2)
Community development	Provide jobs, donate money and construct roads, houses and schools for local community (Q3)
	Establish CSR department to look after community development (Q2, Int. 13, Q3)
	Hold or attend seminars in universities to share expertise (Q2)
	Provide scholarships and financial support for students (Q2, Int. 13)
	Aware prizes and sponsor students' sustainable development projects (Int. 13)
Responsible Supply Chain	Purchase material and primary products from environmentally compliant suppliers (Q5)

Table 22. Actions of engineering businesses as contributions to sustainable development

6.2.4. Engineering universities

Background of stakeholder group	The university informants were employed by engineering education and are representatives of engineering universities located in big cities in different regions of the country (i.e. the North and the South regions). Informants of this group include universities and departments' managers (e.g. rectors, deputy-rectors, deans, members of management board...) and key academic staff (e.g. professors and lecturers).
What?	None of the interviewees had a specific view on how sustainable development could be relevant to the institutions' missions or operations. With regard to ESD, this research suggested that teaching and learning for sustainable development was generally limited to, or equated with, teaching about the concept and principles of sustainable development.
Why?	It was found that: - The emergence of teaching about sustainable development could be traced to the teaching of subjects related to environmental management and planning; - The main driver for actions towards ESD was from within: the awareness of academic staff; and - Formal instruction and directions from MOET, expectations and pressures from the community and businesses did not play a strong role in promoting ESD activities.
How?	This study found evidences of teaching activities related to sustainable development: - Curriculum amendment to include sustainable development took forms

| | of: a specific module; a part of a module; or one or two lectures in a module considered to be relevant to sustainable development.

- The content of the lectures was designed and controlled by the academic staff being in charge. |

Table 23. Key findings of the engineering universities group

- ***What is sustainable development and education for sustainable development as understood in Vietnamese engineering universities?***

None of the nine universities that participated in the research acknowledged an explicit requirement for sustainable development from the universities' board of management. All the university managers being interviewed referred to either the Brundtland's definition or the three pillars model when being asked about their understanding of sustainable development. However, none of the interviewees had a specific view on how sustainable development could be relevant to the institutions' missions or operations[93]. This assertion was confirmed by a documentation and official website review which found no statements on or direct references to sustainable development in the visions and strategic plans of the participating universities.

The research also revealed no whole-institutional approach to sustainable development in the universities under study. For example, when being asked about any policy concerning sustainable development and education for sustainable development (ESD) in the institution, one deputy rector understood it as teaching about sustainable development and said:

> "I don't think there is anything to do with the management board since it's about teaching content and it only concerns the lecturers themselves." (Int. 31)

Similarly, one member of another university's management board told the researcher:

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[93] The current ESD literature acknowledges that higher education institutions pursuing sustainable development goals around the globe have been looking to demonstrate sustainability in operations, planning, facility design, purchasing, transport and investment (see section 3.2.2).

"At our university, we assign responsibility of teaching about sustainable development to specific lecturers or departments. You should come talk to them directly about this matter. I don't know the details." (Int. 18)

Others replied to the same question as:

"No, we don't have any policy at the institution's level with specifications on sustainable development" (Int. 19; Int. 21; Int. 23)

With regard to ESD in the participating universities, interviews with departmental managers and academic staff revealed that teaching and learning for sustainable development appeared to have been generally limited to, or equated with, teaching about the concept and principles of sustainable development in lectures (Int. 4; Int. 17; Int. 19; Int. 21; Int. 23,; Int. 24; Int. 25; Int. 30; Int. 32). When being asked further about the knowledge and skills needed for sustainable development from engineering graduates, some interviewees went on to identify the specific engineering techniques for sustainable development namely environmental management (Int. 23; Int. 24; Int. 25, Int. 4), life-cycle analysis (Int. 23), clean technology (Int. 24; Int. 32), sustainable development assessment (Int. 21; Int. 17) and planning for sustainable development (Int. 17; Int. 19; Int. 32). The soft-skills being viewed as necessary for enhancing the capability of graduate engineers in contributing to sustainable development included language skill (i.e. English proficiency) (Int. 17; Int. 19; Int. 21; Int. 23; Int. 24; Int. 32); teamwork (Int. 23; Int. 24; Int. 25; Int. 32) and systemic thinking (Int. 21; Int. 23; Int. 24). One leading professor in the field of environmental management and sustainable development in Vietnam acknowledged that priority had been given to teaching technical knowledge and less emphasis had been put on developing the students' soft-skills:

"Most of us [professors and lecturers on sustainable development] only focus on teaching the technical knowledge and seek to provide the students with as much information as possible. We know soft-skills are important but few if any actually associate them with education for sustainable development" (Int. 23)

In one university, the informant indicated that no policy or plan was in place, and no specific action was taken with regard to sustainable development or education for sustainable development at the university (Int. 14).

- *Why was sustainable development being taught in Vietnamese engineering universities?*

The emergence of teaching about the concept of sustainable development in the participating universities could be traced to the teaching of subjects related to environmental management and planning. Extracts from interviews with the informants from the universities confirmed this, for example:

> "Sustainable development was first introduced into our teaching materials through environmental management literature" (Int. 23) and

> "We started teaching sustainable development in the modules related to planning and conservation of the environment" (Int. 24)

From the interviews, it was clear that the strong driver for actions towards ESD was from within: the awareness of academic staff (Int. 17; Int. 18; Int. 19; Int. 21; Int. 23; Int. 24; Int. 25; Int. 32). As some interviewees emphasised, the lecturers chose to include sustainable development concepts and principles in the lectures because they thought it was applicable and necessary in the cases (Int. 17; Int. 23; Int. 24).

Whilst managers of the participating universities acknowledged the formal instruction and directions from the ministry of education and training with regard to ESD, they asserted that such instructions and directions did not play a strong role in promoting ESD activities in the institution. According to some informants, at the universities where the managers did not see ESD as relevant, they would choose to pay little attention or in some cases did not respond to such calls (Int. 18, Int. 19, Int. 23, Int. 24). An initial curriculum inventory carried out by the researcher suggested that bigger universities seemed to be more active in ESD: they started to include elements of sustainable development in the teaching materials earlier and the content of the lectures was changed over time as it was developed. One professor suggested that there existed a trend in which some big universities initiated the teaching of sustainable development and the other universities followed by adapting the available teaching materials (Int. 21).

Expectations and pressures from community and businesses regarding the knowledge and skills for sustainable development of engineering graduates appeared to be not tangible as far as the participating engineering universities were concerned. The following comments from the informants supported this assertion:

"No, we don't hear anything from the community or businesses [about what they expect from the engineering graduates]" (Int. 23);

"we [engineering universities] are not aware of what they want outside the technical knowledge" (Int. 4); and

"maybe there are, now that you ask, but I think they [engineering employers] do not care that much about whether their engineers know a lot about sustainable development" (Int. 18)

One interviewee suggested that expectations might be there but only with regard to the environmental aspect:

"I think a lot of company managers, the ones from big companies, start to demand environmental literacy from their employees" (Int. 31)

In response to the question of why the activities regarding teaching of sustainable development in the universities were limited or did not exist, the informants identified the reasons as:

- over crowded curricula (Int. 23, Int. 24, Int. 21, Int. 25, Int. 32), for example:

"well, with all the fixed modules in the curriculum being dictated by the ministry [of education and training], especially in the first year of general curriculum, we can squeeze in hardly anything in the specialised engineering curriculum of the following years" (Int. 23)

- not applicable (Int. 4, Int. 18, Int. 30, Int. 31), for example:

"I think we are doing fine, you know, not all the subjects or disciplines require sustainable development knowledge. We have already included sustainable development in the courses of our environmental department" (Int. 4)

- incompetent academic staff (Int. 17, Int. 19, Int. 23, Int. 24);

- "... because no one else is doing it!" (Int. 24); and

- not knowing (Int. 14)

- ***How is sustainable development taught in Vietnamese engineering universities?***

Among the universities that participated in the research, even though there was a lack of institutional policy on sustainable development, there were evidences of teaching activities related to sustainable development. In the cases of universities where ESD activities[94] existed, the directions for ESD from the Ministry of Education and Training (MOET) was passed over directly from the university managers to the lecturers, departments or faculties in charge of environmental studies.

From the research, different forms of curriculum amendment to include teaching about sustainable development in the participating universities could be identified: (i) a module on sustainable development, (ii) a part of a module or (iii) one or two lectures in a module being considered by the departments as relevant to sustainable development such as environmental management, urban planning, industrial ecology, or management of resources and climate change. From the interviews and direct observation, the study suggested a trend of teaching about sustainable development: larger and more distinguished universities[95] tended to have a separate module on sustainable development, and smaller universities include sustainable development in an existing module.

The content of the lectures was designed and controlled by the lecturers who were in charge of the module. Even though the professors and lecturers followed general guidance and directions from MOET, the lecturers had full autonomy in the details of the teaching material. When

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[94] ESD activities referred to here are any activities related to Education for Sustainable Development. In the engineering universities which participated in this research, these activities are limited to teaching about sustainable development concepts in the classroom context.

[95] The Vietnam Higher Education system consists of 149 universities located in different regions of the country. These higher education institutions include public, private and foreign universities with public universities being the largest category accounting for nearly eighty percent of the total number. Among the public universities, the fifteen largest and most distinguished universities are situated in the country's largest cities and key economic regions. These universities are the longest established with a reputation for excellent education, and training and research, and attract the largest number of students every year. Being the government's focal points of higher education, these leading universities are given funding priority for research and autonomy in respect of their operation, research programmes and recruitment of staff. Among those fifteen top public universities, there are six universities which offer undergraduate courses in technology and engineering and among these six universities, three participated in this research. (General statistics sources: Official website of the Vietnam Ministry of Education and Training http://www.moet.gov.vn/, last accessed on 26/07/2012)

developing the teaching materials and textbooks on sustainable development, they relied on materials from international sources such as NGOs websites, UN and governmental publications and sometimes journal articles. One lecturer explained:

> "I used information from the internet, especially those publications by trustworthy international organisations to develop the teaching materials" (Int. 21)

Another one utilised the information she had researched from professional journals when undertaking her own research:

"I took the information from the literature review chapter of my doctoral research [on life-cycle analysis]" (Int. 17). Table 24 reports the current change to engineering curriculum for sustainable development in the participating universities[96].

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[96] Data sources include: Interviews with informants (Int. 4; Int. 17; Int. 21; Int. 23; Int. 24; Int. 25; Int. 32); Documentary review (Teaching materials and textbook provided by informants); and direct observation (Research diary, 15/12/2010)

Forms of curriculum amendment	Content included	Common teaching and evaluation methods
A specific module about sustainable development	- The economic, social and environmental challenges of development - History of sustainable development - The concepts, models and principles of sustainable development - The international experiences of sustainable development - The Strategic Orientation for Sustainable Development in Vietnam – Vietnam Agenda 21 - The development of Sectoral Agenda 21 and Local Agenda 21 in Vietnam - Education and research for sustainable development	- Lecture - Giving examples - Group assignment - Final written exam
A part (usually three to four lectures) of a module, for example: environmental management, urban planning, industrial ecology, management of natural resources and climate change etc.	- The economic, social and environmental challenges of development - History of sustainable development - The concepts, models and principles of sustainable development - The international experiences of sustainable development	- Lecture - Sustainable development being one topic choice among others in group assignment - One part (i.e. one to two questions) in the final written exam

One or two lectures in the module on environmental management	- The definitions and principles of sustainable development	- Lecture - Might be included as one question in the final written exam

Table 24. Current forms of curriculum change for sustainable development in participating Vietnamese engineering universities

Furthermore, it could be suggested based on the curriculum inventory that the larger universities appeared to be the leaders in initiating teaching activities and developing teaching materials with regard to sustainable development. The smaller universities followed and utilised the available materials without or with only minor changes. Among the participating universities, only one institution at the time of study had a textbook that was developed by a group of distinguished professors in sustainable development. It was confirmed by a number of interviewees from other universities that this textbook was the only one on the topic of sustainable development for engineering discipline that existed (in Vietnamese?) (Int. 19, Int. 21, Int. 23, Int. 24, Int. 25). In other universities, lecturers used their own teaching materials which were approved by the faculties or departments' scientific panel. This approval procedure was viewed by some informants as:

"mere formalities" (Int. 17, Int. 21, Int. 23, Int. 24, Int. 25) and

"did not do much of the job of quality checking" (Int. 24), and that

"the lecturers are the only persons who really decide what to teach" (Int. 17, Int. 23)

At the universities being researched, it was confirmed by the informants that there were currently no evaluation and quality checking mechanism in place for activities related to ESD.

6.3. IMPLICATIONS OF SUSTAINABLE DEVELOPMENT FOR ENGINEERING EDUCATION IN VIETNAM

Having reported on the different perspectives and levels of engagement of the stakeholder groups in sustainable development in Vietnam in the previous section, this section set out to identify the implications of the current scenario of sustainable development for the Vietnamese engineering education. The main intent was to understand the need for change in engineering education in Vietnam in order for the engineering profession, especially at higher education level to contribute to achieving sustainable development in the country.

The need for change in engineering education for sustainable development (EESD) has been acknowledged and advocated for in the international literature of engineering education and higher education for sustainable development (UNESCO, 2010; EESD, 2004; Byrne, Desha, Fitzpatrick, & Hargroves, 2010; Jowitt, 2004). Discussions on what needs to be changed and how to change have also been documented in international contexts (see section 3.3). However, since this study took a grounded approach to research and highlighted the importance of contextual-cultural understanding, it strove for the identification of the 'real' needs for change, or at least, a verification of the predetermined needs instead of imposing the universally perceived ones. The findings presented in this section will also assist in exploring the appropriate ways for EESD change in the Vietnamese context in chapter 7.

6.3.1. Emerging expectation towards engineering professionals in the context of sustainable development

Besides the technical expectation traditionally put on Vietnamese engineering graduates, a new kind of expectation has emerged in the context of sustainable development in the country. A consistent message found throughout the survey has been that implementation of sustainable development goals in Vietnam challenges the current understanding of the concept and requires a certain capacity to deliver (see section 6.2).

The engineering businesses which participated in the survey showed a considerable low level of satisfaction towards their engineer employees with regard to sustainable development. Key words being used by the participating companies' managers included:

"limited contribution to sustainable development" (Q6);

"very low level of awareness" (Q3, Int. 13);

"not good enough" (Q4);

"not good" (Q1),

"at medium level" (Q8),

"limited vision for sustainable development" (Q5),

"superficial understanding" (Q2), and

"good" (Q7)

This current level of satisfaction may go some way to explaining why engineering companies in Vietnam have been commented by the other stakeholder groups as lack of capacity to deliver sustainable development (Int. 9, Int. 10, Int. 11, Int. 16, Int. 27). For example, when talking about the sustainability projects undertaken at Vietnamese engineering companies under a governmental initiative, the key informant stressed that the development of the part on sustainability of the projects had been attributed to the people from outside the companies. He mentioned the involvement of a consultant groups consisted of experts from the different departments in the ministry and some international experts. He said:

> "the team brought with them a huge range of expertise and experience of which the companies were desperately in need" (Int. 11)

Data from the interviews also revealed that general view of the governmental and non-governmental organisations over the young engineering intellectuals in Vietnam was that their current contribution to sustainable development did not live up to their potential (Int. 9, Int. 10, Int. 11, Int. 20, Int. 27, Int. 29). Worthy of attention was the observation from one IDA representative:

> "... they [engineers] have big advantages because they have the knowledge of something very important... That is the process-oriented. They need the ability to see what processes are causing impacts and risks to all the people and things involved. Very often people simply don't look because nobody is teaching them. And because you can't teach them "here are the answers", you have to teach them the way to raise the right questions." (Int. 16)

6.3.2. New knowledge and skills of engineers which contribute to sustainable development implementation

The survey has identified a mismatch between how university managers view the knowledge and skills needed for sustainable development and those expected from the industries and community in Vietnam. Section 6.2.4 suggests that ESD in Vietnamese engineering universities was interpreted as teaching about sustainable development concepts and issues. Moreover, the fact that all universities in the research in which ESD activities exist consider sustainable development a part of the modules or courses on environmental studies indicated a focus on environmental aspect over the other sustainable development themes.

Unlike the Vietnamese engineering education community and similar to the trend experienced in the international community especially in the engineering profession, the Vietnamese industries as well as the authorities and NGOs recognised a new demand for knowledge and skills of engineers that were required for change towards sustainable development beyond the dominating technical knowledge and skills in the curriculum (see sections 3.4.1 and 3.4.2). From the findings of the survey, various forms and levels of expectations or ideals of engineers for sustainable development between different groups of stakeholder has been captured. These expectations fell into three categories of knowledge, skills and values and are presented in *Figure 14*.

Among the knowledge of graduate engineers being viewed as important for sustainable development, awareness on the general concept and principles of sustainable development was mentioned by informants from all the groups being surveyed. For example, a key informant from the Vietnamese government said:

> "Well, I think there is not much difference whether the student comes from what discipline, they all need to understand because not every student, in fact, I think only a certain percent of them would graduate and actually do exactly what they are trained to do. So, it's not just engineer, every student needs at least to get the general principles of sustainable development." (Int.29)

The informant went on to highlight the importance of student's knowledge on

> "how the laws of nature including the laws of conservation and equilibrium could be applied in real-life practices to ensure sustainable development." (Int. 29)

Similarly, among the knowledge for sustainable development being identified, the general knowledge on the balance of economic, social and environmental aspects appeared to be of great importance to the businesses (Q3, Int.13, Q7). One company manager emphasised in the questionnaire:

> "There are many different areas of knowledge related to sustainable development, some of them might be relevant to particular jobs and positions, but the most important knowledge is the understanding of the balance between the three aspects of sustainable development" (Q3)

Another interviewee also shared the same view, he said:

> "different companies will give priority to different areas of knowledge with regard to sustainable development. But generally, all companies need to have employees who understand the "balancing" concept and have the ability to apply it into specific situations" (Int. 13)

For the engineering companies, environmental protection and management was also given priority as crucial knowledge that contributed to the sustainable development of the businesses (Q1, Q2, Q4, Q6, Q8).

With regard to the skills for sustainable development, communication and collaboration were stressed by governmental and non-governmental organisations groups as key, for examples:

> "I think that it is important that engineers find a way to dialogue. It is difficult, very difficult" (Int. 16); and

> "they need to be able to convey and explain their ideas and solutions to other members of the team. They have to learn to work effectively with each other" (Int. 11),

whereas futures thinking, critical thinking and the ability to apply theories into practices were highlighted by engineering business managers as key (Q2, Q3, Q6, Q8, Int. 13). Whilst making explicit the knowledge and skills, some managers emphasised values and ethics as priority (Q2, Q5, Q8):

> "We first and foremost expect our engineering employees to have better responsibility towards the company and the society. We hope they understand that fulfilling their duties and contribute to the sustainable development of the company is a way to contribute to the sustainable development of the society." (Q5); and

"Engineers should have the working attitude and the performing culture that promote sustainable development and seek the betterness for the community" (Q8)

Figure 14. The knowledge, skills and values for sustainable development expected of Vietnamese engineers as expressed by survey informants

6.3.3. The need for better relationships between engineering universities and industries, and the wider communities

Evidence of the increasing appreciation of the partnerships between universities and neighbouring communities, businesses and government agencies could be found in the

literature on ESD and EESD (see sections 3.2 and 3.4). Throughout the survey, the need for Vietnamese engineering universities to reach beyond their walls especially in the implementation of ESD was identified.

First, there was an urgent need for better communication between the universities and the communities of practice that they serve in order to understand the emerging expectation with regard to sustainable development. From the participating engineering businesses' point of view, Vietnamese engineering universities lacked a strategic link to businesses and industries which prevented universities from understanding and addressing the societal needs (Q3, Q7, Int. 13). Even though the strongest and most applicable expectations and requirements came from the industries, informants from the universities suggested there had been little signal being sent to the universities (Int. 23, Int. 31, Int. 32). Interviews with the engineering universities revealed that the teaching and learning activities for sustainable development in the institutions were decided by the key academic staff with a certain level of influence from the education authorities and not based on the needs of industries or surrounding communities (see section 6.2.4).

Second, enhancing cooperation between engineering universities and the communities may help to promote the activities that contribute to sustainable development of the society. The survey found that sustainable development and ESD related projects for students were initiated by the students themselves, NGOs and private companies rather than the universities. In some engineering universities, examples of students' initiatives as extra-curricular activities such as clubs and forums on sustainable development themes were captured[97]. The forming of such initiatives followed a bottom-up approach: the students initiated and implemented projects and activities themselves or with the technical and financial support from NGOs and businesses (Int. 8). Some projects and activities on sustainable development, on the other hand, were developed and implemented by the NGOs and companies for the students. The activities included holding seminars and workshops to raise awareness and build capacity for students in sustainable development, giving awards and sponsoring student projects on sustainable development etc.

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[97] Examples of student initiatives, clubs and forums related to sustainable development included Green Action Vietnam, Cycle for Environment, Green Zoom, Green Vietnam, Environment 360, 3R, Motivation, Talking Green etc.

(see section 7.2.3) In most of the cases, the universities either had no authority and involvement or only provided spiritual supports (Int. 6, Int. 8, Q2, Q3, Q7, Int. 13). As one informant from the NGOs attested:

> "we started with contacting universities for ESD projects but it took too long and the procedures were so complicated that we decided to talk to the student union instead. We then found a number of student groups who are really active and we are very happy to work with them" (Int. 6)

The suggestion was that the significance of those sustainable development efforts could be enhanced if the universities took part in the construction and implementation of the initiatives.

Third, partnerships between engineering universities and businesses in Vietnam might benefit the universities in terms of ESD implementation within the university settings. Currently, academic staff in the engineering universities in Vietnam relied on the internal resources when delivering ESD activities. The lack of partnership with the community of practice, especially the engineering businesses were viewed by the informants as preventing the universities from the receiving the potential support including in terms of expertise and finance (Q3, Q7, Int. 13). For example, one company manager proposed:

> "we are willing to come to universities to hold seminars or talks to share our stories and experiences of sustainable development activities with students [as part of their modules or courses on sustainable development]." (Int. 13)

6.3.4. Engaging engineering education in the national effort towards ESD

The current scenario of sustainable development movements in Vietnam suggested a lack of engagement of higher education in comparison with other sectors (see sections 6.2.1 and 6.2.2). Moreover, the researcher's direct observation accompanied by a documentary review[98] revealed a lack of response from the engineering education community to the sustainable development movements of higher education in Vietnam. For example, at the first conference on ESD in higher education in Vietnam, none of the engineering universities participated which suggested a low level of interest (Research diary, 13/05/2010). Similar observations were

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[98] See sections 7.2.1 and 7.2.2

captured at other conferences and seminars on ESD such as the 3rd National Conference on Sustainable Development – Sessional forum on Education for Sustainable Development (Research diary, 06/01/2011) and the ESD Workshop for Vietnamese higher education institutions (Research diary, 19/10/2010).

Interviewees from engineering universities also admitted that they were less active in responding to ESD calls than peers in other disciplines (Int. 4, Int. 21, Int. 23, Int. 24). Whilst evidences of ESD activities from higher education institutions specialised in business studies[99] or social sciences and humanities[100] could be captured in the forms of initiatives and programmes on ESD, ESD in Vietnamese engineering universities was interpreted as teaching about sustainable development concepts and issues, and the common approach to curriculum for sustainable development being the infusion of the concepts into the existing modules and courses related to environmental management (see section 6.2.4).

Throughout the survey, a need for champions in the area of engineering curriculum for sustainable development was suggested. One informant from the Vietnamese higher education authorities said:

> "in the current situation, we can only rely on the largest and most distinguished engineering universities to take the leading role" (Int. 12)

Interviews with engineering universities also revealed that the big universities were waiting for a counterpart institution to make a step-change to the engineering curriculum towards sustainable development (Int. 19, Int. 23, Int. 24), and smaller universities, which were used to

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[99] For example: The project to introduce Corporate Social Responsibility (CSR) in the Vietnamese business schools. This project, at the time of observation, involved a survey of 2000 business students to investigate the current awareness on CSR in Vietnam, and the development of 10 case studies in Vietnamese companies to be used as teaching materials in the core modules of the business courses being offered at Vietnamese business schools. (Recorded by the researcher in the research diary on 17/12/2010 at the Forum on sustainable development for Vietnamese businesses)

[100] For example: The programme on "Including ESD in new Industrial organizational psychological curriculum" at the University of Social Sciences and Humanities and Van Hien University in Ho Chi Minh city. The programme's objective was to amend the current curriculum by reducing the old and unnecessary knowledge and adding the knowledge of sustainable development, as well as changing the method of teaching from lecturing to project-based learning. The main themes being covered include: Natural resources management, citizen participation and good governance, sustainable urbanization, and sustainable production and consumption. For more information: http://www.vnuhcm.edu.vn/

be followers, were seeking best-practices as models to take after (Int. 4, Int. 17, Int. 25). This call for ESD leadership was also recognised in the literature of global ESD in which the argument was that changes in higher education for sustainable development do not just happen but must be led (Scott, Deane, Tilbury, & Sharp, 2011).

6.3.5. Innovative approach to curriculum change for sustainable development in Vietnamese engineering universities

Internationally, various declarations on ESD in higher education have recognised that curriculum change for sustainable development is needed across all programmes of study offered by higher education, and not just those programmes which focus specifically on sustainable development issues (Tilbury, Keogh, Leighton, & Kent, 2005; Sterling, 2004b) (see also section 3.2). This view has been supported by many in the engineering education community as they recognize that the tradition of single-disciplinary, single-purpose and technical oriented curriculum design no longer fit for sustainable development purposes (Ashford, 2004; Fenner, Ainger, Cruickshank, & Guthrie, 2006) (see also section 3.3). However, the current level of awareness and action to progress engineering curriculum towards sustainable development in Vietnamese universities as presented in the previous sections has suggested that those international calls for change have yet to reach the Vietnamese engineering education community. Nevertheless, the survey revealed expectation of the stakeholders for change in engineering curriculum in Vietnamese universities to address sustainable development needs. This expectation was aligned with the international movements in the engineering curriculum for sustainable development.

First, stakeholders were critical of the way engineering education was generally being carried out now in Vietnamese universities. Some informants from governmental and non-governmental organisations suggested that curriculum design in universities in Vietnam had been too deeply rooted in the ideology that education is to provide students with as much knowledge on a particular subject as possible (Int. 7; Int. 29; Int. 9). One interviewee went on to explain how this tradition became unsuitable for ESD. He said:

> "Nowadays, knowledge changes so fast. Normally knowledge only lasts a cycle of five years, now they said it only lasts three years. So education for sustainable development should not be based on knowledge but values" (Int. 7)

Informants from engineering businesses also expressed their ideas on the knowledge load currently packed in the engineering curriculum which left little space for coverage of sustainable development issues (Q2, Q3, Q7, Q8, Int. 13). For example, one company manager complained:

"there is a lot of unnecessary focus being paid on some parts and lack of focus on sustainable development" (Q2)

Other managers demanded that engineering curriculum should:

"include modules and subjects on or related to sustainable development" (Q5, Q6)

Besides, engineering employers were concerned with the ways their employees being taught in their undergraduate courses. It is very often in the survey[101] that the informants highlighted how engineering graduates were equipped with a strong theoretical knowledge base with regard to their own specific disciplines. However, the managers observed that their engineers were often found struggling with real-life practices (see also section 7.3.2). From the survey, an emphasis on the action-orientedness of engineering curriculum design for sustainable development was captured (Int. 16, Int. 29, Q2, Q3, Q8). For example, a manager from the participating company suggested:

"teaching at universities should focus on most-updated practices and more practical training" (Q8)

He proposed that this could be done by providing students with opportunities to be:

"exposed to real action in real situation" (Q8)

Another informant shared the same opinion and proposed:

"Departments, faculties and research centres in universities should investigate the current and pressing sustainable development issues of the industries, for examples in our cement industry, carry out research activities to help solve the problems and utilise the experience as teaching materials for students. Everyone will benefit from it" (Q7)

Interestingly, one interviewee from an engineering company highlighted that:

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[101] Six out of nine company managers acknowledged this remark in the questionnaires and interview.

"There is no need for a specific module or subjects, sustainable development could be embedded in the current subjects. But changes need to be done with the current ways of teaching so that the students can really understand and turn into action" (Int. 13)

With regard to the way sustainable development concept should be taught in the engineering subjects, the data found that whilst the concept was viewed by the informants as abstract and vague, it could be made comprehensible for engineering students through innovative teaching methods. The strong message conveyed was that sustainable development needs to be ingrained and embedded in the engineers' thinking. Some suggestions from the governmental authorities and NGOs for teaching sustainable development concept included:

"curriculum design should focus on turning the abstract concepts and definitions into illustrative and specific examples" (Int. 29); and

"This [Sustainable development] is very abstract but if you can make it more technical, it might be understandable and readable for engineering students. For examples, turn the concept into guidelines or frameworks, and incorporate into technical education. Getting the students familiar with the topics [of sustainable development] so that they can be aware and understand from the very beginning..." (Int. 16)

6.4. SUMMARY

This chapter has responded to the need identified in chapter one for empirical study on engineering education for sustainable development in Vietnam. The chapter has presented the stakeholders' understanding, the drivers and influencing factors, as well as the current actions and activities with regard to engineering and higher education for sustainable development. Key points from the findings include:

- At national level, there have been a number of developments especially over the past ten years that have contextualised engineering and higher education for sustainable development policy and practice. Governmental authorities play the most important role in leading the way, establishment strategies and action plans on sustainable development that have resulted in various initiatives and nationwide-scale activities aimed at progressing sustainable development in Vietnam. However, the efforts have been limited to showcasing projects and awareness raising activities. The factors hampering meaningful progress towards sustainable development in Vietnam include

the understanding of key concepts, expertise for delivering, level of priority, communication, division of responsibility, quality control and assurance, and lack of resources for implementation.

- Non-governmental organisations are playing an important part as contributors in the national sustainable development efforts through large-scale initiatives and one-off projects covering sustainable development and ESD themes. Drivers and influencing factors for sustainable development work included individual's awareness, visions and strategies of the donors, and combination of governmental policies, international movements and the perception of the management board on the need for change.

- Engineering businesses have become more aware of sustainable development challenges and have implemented policies and acted on areas such as environmental protection initiatives, well-being of employees and community development. The most important driver which gave rise to the consideration and implementation of sustainable development principles in the businesses was governmental laws and regulation on environmental management and environmental protection. Other drivers include strategic orientation and policies of the industry in sustainable development; the company manager's vision; and the international management board and the industry's codes of conduct.

- Engineering universities have been focusing mainly on environmental education with some institutions starting to make changes to the curriculum to address the ESD call from the Vietnamese government. Teaching and learning for sustainable development, however, was generally limited to teaching about the concept and principles of sustainable development. Changes to the engineering curriculum have been occurring in a piecemeal manner and by committed individuals.

The current situation in Vietnam, along with the country's specific issues and challenges associated with the implementation of sustainable development has created some implications for the Vietnamese engineering education:

- The emergence of societal expectations towards graduate engineers for sustainable development;

- The identification of a new set of knowledge, skills and values of engineers for sustainable development;

- The need for improvement in the relationship between engineering universities and the community of practice that they serve;

- The call for the engineering education community in Vietnam to engage in the national efforts towards education for sustainable development, especially through a profound change in the engineering curriculum.

CHAPTER 7. EXPLORING CULTURALLY APPROPRIATE STRATEGIES FOR TRANSFORMING THE ENGINEERING CURRICULUM TOWARDS SUSTAINABLE DEVELOPMENT IN VIETNAM

7.1. INTRODUCTION

This chapter offers findings from research stage two which includes three case studies of Vietnamese engineering universities (see section 5.4). The focus of the case study research was on understanding the current processes and opportunities for curriculum change for sustainable development, as well as investigating how the specific contextual and cultural factors might influence the desired change. The study found evidence of issues that hampered current efforts in ESD in the engineering universities in Vietnam. The analysis also provided insights into Vietnamese values, attitudes and expectancies, and behavioural preferences that contributed to explaining why these issues existed.

This chapter is organised in two main sections: (1) Identifying the issues and possibilities for change; and (2) understanding the cultural influences. In the first section, the data are reported within three broad areas of contextual issues associated with engineering curriculum for sustainable development in the universities: understanding; planning and institutional support; and implementation. For each area, the section explores the issues that hampered the current efforts in engineering curriculum for sustainable development in the Vietnamese universities (by asking *"What are the issues?"*). The section then identifies the reasons for these issues (by asking *"Why the issues?"*) and explores the possibilities for change (by asking *"How to address the issues?"*).

The second section of the chapter presents findings on the cultural influences over the efforts in engineering curriculum change for sustainable development in Vietnamese universities. This section comprises of two tables: the first one summarises the different cultural characteristics being identified through the research as factors influencing the process; the second table maps how these cultural characteristics have influenced the issues and opportunities for engineering curriculum change towards sustainable development in the Vietnamese universities.

7.2. IDENTIFYING THE ISSUES AND POSSIBILITIES FOR CHANGE IN ENGINEERING CURRICULUM FOR SUSTAINABLE DEVELOPMENT IN VIETNAMESE UNIVERSITIES

This section offers data on the issues concerning engineering curriculum for sustainable development that exist in the case study universities. The research captured various issues related to (i) understanding of ESD; (ii) planning and institutional support in engineering curriculum for sustainable development; and (iii) implementation in engineering curriculum for sustainable development. It is important to note that due to their interrelatedness, issues within these three areas need to be regarded as "an overlapping series of dynamically complex phenomena" (Fullan, 1993, p. 21). It is also important to acknowledge that whilst some issues are generic higher education issues, some are specific to higher education in the Vietnamese context, and some are those specific to ESD[102]. When discussing the issues in detail, clarification on the nature of the issues is provided. Under each area of issues, the section identifies the underlying reasons that explain why these issues exist, as well as explores the possibilities for improvement.

7.2.1. Understanding of Education for Sustainable Development

Key findings	
What are the issues?	*Why the issues?*
- Lack of ESD understanding in Vietnamese engineering universities	- Mis-translation of ESD terms from international discourse in English
	- Lack of opportunities for learning about ESD
	- Lack of resources for learning about ESD

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[102] These are the issues related to the view of Education for Sustainable Development (ESD) as a paradigm that seeks to bring about a systemic change in HE in order to meaningfully contribute to sustainable development (see section 3.2)

- ***What are the issues?***

In the previous chapter, data from the survey revealed that at the engineering universities being studied, there existed a confusion between education for sustainable development (ESD) and education about sustainable development (see section 6.2.4). This finding was confirmed by the case study data. The managers and lecturers who were in charge of ESD[103] at the participant institutions viewed ESD as teaching about sustainable development. In the case studies, some informants limited teaching about sustainable development to introducing the concept of sustainable development. For example, one informant, being a young lecturer who was assigned to include sustainable development in her teaching activities, started her conversation with the statement:

> "Well, there is nothing much to say about sustainable development really. I would spend half a lecture providing students with the Brundtland definition and some principles and that's almost all about sustainable development, isn't it?" (Int. 3B-1)

There were suggestions captured through the research activities that the level of understanding regarding the concept of sustainable development varies, for example:

> "there are individual engineering education professionals who still understand sustainable development as almost equivalent to environmental management." (Int. A1-1)

Other members of the academic staff, as revealed by the informants, thought that ESD did not concern them.

In the literature of ESD and EESD, this issue concerning the understanding of the term ESD has been widely discussed (Huckle & Sterling, 1996; Azapagic, Perdan, & Shallcross, 2005; Holmberg, Svanstrom, Peet, Mulder, Ferrer-Balas, & Segalas, 2008). Whilst the issue of sustainable development has entered the discourses of educators including those in higher education and engineering higher education, the focus has largely been on education about sustainable development (Tilbury, 2012). In EESD particularly, the focus has been placed on disseminating

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[103] The current practice in place at the case study universities (and other engineering universities included in the research stage one) was that ESD implementation was assigned to specific managers and lecturers whose areas of expertise were considered relevant to sustainable development (e.g. environmental management) (see section 6.2.4).

the definition and principles of sustainable development and ways to reduce the environmental impacts and/or improve the social responsibilities of the engineering practices (Byrne, Desha, Fitzpatrick, & Hargroves, 2010). The missing component is education for sustainable development (ESD) in which emphasis is made to the development of knowledge, skills and values necessary for understanding the complexity associated with sustainable development issues as well as the systemic changes needed to address these (see sections 1.2 and 3.4).

- ***Why the issues and how to improve?***

a) Mis-translation of ESD terms from international discourse in English

Data from the three case studies pointed at the ambiguity of the terminology used in Vietnamese engineering universities as the reason for the confusion between education *for* sustainable development and education *about* sustainable development.

This research recognises mis-translation as a factor likely to influence the understanding of the term ESD in the Vietnamese context. This issue of translation is especially critical in Vietnam where English, the language being used in common literature of ESD, is not one of the primary languages, and the mother-tongue does not have the exact equivalent term of expression. As one informant explained:

> "ESD is a new concept. It's natural that people, on first impression, will associate it with the meaning easiest to grasp." (Int. 2D-1)

Another informant highlighted the difficulty in the Vietnamese context in particular when he acknowledged:

> "Finding the right terminology will not be easy. Our language is so different to the Latin ones that a word-by-word translation is not going to be appropriate." (Int. 1A-1)

Throughout the research process, the existence of different translation versions of ESD within different stakeholder groups was captured. The study recorded that the term *Education for Sustainable Development* is translated and being used in Vietnam including the Vietnamese universities as *"Giáo dục Phát triển bền vững"* which is a combination of Education (*Giáo dục*) and Sustainable Development (*Phát triển bền vững*). The word *"for"* was omitted, leaving space for different interpretations. This way of translation was widely used in documents and

conversations in the university settings. The research also recorded that *"Giáo dục Phát triển bền vững"* was the term being commonly used by the informants from other stakeholder groups during the survey.

The research diary, on the other hand, noted that at the top government and education authority levels, Education for Sustainable Development is being formally cited in the ESD Action Plan and at related conferences and seminars as "*Giáo dục vì sự Phát triển bền vững*"[104]. This term, when being back-translated into English has a closer meaning to *Education for the Sustainability of the country (or the community)*. It positions education institutions as contributors to the sustainable development of the country, but, as interpreted by the informants:

> "does not explicitly recognise the institutions as integral parts of the country's sustainable development." (Int. 1A-1)

> "does not connect the institution with sustainable development." (Int. 3C-1)

This research suggests that the term *Education for Sustainable Development*, when being translated into Vietnamese in authoritative documents, has been mostly associated with the wider country and society. The term lacks an implication of ESD as an agenda also applicable at an educational organisation or institution level which has been widely discussed in ESD literature, especially in higher education (Cortese, 2003) (see section 3.2).

The combination of this linguistic constraint and the lack of clarity in the shortened version on translation being used in the participant Vietnamese universities (i.e. *"Giáo dục Phát triển bền vững"*) might go some way in explaining why at the university level, ESD is widely understood as teaching about sustainable development.

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[104] When being asked to deliberate on this issue, one key informant of the survey, during an interview, suggested that the unfamiliarity with the literature and thinking that underpins this ESD has led to the interchangeable use and lack of clarification of the terminologies "Giáo dục vì sự phát triển bền vững" and "Giáo dục phát triển bền vững" which both serve as the translation for ESD at the Vietnamese top management level (Int. 7).

How to improve?

The informants acknowledged that this inaccuracy of translation and use of the term is difficult to solve as:

> "it has already been embedded in the system, not only in documentation but people's minds". (FG4, FG5)

The informants highlighted the responsibility of the Ministry of Foreign Affairs (MOFA) and Ministry of Education and Training (MOET) to take action to deal with this mis-translation.

Within the engineering universities under study, the proposal is that formal and informal opportunities are created for discussing and developing the institution's understanding and interpretations of ESD both in terms of content and boundaries of application. Some informants highlighted the need for a conceptual model which illustrates ESD in engineering education:

> "I think an illustration will be very useful. We need some kind of clear, explicit and easy-to-remember visual explanation of ESD." (FG6)

> "We need a model to build from in developing our own understanding and vision for ESD in our institution" (FG5)

b) Lack of opportunities for learning about ESD

Data collated in this research reveals a lack of opportunities for learning about ESD. The research found no formal training opportunities being offered to the managers or educators at the three participant universities with regard to ESD. During an interview, an informant who came from the management board of one institution confirmed this:

> "Not only in my university, I believe the case is common in other engineering universities as well. We receive the direction from MOET which requires that sustainable development is included in the curriculum. And that's all about it. No further explanation. No training." (Int. 3A-1)

The lack of opportunities for academic staff to learn about ESD was also identified by the informants at the three case studies (FG1. FG2, FG3). For example, during a group discussion, this issue was raised by the participants at institution two:

2E: "ESD, as I understand it, is not just about reading from the textbook to the students that the world is heading to a doomed future. It's about showing our students that we, engineers, can help to make create a better one."

2A: "Ok, so the ones who teach the technical knowledge have an important role here."

2C: "Exactly... but people didn't know that."

2E: "They didn't know, but it's not because they were not willing to know. I have the feeling they feel omitted because they are not used to the terminology. They thought it's not relevant."

2C: "Then they need to be given the chance to see that it's actually relevant. We haven't got it here." (FG3)

How to improve?

The informants suggested that opportunities for learning about ESD needed to be provided to both the managers at the engineering universities and the academic staff who are involved in the curriculum. During the interviews, some informants who are members of the management board of the participated universities proposed that MOET was the most suitable body to provide learning opportunities for the universities' manager. These opportunities, according to the informants, could take form of a seminar or workshop on ESD (Int. 1A-2, Int. 1D-2, Int. 2D-1), or written document explaining ESD (Int. 3D-2, Int. 3A-2, Int. 3C-1). The informants, however, stressed that the content should be:

"concise and relevant to engineering, and not some common, superficial introduction." (Int. 3D-2)

At the academic staff level, in one focus group discussion, the informants highlighted that:

"the opportunities for learning about ESD should be given to all the academic staff and not just those who are assigned the task of teaching about ESD." (FG3)

c) Lack of resources for learning about ESD

The availability of resources for learning about ESD was identified as one issue contributing to the lack of ESD understanding in Vietnamese engineering universities. The study found only one

textbook[105] in Vietnamese that was developed specifically for the science and engineering discipline. The informants, during the interviews, suggested that whilst the reading materials on sustainable development and ESD from international sources (e.g. via the internet, in publications...) were available, the academic staff's access to these documentations was limited due to the language barrier. The informants highlighted that the lack of proficiency of academic staff in foreign language namely English is a particular hindrance to integration and the improvement of quality in ESD. For example, one informant acknowledged:

> "We have a big disadvantage in learning new things. Technical knowledge seems to be fine with limited English, but for topic like ESD, it's more difficult." (Int. 2E-1)

Another informant also suggested that this lack of resources for learning about ESD:

> "... is the main reason why we [engineering universities] haven't been progressing much when compared to other Vietnamese universities of other disciplines like business and management." (Int. 1A-1)

In the wider Vietnamese higher education context and beyond, there are similar research findings that support the view language differences can be an obstacle to the acquisition of new knowledge for academics (Slethaug, 2007; Harman, Hayden, & Pham, 2010). This study confirmed that the same issue occurred in Vietnamese engineering universities with regard to ESD topics and asserted that language has been a major component in the academic staff's lack of confidence when delivering ESD tasks.

How to improve?

The review of the data identifies that user-friendly resources for ESD is an important determinant of the quality of and opportunities for ESD. The role of resources in enabling ESD was stressed by a number of informants during interviews, during group discussions as well as

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[105] The book is entitled *"Education for Sustainable Development"* and published by the Hanoi National University in 2008 for internal use. The book covers general information regarding the international movements in sustainable development (e.g. the international conferences on sustainable development), the Vietnam Agenda 21 and a small section on ESD.

captured by the researcher during participant observations in the research stage one. For example, in one of the institutions, an informant stated that resources for ESD:

"... has a big impact on how an academic individual come to know, connect and then choose to engage with ESD." (FG4)

This statement was also reinforced by another informant who explained that resources for ESD:

"... will welcome more people to get involved in ESD because it clarifies their confusion over the ambiguous terms and boosts their knowledge confidence." (Int. 1A-2)

In terms of quality of current practice, the information captured suggests that certain types of resources can provide the foundation for the improvement of ESD knowledge for staff that eventually lead to the improvement of ESD understanding and practice. *Table 25* highlights critical elements and properties of resources for ESD that determine the positive impacts on academic staff as identified by the research participants.

Critical factors	Types of resources considered as effective
Language	"I think we should have the majority of material translated into Vietnamese. To be honest with you, a two-page English document is OK for me, but it's very unlikely that I would take ten pages of academic English back home to read at night." (FG5) Provided in original language along with translation so that "people have a choice" but still ensure "those who want to use this chance to improve their academic language proficiency could do as they wish" (FG4); as well as "allows for correction in case the translation is inaccurate" (FG6)
Accessibility	Resources for ESD need to be easy to access (FG4, FG5, FG6) Open to every member of staff as "I don't want to have to ask anybody if I need information." (FG5)
Relevance	Reading materials which "are in the same or closely related disciplines" (FG4) Resources for ESD should "address the issues relevant to engineering, not other

	subjects" and "focus on issues of Vietnam, not those of developed countries with super-high technologies" (FG6)
Reality	"Close to real-life experiences" (FG6) Examples and illustrations chosen from actual projects (FG4, FG5)
Currency	Reflect the current issues, "those we are facing at the moment" (FG4) Based on up-to-date literature as "sustainable development knowledge is changing" (Int. 1A-2)
Format	"No need for huge piles of long boring documents" (Int. 2E-3) "I once came across a drawing explaining sustainable development in engineering. I really think those kinds of resources are much more captivating and stay longer in your mind." (FG5) Teaching and learning materials in the forms of images, diagrams, case studies, project briefings (FG6), those that "go straight to the points" (Int. 3D-2)

Table 25. Critical factors of resources for ESD which enhance ESD understanding and activities

7.2.2. Planning and Institutional support in engineering curriculum for sustainable development

Key findings	
What are the issues?	*Why the issues?*
- Lack of understanding on how to progress towards engineering curriculum for sustainable development - Ineffective communication in ESD - Lack of external cooperation in ESD	- Lack a clear vision for ESD - No specific forum for communication of ESD - No effective structure for communication of ESD - Lack of a formal mechanism for external cooperation for ESD

- ***What are the issues?***

The research suggests that, actions and activities aimed at progressing education for sustainable development had been put in place at the three case study engineering universities. The focus of these actions and activities was on embedding sustainable development into the engineering curriculum (see also section 6.2.4). Further investigation found that, whilst the activities were there, the planning and institutional support for curriculum for sustainable development had not been sufficient which resulted in a number of issues.

First, interpretations from discussions, interviews and observations indicated that the academic staff at the case study universities did not know how to change towards engineering curriculum for sustainable development. Following are some remarks that explain this finding and the supporting extracts from the interviews and focus groups:

> *- The academic staff were being told to include sustainable development into their teaching activities without sufficient guidance on how to do it:*

> "I have done this for a long time, well before the requirement from the ministry. There is no one who told me what to do, and what should be done next." (Int. 1C-1)

"I was told that I need to cover sustainable development in my subject and I did. I included. But that's all about it, really." (Int. 3B-1)

"I was given a one-page of key headings to cover. But there is no clear guidance on how to teach SD whatsoever, so we would design the lectures based on our own understanding and interpretations." (Int. 2A -1)

"I feel that we are doing OK, but I am not sure." (Int. 2C-1)

- Except for the lecturers being assigned to teach about sustainable development, the rest of the academic staff were left to decide whether or not to embed, and how to embed sustainable development in their teaching activities:

"Apart from one single lecturer [who is assigned to teach about sustainable development], the change in curriculum to integrate sustainable development are being implemented solely by committed individuals and on a non-regular basis." (Int. 1A-1)

"Some key lecturers are aware of the need for teaching about sustainable development. They are doing it without being told." (Int. 1A-1, Int. 3A-1, Int. 3D-1)

Second, the information collated revealed that communication in ESD in the case study universities had not been effective. The current way of communication for ESD in the engineering universities, according to the informants, was identified as having certain problems:

- *The information "does not reach the right persons" (FG1):*

This includes both the information conveyed from the managers to the staff (i.e. direction with regard to curriculum for sustainable development) (Int. 3A-1, Int. 3D-1, Int. 1B-1), and from the staff to the managers (e.g. feedback of the current situation or suggestions for change) (Int. 2E-1)

- *The recipients "are not listening" (Int. 1A-1, Int. 3A-1):*

This problem was particularly stressed by the informants who were at management level.

- *The people involved in the communication "do not understand each other" or the recipients "do not understand the points being made" (FG1, FG2);*
- *There is a tendency to conceal information or information being communicated has been distorted or partly changed (Int. 1B-1, Int. 2E-1, Int. 3D-1, Int. 3E-1)*

- *There is an uncomfortable feeling towards communication in general (FG2, FG3)*

Third, the data gathered indicates that the facilitative role of external partnership in contributing to actions and activities for ESD (as described in, for example, Lozano, 2007; Ryan, Tilbury, Corcoran, Abe, & Nomura, 2010; Mihelcic, et al., 2008; Sukumaran, Chen, Mehta, Mirchandani, & Hollar, 2004) is yet to be discovered. Current involvement of industries in ESD consists of ad hoc arrangements based mainly on relationships between the people involved. These arrangements occur as a result of informal and personal relationships of the academic staff. At two out of three institutions being studied, the informants could not identify any activities relating to ESD that involve external stakeholders. In the other university, cooperation with engineering business occurred in the form of internships offered by businesses. Students were given opportunities to gather data for their research projects concerning sustainable development related topics such as corporate social responsibility, clean development mechanism or cleaner production.

Findings of stage one indicate that businesses widely express a desire for greater cooperation with universities and research institutes in ESD, but that this demand is rarely met (see section 6.2.3). From the universities' perspective, this lack of cooperation in ESD was confirmed in the case studies. This research recognises that although partnerships with external stakeholders exist in all three universities, none have addressed the possibilities of cooperation for ESD.

- **Why the issues and how to improve?**

a) Lack of a clear vision for ESD

In the ESD literature, it is advocated that since sustainable development is a socially constructed concept, its vision must be built and shared by people involved in the ESD process and programmes (which include but not limited to staff and students) through dialogue, participation and critical reflection (Tilbury & Wortman, 2004). Data from the case studies further confirmed the finding of the survey that there is currently no explicit vision for ESD in the engineering universities participating in this research (see section 6.2.4).

Within each institution, the research also captured a wide range of views on how the informants judge their institutions' progress in ESD. There were some positive comments that implied a satisfaction of the academic staff, for example, Int. 1C-1, Int. 2A-1. Int. 2B-1, Int. 3B-1, Int. 3E-1.

At the same time, disappointment and criticism over the actions for ESD were expressed by a number of informants such as Int. 1A-1, Int. 2E-1, Int. 3A-1, Int. 3C-1. Even though these different perspectives might represent the various view of the research group on the current ESD work, they signified the lack of a common ground and shared vision at the case study institutions on what they wanted and needed to attain with regards to ESD at their institutions, and more specifically, what the engineering curriculum was transforming into.

The informants, during the interview sessions, mainly blamed the case study universities' management board for the lack of a vision for ESD. Some comments captured in the interviews include:

> "I think we are not performing to the full possibilities because the top managers do not help to create a vision for everyone to work towards it. They simply told us [line-managers] that we had to cover ESD and had to ensure young staff know what they were doing. We are sometimes not even sure what we are doing". (Int. 1B-1)

> "They [the managers] did not really play any role in this whole ESD thing, they received the direction from the ministry and directly passed it on to the academic staff. They did not add much into it." (Int. 3A-1)

How to improve?

The view that a clear vision of ESD by the managers as well as the academic staff is crucial for implementation of ESD agenda has been well acknowledged in the literature (Hicks & Holden, 1995; Tilbury, Keogh, Leighton, & Kent, 2005). This is confirmed in the cases of the participating universities. During the second round of group discussions (FG4, FG5, FG6), informants agreed that creating a shared vision for ESD was essential for the institutions to establish the purpose of change programmes and initiatives related to ESD; inform direction; and motivates actions among academic staff. Engaging staff in the envisioning activities to facilitate common understanding and interpretation of ESD, according to the informants, also helped solve the issue concerning the lack of orientation from the manager.

During group discussions, there was common consensus that such vision needs to be accompanied by an action plan for ESD implementation. The informants also deliberated on how the action plan should be developed to be relevant to the Vietnamese case. First, it has to be

realistic. Some participants criticised the common approach in planning at the case study institutions for producing:

"... plans which were far from realistic." (FG4, FG5)

and suggested that action plan for ESD should be:

"... not some overly ambitious ones being borrowed from elsewhere, but rather be do-able and focus on what we need the most." (FG4)

"... for practical use and not develop for the sake of having one." (FG6)

Second, whilst being long-term oriented, the ESD action plan should include clear, short-term tasks. The study captured a cynical attitude of the informants towards long-term planning. This recognition was confirmed by the participants in one group discussion as they criticised that:

"long-term goals in strategies and plans sometimes mask failures and distract people from seeking real, instant achievement." (FG4)

Third, the informants suggested that where possible, the ESD action plan should aim for visible results as:

"They helps track the progress... [especially] when we don't have a quality assurance and control tool in place." (FG6)

b) No specific forum for communication of ESD

The investigation of the issues hampering the effectiveness of ESD activities acknowledged that at the time of study, there was no specific forum for communication of ESD at the three case studies. The current platform for communicating ESD, in all cases, had been formal meetings in which ESD is incorporated as one area to cover. However, this arrangement was generally viewed by the informants as not appropriate. The research captured various problems associated with using formal meetings for ESD communication:

- *Formal meetings at the universities usually entail brief discussions on pre-determined issues and only seek final approval or agreement on solution packages.*

The informants argued that the nature of such meetings is not suitable as a forum for ESD since ESD requires:

"more in-depth discussions" which "sometimes do not have a clear issue to build from in advance." (FG1, FG2)

Furthermore, some informants acknowledged that compared to other issues, ESD was less of a priority in the meetings which led to the current situation where:

"there is a lack of focus on ESD" (Int. 3A-1); and

"ESD has never been a main areas of discussion during the general meetings." (Int. 1C-1; Int. 2C-1)

- *Informants also highlighted the need for interaction in ESD and stressed that a setting like department meeting is too formal for interactive deliberations.*

For example, one informant shared her feeling over the experience:

"The meetings always have this kind of seriousness, very hard to explain... but I feel tense, a bit like you are in a group interview. Staff members speak quietly to each other, the managers wear solemn faces. We tend to listen to what people have to say, and only talk when being asked." (Int. 1D-1)

Another informant confirmed this assertion by saying:

"it's too formal for active interaction. You raise voices only when you think it's your turn, your share to contribute something. But if I have a choice, I would stay quiet." (Int. 3B-1)

- *The research also recognises a tendency of hiding mistakes and concealing failures of ESD during formal meetings. One informant explained this tendency as:*

"At a meeting where there are many people including those who do not know about your specific area, here I mean ESD, you don't want to talk about your problems. You only want to mention achievements." (Int. 3D-1)

In support of this view, a group discussion acknowledged the issue but emphasised that:

"sometimes people do not think of it as hiding mistakes or ignoring problems. They just feel like it is not the right place to talk about it. They think there will be another chance but it never happened." (FG3)

- *The data collated suggests that formal meeting is not appropriate for ESD in particular since it does not encourage people to raise critical issues and give positive critiques.*

For example, a dialogue between two informants during group discussion FG3 said:

2E: "...like we do all the time, when the boss asks if there is any problem [with ESD], we say no. But out of the board room, we start complaining and criticising...";

2A: "but... you know well enough that we don't have time for it. The meeting always run late, and at the last minutes, of course you don't want to ask a question or say something you already knew it will take half an hour or more to discuss.";

2E: "I have the feeling that they [the managers] don't want us to raise issues or criticise. They ask, for the sake of asking, but do not allow enough time and show no sign of encouragement." (FG3)

Attending a formal department meeting helped the researcher to confirm this assertion. An extract from the research diary wrote:

"It is true that the formal meeting does not provide a comfortable atmosphere, at least that was how I felt today. Also, I recognised that when Mr. X [head of department] asked if anyone had a question about the change in supervision arrangement for student close to their thesis submission, no one said anything. But outside the board room, I heard A [informant 2B] told her colleague that she did not like the new schedule because it coincided with her task, and she was not consulted in the first place. Whilst this is not exactly something related to ESD, the point is that formal meeting is not the best place for people to show their opinion". (Research diary, 31/05/2011)

How to improve?

The need for a specific forum for communication of ESD matters which was separated from formal meetings was identified in the three case studies. Specifically, informal settings were suggested by the informants as an appropriate form for communication and engagement in ESD.

Through interviews and especially during the groups discussions, the participants deliberated on how an informal setting such as social activities fitted with the values and attitudes of the Vietnamese regarding communication. The informants identified various benefits of having a forum for ESD embedded in social activities in their institutions that include:

- *Enhances interaction:*

This exploratory investigation indicates that interaction on work-related issues and problems including those on ESD is more likely to occur during social and non-formal gatherings. This finding is particularly strong at two institutions in which social bond seems stronger[106]. For example, two informants from one of these two institutions in a group discussion acknowledged that people at her department had many chances to share opinion and discuss work matters because:

> "We are very close here, like friends. We are comfortable when talking about things"; and "we go out a lot together and we talk about almost everything, from work to personal life". (FG3)

Informants expressed that they felt more "comfortable" and "in control" because they "didn't feel being forced to talk" (FG4). There was also acknowledgement that the tone and voice in social activities would be less tense which reduced the sense of hierarchy and authority as one informant pointed out:

> "This [the belief that informal settings help enhance interaction] might be because a social, friendly atmosphere breaks the barriers of authority and power" (Int. 3B-2)

- *Allows facing "the ugly truth":*

Deliberations from FG4 and FG5 suggested that a less formal setting tended to encourage communication of mistakes, issues and poor outcomes. In a more relaxed atmosphere, according to the informants:

> "...people feel that they do not bear the responsibilities as huge as when it's formal and recorded" (FG4)

One informant also suggested that:

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[106] During the time spent at the participating universities for observation (11 full-days for each institution), the researcher recorded the frequency of social/non-formal gatherings of the informants and noted down her observation on how the academic individuals bond with each other during in-hour and out-of-hour interactions in her research diary. The data collated indicates a stronger bond in cases 2 and 3 in comparison to case 1.

"In a gathering, when I have to point at someone's mistake, I feel more like a constructive comment. In formal meeting, I am worried that the person will take it as a critique and might feel offended." (Int. 2E-3)

Evidences gathered through connecting the records of a formal focus groups meeting and a non-formal group discussion in case study 2 helps strengthen this finding. At FG3, when issue of quality was being discussed, an exchange between two informants was captured as follows:

2E: "well, the rewarding scheme is corrupted... you know well before who is chosen... of course not on professional merit...";

2A (cut across 2E's line): "M. [2E's name], I think you forget where we are, we shouldn't be talking like this. Why do you always want to talk about bad things?";

2E: "Yep, that's exactly what it is. What is wrong with telling the truth? We never want to face the truth". (FG3)

However, 2E stopped there and appeared like he was not prepared to elaborate. At the next group meeting (FG6) which happened at an out-of-hour gathering, when the researcher mentioned:

"Last time, we touched on the issue of rewarding scheme but didn't have time to discuss further. Can anyone elaborate a little bit more?" (FG6)

2E started to reveal his feeling. This time, 2A seemed to be much more relaxed and joined in to express her opinion about the issue.

- *Ensures and promotes engagement in ESD*

Creating structures for communication to occur on a regular basis, according to the informants, will help keep the academic engaged with ESD in a continuous and sustained manner. As one informant highlighted:

"It helps remind that it [ESD] is not something that you do once and you are done with it." (FG4)

- *Involves individuals who are at different levels regarding their understanding of ESD*

A more natural setting for communicating ESD was believed to attract voluntary interest from academic staff. During a group discussion that happened at a beer gathering after work, this remark by an informant was captured:

> "Imagine I am just a normal staff who knows nothing about ESD. Normally I would not care about what you guys are talking about in a meeting, I completely shut down when the topic is salient to me. But if you guys talk about it here, I would want to join in, or at least, I would listen to what you are talking about". (FG6)

Evidence is provided by informants about the possibilities of engaging staff who have not been involved through provision of opportunities. In an informal conversation, one informant told the researcher:

> "The other day, D [a young academic staff at a participating university] asked me what your research is about. When I told her you were seeking ways to help us embed sustainable development in our teaching activities, she said she thinks it was a very attractive topic. She asked me what it meant by embedding sustainable development, and when I told her what we discussed the other day [at the group discussion FG3], she said it sounded more relevant to her than she thought before". (Int. 2B-2)

This informant went on to explain that she thought a forum for ESD which was not only open to the ones "being considered as relevant" would be necessary otherwise

> "we will miss out the unrecognised ones who are actually as relevant as us" (Int. 2B-2)

- *Influences the management board and raises institutional profile for ESD*

The research identifies certain impacts of an ESD forum in influencing the view of the management board over the effort to transform the curriculum towards sustainable development. This was captured through group discussions and interviews in all three case studies. In one of the case studies, for example, a line-manager shared his opinion during a group discussion:

> "When being part of a formal meeting, ESD has always been viewed by the top managers as one small topic. The positive changes brought about by a forum specific for ESD will raise weight of ESD, hopefully will make them approach ESD with a more strategic perspective." (FG5)

Social activities such as out-of-hour gathering, lunch break and tea break[107] were identified by the participants as having a great potential to encourage communication and engagement in ESD. When being challenged by the researcher if it were possible that work issues were discussed at out-of-work events, informants confirmed that there was a culture in Vietnam where actually the most important decisions and ideas related to work were made in such informal settings (FG5, FG6, Int. 3D-2). An informant even gave an example when he said:

> "Don't you hear all these stories about foreigners being frustrated about not being able to close any deals during lots of meetings over a long period of time, and eventually got everything sorted out in one day at a party table? It's the way things work around here. It's our cultural thing" (Int. 2C-2)

Even though opportunities for communication of ESD were proposed to be embedded in informal settings, the role of a facilitator was highlighted since "we still need a person to guide and ensure it happens exactly like it supposed to" and the institutional support being viewed as "key to keep it going over the long run" (FG3). The deliberations from group discussions suggested that the line-manager who was in charge of over-viewing ESD be responsible for meeting these requirements (FG4, FG5, FG6).

c) No effective structure for communication of ESD

This research acknowledges that giving out general direction at general meetings has been the common way in which managers communicate about ESD tasks to the academic staff at the universities under study. Managers' reliance on the general format of direction, according to the informants, is the main reason for ESD tasks not being fulfilled or completely ignored. As one informant asserted:

> "Saying "we should do this and that" during a formal department meeting without giving clear guides and indicating main recipients guarantees a big disappointment". (Int. 1B-1)

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[107] Observation of the researcher recognises a common form of tea-break in the participating universities. In each working room, there is often a common table for a short break with tea or coffee. However, a tea-break being referred to in this context means a get-a-way from the room, most often to the canteen for a fifteen minute to half an hour chat with one or more colleagues.

Further deliberations indicates that since ESD is a rather new term and the current level of ESD understanding remains low (see section 7.2.1), general direction from top management to staff regarding ESD does not work because:

"... the majority of academic staff feel like it [ESD] does not concern them." (Int. 3A-1)

"There are way too many general directions...which are not always significant... so we would choose to ignore as much as we can." (Int. 2E-2)

One problem of general direction being identified by informants is that there is sometimes a lack of clarification of whether a direction is a requirement - "a must", or a suggestion - "a should or could" (FG1). The informants explained that without such clarification, "one can choose to ignore the requirement, thinking or pretending it's just a suggestion"; in the case of the direction being a suggestion, a general message from the top management which "sounds random" and "lack enthusiasm" means it "would not help in initiating or promoting ESD" (FG1). An informant went as far as suggesting that:

"General direction has destroyed the sense of importance of ESD at our institution." (Int. 3E-2)

How to improve?

Informants, through interviews and discussions, suggested that direction from managers needed to be more specifically targeted and clearly expressed. As one informant pointed out:

"The idea of ESD is already quite vague for most of us. There is a need for more direct interaction between the manager and academic staff if we want real things to happen." (Int. 1B-2)

Another informant supported this remark when he suggested:

"Only when you tell a person to do the job and make sure he understands it then there are chances for the job to be done. We learnt this lesson in many occasions already." (Int. 3D-1)

The need for more targeted direction was also acknowledged to be important in order to direct the responsibilities to the right persons and increase transparency in communication in the group discussions (FG2, FG4, FG5, FG6). The participants agreed that a well-established structure for communication of ESD would serve as a valuable tool for dealing with this issue (see *Table 26*). According to the deliberations, general directions should be replaced by general orientation

from the management board to goal-level managers and more specific and explicit directions from goal-level managers to relevant staff members.

Qualities	As explained by informants
Hierarchy	"It's stupid trying to break the hierarchy. It [the structure] needs to fit into the current system." (Int. 2E-2) "Hierarchy should be respected. There are still the bosses: big bosses and little bosses. All are important [in ESD communication]." (FG4) "It's good to have the order and rules, things will work better." (FG6) "I don't need to talk to the top boss, I prefer talking to my line-manager. The important thing is my idea and messages reach the right people at the right time." (Int. 3A-2)
Allow feedback	"it's important that the arrangement allows members to give feedback regardless where they are in the system." (FG4) "people should be able to raise opinions about things and be heard." (FG5)
Connected	"there should be no loose knot, no missing link in the structure." (FG4) "if we draw the structure, everything needs to be connected so that no one is left out of the system." (FG6)
Authority	"I think when one is given the position, it is essential that he or she is given the genuine power to do his or her job." (FG6) "Authority should be ensured and maintained." (Int. 3D-2, FG5)
Responsibility	"Responsibility must be emphasised." (FG4) "It's key that everyone understands their roles and duties and fulfils them." (FG5, FG6)

Transparency	"Increased transparency should be one main goal of this new structure." (Int. 1A-2) "Communication should be clear, and information being made public when possible and applicable." (FG4, FG5)
Accountability	"… keeps record of communication." (FG4, FG5, FG6) "… enhance trust through accountability." (Int. 3D-2)

Table 26. Qualities of a structure for communication in ESD

d) Lack of a formal mechanism for external cooperation for ESD

The research found no formal mechanism for engaging external stakeholders in ESD at the three universities being studied. This might explain why external drivers for ESD are viewed by the informants as "weak" or "non existant" apart from the formal requirement by MOET (Int. 1A-1, Int. 2C-1, Int. 3A-1, Int. 3C-1).

Joining the social activities out of work with the informants provided the researcher with the chance to witness the actual close relationship between academic staff and business partners even though this relationship mainly rested on a personal basis. Discussion among informants on this issue revealed that whilst opportunities for communication with external stakeholder existed, they were primarily for the purpose of finding opportunities for cooperation between academic and business which did not concern the curriculum (FG1, FG2). It was, for example, asserted in a group discussion that:

> "academic staff doesn't talk about teaching and learning when meeting with external stakeholders." (FG1)

The main purposes for communication, according to the informants, were for discussing projects which were either undertaken under personal and individual agreements or institutional contracts. Informants explained the partnership as:

> "finding ways to help each other: academic individuals can help business in their projects with their expertise, and businesses help academic staff to earn extra-money to support their lives." (Int. 3A-1)

"the institution provides consultation and research services to businesses and this is totally separated to the teaching and learning activities at the institution." (Int. 1C-1)

How to improve?

Most important factor in improving external engagement in ESD, according to the informants, was the orientation from the managers. Most informants believed that the link, "the relationship", had already been established. The wise and most appropriate way for engaging external stakeholders in ESD, according to the informants, was that the institutions utilise this link in a more strategic manner. For example, one informant suggested:

"The management board is playing a key role here. It's more about vision and strategy than execution." (Int. 2D-2)

This statement was also reinforced by another informant who emphasised on the need for a clear vision with regard to external engagement:

"It [engagement of external stakeholder in ESD] can only happen if our bosses have a clear vision on how we want it to look like, and communicate these goals to the staff." (Int. 3D-2)

Whilst the research captures a common consensus among the informants that at the three case studies, external cooperation for ESD has not been the norm, the data being collated suggests there are ways to improve the situation. The informants proposed that the best channel for initiating cooperation with external stakeholder groups was the personal and institutional relationships had already been established through collaborative research activities and industry projects. The research diary helps verify these close connection as it records the observations that some after-work gatherings of the informants involved representatives from stakeholder groups including governmental officials, businessmen and counterparts from other universities. One extract from the research diary wrote:

"This is not the first time there are people from outside the institution who come and join in. They include a professor from [name of a different university], governmental officials and businessmen. And I can see that they are very close, like friends. And this seems to happen very often. And they talk about work, serious work things..." (Research diary, 16/06/2011)

The informants highlighted the advantage of having such relationships in place, stating that:

"In Vietnam, establishing relationship means you have done 90% of the work. Things should start flowing smoothly." (Int. 2D-2)

"We [the academic staff and the external stakeholders] have already know each other, it's just the matter of using this acquaintance to enhance ESD activities." (Int. 3D-2)

Some specific suggestions for external cooperation being captured in the group discussions (FG4, FG5, FG6) and various interviews (for example, Int. 1A-2, Int. 3A-2, Int. 3C-2, Int. 3D-2, Int. 2E-3, Int. 2D-2) include:

- Academic staff members utilise their connection with industries and NGOs to provide students with real life examples and hand-on experiences related to sustainable development.
- Managers of the different engineering universities seek opportunities for joint-training course for academic staff in ESD
- Both institutional managers and academic staff encourage external participation in teaching activities on sustainable development topics (i.e. guest-lectures, seminars, workshops, etc.)
- Institutional managers negotiate and request further support from the education authorities in matters related to ESD (i.e. training, provision of resource).

7.2.3. Implementation in engineering curriculum for sustainable development

Key findings	
What are the issues?	*Why the issues?*
- The ability of the academic staff in delivering ESD tasks	- Ineffective professional support for ESD
	- Lack of a mechanism to motivate staff in ESD
- The attitude of the academic staff in delivering ESD tasks	- Lack of innovation in engineering curriculum for sustainable development
- Pedagogical approach in ESD	- Ineffective or lack of mechanism for quality assurance and control

- *What are the issues?*

The research identified several issues concerning the implementation of actions and activities aimed at engineering curriculum for sustainable development at the three case studies. The data suggested that these issues were concerned with:

- The ability of the academic staff in delivering ESD tasks, especially the young lecturers:

> "One or two of them are very good. But most of the young ones still lack the knowledge and skills required." (Int. 3D-1)

> "I personally think that the task is overwhelming for her [the lecturer who is in charge of teaching sustainable development]" (Int. 3C-1)

> "We'd rather stick to our old topics and materials. It's not easy to, in one day, tell us to change. It's not easy just like that. Not all of us know how to do it!" (Int. 2E-1)

- The attitude of the academic staff in delivering ESD tasks:

> "Young lecturers are becoming very lazy." (Int. 3A-1)

> "The staff I work with never shows eagerness." (Int. 1A-1)

> "Why do we have to spend that much effort, honestly?" (FG2)

- The pedagogical approach in ESD:

> "Sometimes they use PowerPoint presentations, but it's quite rare." (Int. 3C-1)

> "[we use]... the conventional way [of lecturing with blackboard]" (Int. 1D-1, Int. 2B-1)

> "I am so unhappy to see young lecturers not even provide examples in their lectures." (Int. 3D-1)

- *Why the issues and how to improve?*

a) Ineffective professional support for ESD

The research identifies that the current professional support services associated with ESD take form of one-on-one mentoring sessions for young staff. In case study one, the setting for this support is more informal, as described by the informants:

"one guru professor was assigned by the management board to be the mentor for one or more young staff. But only first few meetings were formally set up, the subsequent ones were upon request of young staff." (Int. 1D-1)

"we only meet when they [the young staff] need help."(Int. 1B-1)

In case studies two and three, the data obtained reveals a more formal mentoring scheme. Similar to case one, this includes an experienced professional being in charge of mentoring young staff in ESD. However, the meetings are organised on a regular basis (FG2, FG3). Whilst this is acknowledged by some informants as a privilege only enjoyed in larger institutions (for example, Int. 1B-1, Int. 3A-1, Int. 2C-1), interpretations of the data recognise certain issues which hamper the effectiveness of this current form of professional support in the participant universities.

In the eyes of the mentors, the relationship was seen as being built on dependence and not partnership foundation. Young staff relies on the mentor and become passive. Some informants who are mentors at the institutions complained during the interviews:

"Young lecturers are becoming very lazy. They came into the session expecting to be given the teaching materials to use straight away." (Int. 3A-1)

"They [the young staff] thought that the sessions are for us [the mentors] to tell them exactly what to do and even show them how to do it." (Int. 3C-1)

"I felt that this is a complete waste of time. I think they only come for the materials. I'd rather send my teaching materials to them via email!" (Int. 1A-1).

Interviews with the young staff indicate that they did not find the individual mentorship meaningful either. Informants pointed out the critical constraining factors which include the atmosphere, the mode of interaction between the mentor and mentee, and the content of the mentoring sessions. One informant described the atmosphere of the sessions as "uncomfortable" (Int. 3E-1) whilst another said:

"it [the mentoring session] brings an uneasy, a little bit tense feeling." (Int. 1D-1)

During groups discussions, the participants deliberated on the interaction mode in use during the sessions and acknowledged a pervasive one-way, directive style of communication from the

mentor towards the mentees. For example, one participant who was a young lecturer shared her/his view:

> "I was more often being told than being asked." (FG2)

There were also suggestions that the mentoring sessions tend to focus on the details of the teaching materials whilst the young staff needed more guidance on:

> "the general approach to teaching, the "how to" and not too much of the "what"…" (FG3)

How to improve?

In education literature, interactive pedagogy is being viewed as a tool for students to learn ways of thinking and learning that enable them to discover knowledge independently and to deal with professional challenges in their own circumstances (Reyhner, Gilbert, & Lockard, 2001). In the literature of ESD, it is advocated that realities of ESD are constructed and its vision built and shared by people involved in the ESD process and programmes (which include but not limited to staff and students) through dialogue, participation and critical reflection (Tilbury & Wortman, 2004). This value is typically called "collaborative learning" and is a central value in the ESD literature (Huckle & Sterling, 1996; Fien, 1993; Tilbury, 2004).

Deliberations from focus groups has recognised a more appropriate way for professional development for ESD in Vietnamese engineering universities which aligns to the above view in the literature. The data suggests that instead of individual mentoring, professional support in ESD should be provided on a group basis which is underpinned by interaction and collaboration.

The underlying value that supports this proposal, as identified by informants, is the strong attachment to groups of Vietnamese people. The proposal is further enhanced by an understanding of the Vietnamese attitude that people at a lower rank in a hierarchy, when being together, might be able to challenge or break the barrier of authority. A group-based training, according to the participants, provides various positive outcomes:

- *It helps to avoid the uncomfortable feeling of being in front of teacher on individual basis.*

For example, one informant shared her view:

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"It would be much more comfortable when it's not you who has to face the teacher alone... but with other friends around. You know there are people on the same boat with you[108]." (Int. 3B-2)

- *The interpretations indicate that such forms of training increase the chance of trainees asking questions and seeking clarification.*

"Being in a group with the same level of understanding will help overcome the shyness." (FG4)

"If I were alone with my mentor and had ten questions, I would ask two questions. Hopefully when there are more people and we take turn to ask, we have the answers for all ten." (Int. 2B-2)

- *The research captures a possibility that group-training encourages young staff to be more critical.*

For example, some informants' quotes proved this:

"It's more likely that young staff become more daring to challenge the information being given, especially when they feel they are backed by others." (FG5)

"Discussions are real chances for them [young academic staff] to be more critical. We don't have those chances often here." (FG4)

- *Informants also considered group-training:*

"... an additional chance for ESD communication." (FG5, FG6)

- *There were suggestions that ESD trainers could also play a key role in the feedback channel in ESD (FG6)*

With regard to the organisation of the training activities, the data being collated revealed various suggestions from the informants on the possibilities for inter-department and inter-institution cooperation. For example, one informant pointed out that:

"Training for academic staff on ESD could be provided for a number of departments or faculties in the institution instead of a single-unit basis." (Int. 3A2-2)

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[108] The informant used the Vietnamese term "cùng hội cùng thuyền" which is translated into English as "in the same group, on the same boat" (translation made by the researcher)

Other informants highlighted the fact that counterparts in different engineering universities in Vietnam normally had good relationship with each other and thus:

"Institutions could cooperate in ESD training, holding joint-classes for staff." (FG5)

It was emphasised, however, that further consideration over these options will be needed when the actual planning processes start:

"... to evaluate the best ways to do it based on the actual context and circumstance." (FG5, FG6)

b) Lack of a mechanism to motivate staff in ESD

The data collated from the interviews with informants reports a strong view over the current low level of motivation for ESD among staff members at the three case studies. According to Doppelt (2003b), people are the most important resource of any organisation, and an organisation's system of rewards is a key lever for change towards sustainable development. Whilst the research found no specific arrangements in place to enhance motivation for ESD either in terms of rewards or in terms of promotion, it acknowledged the current situation in the three case studies in which ESD was one area under consideration in the general institutional reward schemes. However, individual interviews as well as group deliberations revealed that the participants did not consider the current reward scheme as a meaningful source of motivation, especially with regard to ESD. *Table 27* below captures the issues identified by the informants as the factors causing the failure of the current motivation system.

Issues	As explained by the informants...
Lack of fair assessment	"I don't trust this prize thing. We already know who will be given the award." (Int. 2E-2) "It's normally about who you are, not how you do, I'm afraid" (Int. 1D-1) "If you have a good relationship, you behave like a good girl, you get along well with the boss, then you are named!" (Int. 3B-1)
Poor materialistic	Materialistic award was viewed as "not worth it" (Int. 1A-1, Int. 3C-1)

award	A participant in a group discussion bitterly said: "if only for the prize, I would spend that time moonlighting instead" (FG3)
Lack of acknowledgement	"The awards are announced every year at the year-end meetings but that's all about it. No further acknowledgement to the public or wider staff force." (Int. 1C-1) "I was told by my boss that I get the award one year. And that was all I could remember. I can't even recall them giving me the envelop[109] or not." (Int. 3A-2)

Table 27. Issues with the current reward scheme at the participant universities

Another issue of motivation identified at the participating universities was the lack of financial incentive for working and improvement due to poor remuneration and working conditions. The remark below attributed to a top manager in one case study and made during an interview substantiate the lack of financial incentive as a constraint to motivation of staff in Vietnamese universities:

> "The current salary of the academic staff in far below the figure believed to satisfy even basic needs for living. It might sound ridiculous but it's how it is in Vietnam, I would say, not even at our university but everywhere. That's why we [the managers] even though are not happy with the working attitude and motivation of the young staff, have to accept that they [the young staff] spend their time and effort and passion doing something else apart from their main job to earn money for living." (Int. 3C-1)

This research found several similar quotes made by informants from all three case studies in support of this assertion. Research on higher education in Vietnam also reports this issue as a common challenge being faced by Vietnamese institutions (Harman, Hayden, & Pham, 2010). With regard to ESD activities, the informants of this study acknowledged work ethics and personal sources of motivation as the primary drive for maintaining and improving performance.

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[109] The informant implied "money" when she said "envelop". This is a metaphor widely used in Vietnam since the money (in cash) is usually put in an envelope when being given to the receivers. (Explanation by the researcher)

How to improve?

Interpretations gained through the research activities including group discussions, interviews and observations suggest two main ways for improving the motivation of staff in ESD.

First, awarding champion in ESD effort and publicly acknowledging it to peers and students will motivate and also create positive pressure to staff to maintain the quality in ESD. This finding was underpinned by the culturally based value and attitude of the Vietnamese academic staff which value the self's image and public appreciation over materialistic reward.

Second, from the interpretations and discussions of informants, having an example of ESD is valuable to motivate staff as it provides the "how"; gives a sense of "we can do it" and "it is not that complicated"; and promotes the feeling "they can do it, then I can do even better" (FG4, FG5, FG6). This example for ESD, according to the informants, could be either a key lecturer who is ESD champion at the institutions, or a show-lecture which adopts an innovative approach to teaching.

c) Lack of innovation in engineering curriculum for sustainable development

In the literature of sustainable development in general and ESD in particular, there is a premium placed on change towards a new a paradigm as opposed to status-quo (Sterling, 1996; Huckle & Sterling, 1996; Tilbury, 2004; Corcoran & Wals, 2004). This value, which is usually referred to as change for sustainable development or transformation towards sustainable development in the literature, is one of the fundamental dimensions of the sustainable development and ESD philosophies. A specific dimension of the change mentality called for in ESD is the belief that curricula for ESD could and should be changed through innovation within the existing system and not by simply adding additional content (Tilbury, 2010; Sterling, 2004a). Curriculum change for ESD could be achieved by embedding the principles of ESD in the existing content and innovating the teaching methods which support necessary skills for sustainable development at all levels and across all the programmes of study offered in educational institutions (see sections 2.4.1, 3.2.2 and 3.4).

The issues concerning a lack of innovation in teaching ESD at the three participant universities were identified by the informants both in terms of content and in terms of teaching method.

Interview data acknowledged that the current teaching material on the topic of sustainable development was:

> "... kind of boring with a collection of definitions and lists of international and national agreements." (Int. 2E-1)

> "... very abstract and distant to the other parts of the lecture series." (Int. 1A-1)

> "based on old references and used every year without any changes." (Int. 3A-1)

Regarding embedding sustainable development in the curriculum beyond concept introduction, the participants, during group discussions, deliberated and emphasised further the issue of innovation. For example, some exchanges included:

> 3D: "We used the teaching materials with content being very much influenced by international experiences and did not relate much to our day-to-day practices."

> 3E: "I agree, I think some of the examples are not even relevant to engineering. Some lecturers are too lazy to look for them."

> 3A: "I don't think it's lazy... well, ok, maybe it's partly lazy, but partly because they didn't think creatively enough to adapt those templates into something more suitable." (FG2)

Not only the content, the current pedagogical approach in ESD in the case studies was considered by the informants as lacking innovation and not suitable for ESD. The use of lecturing as the main teaching method follows the prevailing pedagogical approach in Vietnamese higher education which has been widely acknowledged in the literature as conservative and outdated (Pham T. N., 2010; Lam, 2009). Whilst some informants mentioned the use of examples in teaching sustainable development as one indicator of the lecturer's innovation in teaching, one informant suggested that this is not happening in every case:

> "I am so unhappy to see young lecturers not even provide examples in their lectures." (Int. 3D-1)

The research informants, however, highlighted that there were cases in which experienced key lecturers attempted innovative ways to embed sustainable development in their teaching even though not on a regular and systemic basis. For example, some informants shared their experiences:

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"When possible, I used the real-life business projects that I was involved as a consultant to illustrate the key principles of sustainable development. For example, when teaching about planning in construction, I referred to my project with [name of the company] to teach the students how we took into consideration the surrounding community, the environmental issues and requirements, and the choice of materials which are more friendly to the environment and also cost-effective." (Int. 3A-1)

"using the real data of my current project, I asked the students to come up with different scenarios for solving problems. They, in groups, had to present and convinced why the developers should choose their solution packages." (Int. 1A-1)

How to improve?

Throughout the research process, the importance of having examples to follow was raised by a number of informants. For example, one informant suggested:

"we need a guru figure in ESD, an exemplar model that people can take after when they seek innovative teaching." (Int. 2A-2)

Another informant, on the other hand, proposed that:

"the manager organises a show-lecture carried out by an experienced lecturer to give an example for young staff of how it should be done." (Int. 3B-3)

The informants emphasised that, such examples were not for the academic individuals to copy, but rather to use as a benchmark against which to adapt and improve their own work (FG4, FG6).

d) Ineffective or lack of mechanism for quality assurance

The case study research confirmed the finding of the survey regarding teaching about sustainable development in the engineering universities. The lecturers developed a structure for the teaching material based on a general frame provided by MOET and sought formal approval from the management board. Once being approved, they had full autonomy and were responsible for the content and teaching methods (see section 6.2.4). According to the informants, quality assurance in ESD in the participant engineering universities, like all other programmes in these institutions, was not well developed. An analysis of the data suggests that assurance of academic standards and quality of ESD in the curriculum were matters that were

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left largely in the hands of individual academics. In general, there were currently no formal and continuous processes for monitoring the quality of the teaching performance of individual members of staff. Literature on Vietnamese higher education suggested that this was a common issue in many institutions and across many programmes of different disciplines (Dang, 2009; Harman, Hayden, & Pham, 2010).

According to the informants, the principal barrier to quality control in ESD was the lack of a basic evaluation scheme for monitoring and assessment of academic staff's sustainable development teaching activities (for example, Int. 3A-1, Int. 1A-1, Int. 2D-1, Int. 3D-1). At the three case studies, the research recognised that direct observation had been used as the only method for quality assurance in ESD. The informants, however, considered this widely used technique of observation and evaluation of lectures unnecessary and counter-productive. During a group discussion, a comment was captured:

> "For me, the idea of knowing that someone will be watching and get prepared for it is... how can I say, tantamount to cheating. Of course you will try to perform much better than you would normally do. It won't help" (FG3).

This remark was supported by other participants who agreed that:

> "...a prepared show-performance is very likely an inaccurate reflection of true performance." (FG3)

There were also suggestions that observation that happened only once in a while did not result in any positive and sustainable changes:

> "Things will go back to normal after the observation sessions." (FG1)

Furthermore, from the lecture observer's point of view, as some informants expressed during interviews, this technique did not help in improving the situation. According to one of these informants, the observer as the judge was put in the position where he or she knew that his or her comments would affect the lecturer and thus:

> "we ended up not giving much criticism to save face for the lecturer." (Int. 2C-2)

Another informant shared the similar sentiment:

"Because I know that the comments will be taken personally and not as constructive critiques... and also, you know, the problems won't be dealt with properly... because of the system... Of course I am still giving suggestions for improvement, but I would not be as critical as I should. I don't want the lecturer to lose face." (Int. 3A-1)

When discussing the issues related to quality assurance, the most common method being used at the participant universities was identified by the informants as requirement and direction from the management board. This command style for quality assurance, however, was considered a barrier to, rather than driver for ESD. For example, some extracts from a group discussion include:

"Directions made people feel obliged so they would do something for form's sake, and not necessarily pay enough attention and effort." (FG3)

"Everyone will ensure basic standards but general commands are unlikely to encourage innovative teaching method and content." (FG1)

The lack of an evaluation scheme, however, was identified by the informants as mostly due to the current Vietnamese contextual factors. For example, when explaining to the researcher that there was currently no student feedback mechanism at the institution, one informant shared the reason:

"Currently we are not at all demand-sensitive, we are always running out of spaces for students every year. Student satisfaction is not the greatest concern" (Int. 3D-1)

The informants criticised the current attitude of the institutions' managers being "*why do we have to do when no one is doing?*" but acknowledged that the fundamental reasons for this lack of quality assurance and control which include structural and financial constraints were out-of-control and out-of-capacity of the institutions (Int. 3D-1, Int. 1A-1, Int. 2A-2).

How to improve?

During group discussions and the researcher's individual interactions with the informants, a key message recognised was that it was not feasible to propose any radical changes in quality assurance in the participating universities. Some informants who were managers suggested that this was the case of the majority of universities in Vietnam, and that the current structural and financial context were the main constraints to the desired changes (Int. 3D-1, Int. 1A-1, Int. 2A-2,

Int. 3C-1). A review of research on issues concerning quality in higher education in Vietnam also confirmed this assertion, viewing quality as the one of the most challenging areas in the recent Vietnamese higher education reforms (Harman, Hayden, & Pham, 2010; Dang, 2009).

The research, however, recognised several ways for improving quality assurance with regards to teaching ESD in the participating universities. In general, the participants strongly recommended the use of carrot rather than a stick as a means of addressing quality issues. Particularly, these measures built from the assumptions similar to the measures aimed at increasing motivation: "making people feel good about doing good things", and "letting people know how to do good things". On one hand, the informants emphasised on how they believe encouragement works better in Vietnam. The fundamental point which supports this belief is that, as informants explained, even when there was mechanism to punish, it ended up not effective:

> "... because no one really gets punished anyway." (Int. 3A-2, Int. 1A-2, Int. 1C-2, Int. 2C-2, Int. 2E-3)

One informant illustrated this remark by quoting an old Vietnamese saying[110] which means:

> "pretend to strike hard but only hit slightly." (Int. 3C-2)

On the other hand, the study revealed that there is currently no feasible ways to control the quality through a formal mechanism. To illustrate this remark, the informants gave examples of how common evaluation schemes being used in other countries do not fit with the Vietnamese circumstances and culture. For example, during a group discussion at one institution, the participants deliberated on the potential of student's evaluation in ESD as a mechanism for quality assurance and concluded that at the moment, it would not be effective. The participants explained this as:

> 2E: "It's about culture, Vietnamese is not used to be critical of others. The students were not taught to be critical. The feedback might be inaccurate. I am not generalising, I am just saying that it's not there, the awareness, the attitude, the culture."

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[110] The original saying in Vietnamese is "Giơ cao đánh khẽ" (translated by the researcher)

2A: "I agree. There were cases when the university tried a pilot for it, and it failed. Some students gave good feedbacks for the ones who were easy to them, not recording their absence, giving them good marks, and not necessarily the ones who delivered good lecturers. " (FG6)

Another informant from a different institution also shared the same view:

"... because we haven't got the culture of feedback and assessment for students. There is no institution-wide system in place and students are not used to this. They do not have the right attitude towards it." (Int. 3D-2)

To account for the lack of a systematic, objective and enforceable system for quality control, the interpretations suggested that under the current circumstances of the universities, quality assurance should focus on building motivation for academic staff and providing opportunities and resources for professional development with regard to ESD.

So far, the chapter has presented the findings from the research stage two including the issues and the possibilities for change towards engineering curriculum for sustainable development in Vietnamese universities. Another key aim of stage two is to understand the cultural influences existed in Vietnamese universities in order to develop strategies for change that are culturally appropriate and most relevant to the Vietnamese context. The following section seeks to address this aim through: (i) identifying the cultural characteristics that exist in Vietnamese engineering universities and (ii) mapping the influence of these cultural characteristics on the issues and opportunities for engineering curriculum for sustainable development.

7.3. UNDERSTANDING THE CULTURAL INFLUENCES

This study of Vietnamese engineering universities with the goal of building culturally appropriate strategies assumed that an understanding of the Vietnamese cultural factors existed at the institutions which influence the change effort is crucial when designing strategies for change. This is based on the assertion that strategies for change including in the context of ESD cannot succeed without being built with an appropriate consideration of the beliefs, values and practices which constitute the culture of the targeted groups (Dimmock & Walker, 2000a; Marin, 1993; Corcoran, Walker, & Wals, 2004). This section provides data on the cultural influences over the transformation of engineering curriculum for sustainable development in Vietnam. It aims to critically review the cultural factors associated with change effort to embed sustainable development in the curriculum in Vietnamese engineering universities (see section 1.3.1).

The cultural theory proposed by cognitive anthropology namely Goodenough's framework view culture as a set of standards which guide values, attitude and behaviour of the members of a social group. This definition of culture was used in this study to provide theoretical lens for interpreting data (see section 4.3.3). It assisted in realising the cultural characteristics revealed by informants through research activities with regard to the various issues identified in the previous section. In seeking to provide deeper understanding of the culturally based values, attitudes and behaviours, this section also draws on the wider literature for insights into the cultural influences. Authors following a grounded approach to research suggest that comparing and contrasting the emergent concepts and constructs with the literature helps to enhance the internal validity of the findings (Eisenhardt, 1989) (see also section 4.4.1). It is for this advice that the emerged concepts and constructs are interpreted within the frameworks widely used for conceptual analysis of cultural dimensions, as well as compared and contrasted against findings of other relevant empirical studies in the literature.

7.3.1. Drawing on the wider literature for understanding the cultural influences

Social science research has clearly shown that cultures differ across a number of dimensions (Hofstede, 2001; Trompenaars & Hampden-Turner, 1997; Detert, Schroeder, & Mauriel, 2000; Griswold, 2008; Doney, Cannon, & Mullen, 1998). Such recognition of cultural differences has led to the argument that change strategies need to reflect what is central to the targeted group's cultural characteristics. Failure to do so might hamper or lead to failure of the change effort (see section 1.3.2).

Over the last few decades, researchers have taken different approaches to uncover universal dimensions of societal culture, among which the most influential of cultural classifications is, perhaps, that of Geert Hofstede[111] whose work has been "inspiring thousands of empirical studies" and more widely cited than any others (Kirkman, Lowe, & Gibson, 2006). Hofstede (1980) suggests four dimensions of culture difference between nations, and clusters societal cultures according to whether they are high or low on each of these dimensions which he labels

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[111] Hofstede's framework was developed using data from over 116,000 morale surveys from over 88,000 employees from 72 countries (reduce to 40 countries that had more than 50 responses each) in 20 languages at IBM between 1967 and 1969 and again between 1971 and 1973. He later expanded the database with 10 additional countries and three regions (i.e. Arab countries and East and West Africa) (Hofstede, 1980; Hofstede & Bond, 1988).

as: power distance, uncertainty avoidance, individualism-collectivism and masculinity-femininity. Later work revealed a fifth dimension which has been labelled Confucian dynamism (Hofstede & Bond, 1988) and relates to the cultural preference for long or short term orientation in life and the Eastern preference for "virtue" compared with the Western search for "truth". Trompenaars (1993, p. 8), and later on together with Hampden-Turner (Trompenaars & Hampden-Turner, 1997) from a large-scale survey[112] deduce that "every culture distinguishes itself from others by the specific solutions it chooses to certain problems", and that these problems can be classified into seven dimensions within three categories: relationships with people, attitudes to time, and attitudes to the environment. In the specific area of educational management, Dimmock and Walker (2000b) propose a cultural framework which according to the authors, helps facilitate cultural sensitivity when policy, theory and practice are transported between education systems. Their framework[113] consists of six dimensions including Power concentrated/power dispersed, Group-oriented/self-oriented, Aggression/consideration, fatalistic/proactive, generative/replicative and limited relationship/holistic relationship.

Seeking to understand the cultural influences over the issues associated with embedding sustainable development in the engineering curriculum at the participant universities, beside a grounded approach to analysis, the study draws on these widely used conceptual frameworks of cultural dimensions offered in the literature to interpret the findings. At the same time, the study also compares and contrasts the findings with other empirical studies in the extant literature to provide further verification of the cultural influences identified at the Vietnamese institutions.

7.3.2. Identifying the cultural characteristics that exist in the Vietnamese engineering universities

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[112] His survey uses a database of 15,000 questionnaire responses from 30 companies spanning 50 different countries (Trompenaars, 1993).
[113] Even though defining cultural dimensions as "core axes around which significant sets of values, beliefs and practices cluster", the authors, in agreement with Hofstede's cautionary remarks, note that the proposed framework's dimensions, whilst being tools for analysis, are also constructs that should not be reified (Dimmock & Walker, 2000b, p. 308).

Cultural Characteristics	Description	Evidence from the data	Theoretical terms or similar research in the literature
Hierarchy	This cultural value was found as a very strong characteristic in the case study universities. It reflected the centralism culture in decision making, and a command and control culture in management.

This characteristic appeared at different levels: Between the governmental authorities (MOET) and the university management board; and between the university managers and the academic staff | "Historically, university 1 [name of the university] has been under the full control of the ministry of industry. Now it is under the ministry of education and training. It has been so used to being controlled from the top reflecting a command and control ways of doing things. Everything is tightly designed from the top that even when we want to include something else, there is no more time or resources". (Int. 1A-1)

An informant who is a line-manager admitted during a group discussion that in his/her communication with top-managers:

"there is always an uncomfortable, unreasonable tense even when we are on very good terms" (FG1, remark by informant 1B)

A young staff, during a conversation with the | In the literature, these characteristics are widely acknowledged as dominant in the cultures where emphasis is on vertical hierarchy and formal power (Hofstede, Neuijen, Ohayv, & Sanders, 1990; Trompenaars & Hampden-Turner, 1997; Handy, 1986).

More specifically, this strong culture of centralism in decision-making in higher education in Vietnam has been acknowledged in the literature (Hayden & Lam, 2010). |

Cultural Characteristics	Description	Evidence from the data	Theoretical terms or similar research in the literature
		researcher, also revealed: "it's difficult to talk to the boss here... very difficult." (Int. 3B-1)	
Authority	This value includes the underlying beliefs that the top authority should always appear to hold the absolute knowledge and acceptance is the norm for the people at the lower level in the hierarchy. This value appears in both the relationship between the managers and the employees; and between the experience academic staff (i.e. mentors) and the young academic staff.	"it's because we are used to take what is given, especially when it's given by your boss." (Int. 2E-2) "nothing will work unless our boss is determined to work towards it and shows strong support." (FG6)	The participant universities are, as identified earlier, still influenced by the Soviet culture in which institutions are driven primarily by a tight form of authoritarian control wielded from the top (May, Puffer, & McCarthy, 2005). This finding fits into the literature of Vietnamese culture which is characterised as being influenced by the principles of Confucius (Hữu Ngọc, 1998). Vietnam belongs to the Confucian culture zone, which is dominated by values that contrast with the self-expression and secular-rational values of the West (Inglehart, 1997) and by the strong hierarchy in social relationships in Vietnamese academic society (Leung, 2010; Pham T. N., 2010)

Cultural Characteristics	Description	Evidence from the data	Theoretical terms or similar research in the literature
			This value echos Hofstede's definition of high "power distance" culture (Hofstede, 1991).
Dependence attitude	This attitude appears at different levels: University and department's managers tends to depend on the governmental authorities in strategic issues concerning ESD; Young academic staff tended to depend on the experienced academic professionals in implementation of ESD activities	"I have the feeling that our managers tend to wait for strategic direction from the ministry..." (Int. 3A-1)

"The young staff ended up waiting for the mentor to help them in everything. That's easier. No need to think or do anything." (FG2) | At strategic level, literature suggests that this observed tendency of waiting for direction from the top authority prevails in Vietnamese higher education institutions and has its origins in the Soviet legacy, which constrained institution's managers' capabilities for vision and strategy formulation (Pham T. N., 2010).

Other studies on planning processes under the Soviet culture further supports this view as they recognise that strategic content is very often completely disconnected from the strategic process, with managers being made dependent since they only receive plans from central administration rather than being involved in the strategy formulation process (May, Puffer, & McCarthy, |

Cultural Characteristics	Description	Evidence from the data	Theoretical terms or similar research in the literature
			2005).
Value of self's image	The academic staff highly valued their images in the eyes of peers and students. They also cared much about saving face and keep their names. This characteristic was found being very important to the persons at high level positions in management or in academic rank.	"In front of a lot of people, it's likely that you will play safe. You didn't want to be wrong or seen as making mistakes." (Int. 3B-2) "You just have to try your best to maintain your reputation." (Int. 3A-2) "I am always doing the best I can. In all the jobs. Everyone in this small community knows who I am." (Int. 3C-2)	These interpretations reflected the basic belief underlying collectivism which is achieving professional excellence is more than a personal matter and the motives to achieve involve fulfilling obligations to oneself as well as to the social group (i.e. the institution) and society to which one belongs (Leung, 2010). This strong moral undertone makes professional achievement a virtuous pursuit and public appreciation an invaluable reward. It also helps to explain the undermining attitude towards materialistic reward as necessary conditions for fulfilling the tasks with quality. This value is being strongly influenced by the principles of Confucius (Hữu Ngọc, 1998)

Cultural Characteristics	Description	Evidence from the data	Theoretical terms or similar research in the literature
Relationship	This value concerns the orientation towards wider group of the Vietnamese academic individuals. The informants revealed that at their institutions, the ties between people are tight, relationships are firmly structured and individual needs are subservient to collective needs. These important collectivist values include harmony, criticism avoidance, saving face.

In communication, this value is characterised by the desire for | "When you are in the group, it's the norm that you agree with people..." (Int. 1D-2)

"... of course you have to think about others..." (FG3)

"I don't want to be seen standing out from the crowd." (FG4)

An informant, during a group discussion, referred to a Vietnamese idiom[114] which means "when you are in the same group, you don't criticise each other" (FG3)

"I would talk to him or her in person instead. I don't want him or her to lose face in front of | This value is labelled in the literature as communitarianism (Trompenaars & Hampden-Turner, 1997), collectivism (Hofstede, 1991) or group-oriented (Dimmock & Walker, 2000a) and is viewed as common for Vietnamese people (Trần T., 2006) as well as other Asian societies influenced by the moral principles of Confucius (Leung, 2010).

The findings related to this cultural characteristic fit into the literature which acknowledges that the ideal affective state for Asian people including Vietnamese is low-arousal positive states (Trần V., 2000; Ji, Lee, & Guo, 2010). This value, as advocated in cultural research, is linked to Buddhist beliefs which emphasise on relationship, solidarity and resolution of conflicts by compromise and |

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[114] The original idiom in Vietnamese is "Gà cùng một mẹ chớ hoài đá nhau" which could be translated verbatim as "chickens which share the same mother hen should not fight with each other" (translation by the researcher)

Cultural Characteristics	Description	Evidence from the data	Theoretical terms or similar research in the literature
	calm and peaceful atmosphere and the tendency of thinking about saving face for others. This value also emphasises looking at the whole picture to examine the situation carefully and inspect the opinions and interests of other people from different perspectives. Actions are only taken after such contemplations, and thus, might not reflect the original intentions or match with the expectations.	everyone." (Int. 2A-1) "at this institution, we are very close. It gets difficult raising issues which concern others." (FG4)	negotiation instead of assertiveness, selling oneself and decisiveness (Leung, 2010). Such approach is viewed as to facilitate a reasonable resolution, usually by taking "the middle way" through cooperative and compromise strategies in resolving issues or interpersonal conflicts (Ji, Lee, & Guo, 2010; Trần, 2006). In the literature, culture underpinned by this value is also characterised as consideration instead of aggressiveness (Dimmock & Walker, 2000a); or femininity over masculinity (Hofstede, 1991).
Internal orientation	The data being collated revealed that the Vietnamese institutions under study tend to assume an internal orientation in contrast	"there is somehow a "we know best" attitude when it comes to communication with business people." (Int. 3A-2)	This value is characterised in the literature as a normative approach in which a social group assumes that internal experts are the ones who know what a change agenda or improvement over

Cultural Characteristics	Description	Evidence from the data	Theoretical terms or similar research in the literature
	to being controlled by external environment especially in the relationship with stakeholders from the business group.	"It was probably because we are used to being in closed systems with no mechanism for external communication. We were taught that we are the best when it comes to our jobs, and that no one should tell us what to do." (FG4)	existing conditions would look like, and expects stakeholders to fit with the agenda rather than moulding the agenda to meet the needs of others (Detert, Schroeder, & Mauriel, 2000).

The interpretation aligned to the findings that the Soviet patronage and closed systems tend to value internal knowledge over external opinions, and bureaucratically follow pre-determined agendas and imposed strategies (Pham T. N., 2010; May, Puffer, & McCarthy, 2005; Bain, 2007). |
| **Uncertainty avoidance** | The underlying characteristics of this cultural value include problem avoidance and fear of being wrong. | "of course people only talk about good things and don't mention bad things or weak points because they don't want to identify problems that they might not be able to solve." (FG4)

"the managers wouldn't like it if there are problems that they can't control." (Int. 2E-2) | This value is characterised in the literature as uncertainty avoidance (Hofstede, 1991) or fatalism (Dimmock & Walker, 2000a). In fatalistic cultures, according to these authors, people seek to reduce uncertainty and limit risks by hanging on to tradition or avoiding initiating actions to prevent problems.

It is also confirmed in other studies on the cultural |

Cultural Characteristics	Description	Evidence from the data	Theoretical terms or similar research in the literature
		During an interview, one informant quoted a Vietnamese idiom[115] which means "you never initiate to show people your bad points or your mistakes". (Int. 3D-1) "It's the norm that the meetings go on smoothly. If there is a big dispute or problem, it will be solved in privacy which only involves the relevant ones." (Int. 1B-2) "They did not want to take the risk of being wrong." (Int. 2C-1)	influences of the Soviet management system (May, Puffer, & McCarthy, 2005; Trần V. , 2000). Research in the literature acknowledges that Soviet influenced systems do not normally promote active engagement in or encouraging actions towards solutions (Michailova, 2000; McCarthy, Puffer, & Shekshnia, 2004). When people are not confident about their knowledge and skills, they tend to avoid attention and avoid responsibilities as they worry about not being able to fulfil the tasks (Puffer, 1981; Hollinhead & Michailova, 2001).
Replicative	Interpretations of the data pointed at the inclination to replicate instead of generate	"the academic staff didn't care about finding the best ways but chose to follow the popular ways …" (FG5, FG6)	In the literature, this value is labelled "replicative" and is characterised as the tendency to adopt innovations, ideas and inventions developed

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[115] The original quote in Vietnamese was "chớ vạch áo cho người xem lưng" which could be translated verbatim as "don't take off your top and show your back to others" (translation by the researcher)

Cultural Characteristics	Description	Evidence from the data	Theoretical terms or similar research in the literature
	among Vietnamese academic staff in ESD activities.	"they [young academic staff] only want to be given the ready-made materials and even, being taught how to teach the students..." (Int. 3C-2)	elsewhere than to seek original solutions, policies and ways of operating (Dimmock & Walker, 2000a).

Research in the area of higher education argued that this attitude was strongly influenced and strengthened by the old Soviet system which resulted in excessive conservatism and adherence to outdated pedagogical practices and discouraged innovation (Harman, Hayden, & Pham, 2010) |

7.3.3. Mapping the influence of the cultural characteristics on the issues and opportunities for engineering curriculum for sustainable development

Building on the cultural characteristics identified in the last section, this section aims to examine how these characteristics influenced the specific issues and possibilities for change to engineering curriculum for sustainable development in Vietnamese universities. *Table 28* identifies the key cultural characteristics and the level of influence on each area of issues/possibilities. The section follows by a more detailed explanation of these influences.

Issues/ Opportunities	Cultural characteristics								Level of influence
	Hierarchy	*Authority*	*Dependence attitude*	*Value of self's image*	*Relationship*	*Internal orientation*	*Uncertainty avoidance*	*Replicative*	
Resources for learning about ESD				x				x	Low
Vision for ESD	x		x						Medium
Forum for communication of ESD		x			x		x		High
Structure for communication of ESD	x						x		High
Cooperation for ESD						x		x	Low
Professional support		x	x				x	x	High
Motivation in ESD				x					High
Engineering curriculum innovation		x	x					x	Medium

Issues/ Opportunities	Cultural characteristics								Level of influence
	Hierarchy	*Authority*	*Dependence attitude*	*Value of self's image*	*Relationship*	*Internal orientation*	*Uncertainty avoidance*	*Replicative*	
Quality assurance and control					x		x		High

Table 28. Cultural influence on engineering curriculum for sustainable development in Vietnamese universities

a) Resources for learning about ESD:

Whilst the lack of resources for learning about ESD was identified by informants as more of a contextual issue and not a cultural issue, developing user-friendly resources for ESD in engineering universities was interpreted through the data as matching with the culturally based attitude of the Vietnamese academics. During group discussions, the participants deliberated on the value of a good resource for learning about ESD, emphasising that:

> " it's appropriate because the staff will feel in control of their own learning and do not have to worry about losing face as they seek knowledge. They don't have to ask for help from anyone." (FG4)

> "it's better that the academic individuals do not think they are being forced, but they are being given the choice. I think it's a very good motivation." (FG5)

Resources for ESD was also viewed by the informants as a valuable provision for academic staff to develop their own teaching materials which is appropriate and tailor-made to their own needs, solving the problem of copying and using old materials from elsewhere (as identified in section 6.2.4).

b) Vision and action plan for ESD:

Besides the lack of ESD understanding, the passiveness of management board in Vietnamese universities was believed to be a factor contributing to the lack of vision for ESD. The informants

interpreted the passiveness of the managers in Vietnamese universities as a legacy of the Soviet culture of centralism (Int. 1A-1, Int. 3D-1, FG1, FG2). One participant, for example, reflected during the group discussion:

> "The manager in Vietnamese universities are so used to being told by MOET. The fact is that with our current administration structure, managers are not given much space to be active or pro-active. Ever since the establishment of the university under the Soviet system, top-down control has always been the case." (FG2)

The informants explained that participating universities are controlled by MOET through curriculum frameworks for all programmes offered at the universities. These framework prescribe for each specialised study area the necessary objectives, the minimum knowledge requirements, the structural curriculum components and the necessary allocations of time to theory, practice and internship experience (Int. 1A-1, Int. 2C-1, Int. 3D-1. Int. 3A-1).

Interpretations from the data suggested that at the moment, whilst institutions are encouraged to take initiatives and show leadership, top-down control mechanism in higher education system in Vietnam constricts the space available for universities to respond to social and student needs and innovate at the grassroots.

Besides the limit of space given to the universities' managers to deal with ESD, the lack of a vision for ESD was interpreted by the informants as due to the "dependence" attitude being deeply rooted in the management style. One informant corroborated this assertion when he said:

> "I have the feeling that our managers tend to wait for strategic direction from the ministry rather than suggesting or developing own strategies, I mean the small ones, like one for ESD, not the really big development strategies which I know are impossible." (Int. 3A-1)

c) Forum for communication of ESD:

The interpretations revealed the prevailing values which explain for the undesirable behaviours in ESD communication during formal meetings. The first value concerns the orientation towards wider group of the Vietnamese academic individuals. Data suggests that at the three case studies these important collectivist values include harmony, acceptance and authority. Some

extracts from the interviews and focus groups which provided evidence for these remarks include:

> "When you are in the group, it's the norm that you agree with people..." (Int. 1D-2)

> "... of course you have to think about others..." (FG3)

> "it's because we are used to take what is given, especially when it's given by your boss." (Int. 2E-2)

> "I don't want to be seen standing out from the crowd." (FG4)

When deliberating on the reasons for not raising voice and critique at the formal meeting, the informants emphasised the desire for calm and peaceful atmosphere of the meeting and the tendency of thinking about saving face for other colleagues. For example, an informant during a group discussion referred to a Vietnamese idiom which means:

> "when you are in the same group, you don't criticise each other" (FG3)

Other informants asserted:

> "I would talk to him or her in person instead. I don't want him or her to lose face in front of everyone." (Int. 2A-1)

> "at this institution, we are very close. It gets difficult raising issues which concern others." (FG4)

The interpretations also revealed the prevailing attitudes which hamper the effectiveness of the current platform for ESD communication namely the tendency to hide mistakes and not give opinions or ask questions. According to the informants, the underlying characteristics include problem avoidance and fear of being wrong. To illustrate this remark, during an interview, one informant quoted a Vietnamese idiom which means

> "you never initiate to show people your bad points or your mistakes". (Int. 3D-1)

Other evidences include:

> "of course people only talk about good things and don't mention bad things or weak points because they don't want to identify problems that they might not be able to solve." (FG4)

> "the managers wouldn't like it if there are problems that they can't control." (Int. 2E-2)

"It's the norm that the meetings go on smoothly. If there is a big dispute or problem, it will be solved in privacy which only involves the relevant ones." (Int. 1B-2)

"In front of a lot of people, it's likely that you will play safe. You didn't want to be wrong or seen as making mistakes." (Int. 3B-2)

d) Structure for communication of ESD:

According to the deliberations during group discussions on ESD communication issues, "there seems to be a bureaucratic system" at the institutions that does not allow smooth flow of communication. This system, according to the participants, stems from an authoritarian approach to communication that can be traced back to the Soviet-style history of the institutions (FG1, FG2, FG3). In this type of culture, seniors hold the expectation that they must always appear more knowledgeable than their subordinates in order to maintain their formal power in the hierarchy. Thus, many mid-level managers seldom participate in important decisions, leading them to see little value in sharing knowledge across their organisations or with lower hierarchical level. Furthermore, research over the Soviet legacy indicates a culture where information is regarded as belong to the ones with power (Bain, 2007; May, Puffer, & McCarthy, 2005; Michailova, 2000).

The informants described the current system as where power is concentrated at the top level and the style is command and control (for example, Int. 2E-1, Int. 1D-1, Int. 3B-1). These values and attitudes are interpreted by the informants as contributing to a lack of structure or channels for information flow and lack of capacity in communication in ESD (FG1, FG2, FG3).

During group deliberations, some participants thought that the way some academic staff response to general direction was:

"a problem of attitude, don't care and sometimes intentional" (FG4)

This attitude, as further examined by the informants, could be characterised as maintaining low profile and reflected the dimension of uncertainty avoidance. The remarks by some informants allude to this interpretation:

"I know that some young staff are actively trying to draw little attention to themselves. Maybe they think that it's safer..." (Int. 3A-2)

"there seems to be a trend in which every time there is a direction, people see it as a problem that needs to be solved rather than think about the actions towards fulfilling it. And because of that, they believe and sometimes pretend that it does not concern them." (Int. 1C-2)

e) Cooperation for ESD:

The informants identified the value of internal orientation as the underlying assumption causing the lack of cooperation for ESD at the three case studies. Some informants being the managers of the participant institutions pointed at the higher education structure which is a Soviet relic as restraining factor for cooperation, not only among higher education institutions but also between these institutions and the business sector and the wider community (for example, Int. 1A-2, Int. 1C-2, Int. 2D-2, Int. 3A-2, Int. 3D-2, Int. 3C-2).

A review of the literature confirmed this assertion and suggested this is a common issue not only in ESD but in general, and not only at the participant universities but in the wider context of Vietnamese higher education system (Pham, 2010; Hayden & Lam, 2010; Dang, 2009).

f) Professional support in ESD:

With regard to the issue of individual mentoring scheme not being effective, the challenges being identified earlier were manifestations of the cultural condition at the participant universities.

First, the relationship between mentors and young staff was viewed as equivalent to both teacher-student and boss-employee. In fact, the study found that it was very common that the young staff were once the students (usually the best ones) at the universities who were kept to join the academic staff after graduation. It was also common that the mentors are key lecturers and at the same time, managers in the institutions. Therefore the mentor, in this relationship, was viewed by the informants as an authority not to be questioned. For example, one young lecturer commented:

"You know, it's like... imagine you were back to primary school, sitting in front of your teacher. I don't say it's a problem. But, when you are with your old professor, even now he is your colleague, you are still the student. You will take what you are given." (Int. 3B-2)

Whilst another informant acknowledged:

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> "My mentor is also my boss. I find it hard asking questions... because I don't want her to think that I am not qualified for the job, of course. But it's not the main point. The point is it's always hard talking to the boss. It's not about the topic." (Int. 1D-1)

Second, the dependence attitude of the young staff towards their mentor had been a factor influencing the effectiveness of the current support scheme. In the current mentor-young lecturer relationship at the case studies, the mentor is the teacher who wants their students to listen to them, and the young staff as students prefer to assume a passive position in relation to their teacher. It is common in Vietnamese as well as other Confucian cultures, as widely acknowledged in the literature, that the students want teachers to provide them with the "correct answer" so that they can write it down and memorise it. They defer to the authority figure (the mentor) and expect him or her to know all the answers and solutions (Pham T. N., 2010; Hữu Ngọc, 1998; Ji, Lee, & Guo, 2010). This reflects as didactic style of teaching rather than what is commonly advocated for in ESD, that is a more facilitative/transformative style (Tilbury, 2010; Sterling, 2004b).

g) Motivation in ESD:

Whilst the lack of an effective reward scheme was identified as the main reason for a lack of motivation in ESD, the opportunities for motivating staff in ESD were mainly based on the understanding of the cultural value that underpins how a Vietnamese person values his/her self-image.

According to the informants, the main motivations in ESD have been their images in the eyes of peers and students, and their self-esteem in doing the job.

> "I do it as a promise to myself as a teacher." (Int. 2A-2)

> "You know, the students are very smart now, they know who is good and who is not good. You just have to try your best to maintain your reputation." (Int. 3A-2)

> "I am always doing the best I can. In all the jobs. Everyone in this small community knows who I am." (Int. 3C-2)

Because the Vietnamese academic staff value the self's image and public appreciation and consider professional achievement a virtuous pursuit, the informants highlighted this as one advantage for motivating actions in ESD:

"Even if the tasks appear uninteresting to the academic staff, or the work involved requires lots of effort, they will more readily accept the need to accomplish them as it is their duty to do so, and that they will be acknowledged by the peers and students for their hard-work." (FG5)

h) Engineering curriculum innovation for ESD:

Interpretations of the informants pointed at the inclination to replicate instead of generate among Vietnamese academic staff in ESD activities (FG1, FG2). The informants also identified the dependence attitude of the young staff in combination with the controlling behaviour of managers and mentors as the factors contributing to the lack of innovation in ESD at the three case studies.

Deliberations of the informants also pointed at the attitude of the managers at their institutions which tends to focus on problems rather than encourage actions. As explained by the informants, this has contributed to:

"the academic staff didn't care about finding the best ways but chose to follow the popular ways to avoid potential mistakes or problems." (FG5, FG6)

i) Quality assurance and control in ESD:

With regard to quality assurance and control for ESD at the participant universities, the informants identified some prevailing attitudes which were believed to contribute to the current issues being faced. These include face-saving, the denial attitude and the tendency to overlook other's mistakes and incompetence (FG4, FG5, FG6).

The data confirmed this assertion as the academic staff chose to compromise by giving comments for improvement but avoiding criticism and not seeking punishment for failure in fulfilling ESD tasks. For example, some extracts captured include:

"Because I know that the comments will be taken personally and not as constructive critiques... and also, you know, the problems won't be dealt with properly... because of the system... Of course I am still giving suggestions for improvement, but I would not be as critical as I should. I don't want the lecturer to lose face." (Int. 3A-1);

"... because no one really gets punished anyway." (Int. 3A-2, Int. 1A-2, Int. 1C-2, Int. 2C-2, Int. 2E-3);

"the closer we are to each other, the harder it is to judge or to express negative opinions." (Int. 3A-2, Int. 2E-2, Int. 2A-1, FG5)

7.4. SUMMARY

This chapter has addressed the two aims of the research stage two: (i) To explore the issues and identify the possibilities for change in engineering education for sustainable development in Vietnamese universities; and (ii) to review critically contextual and cultural factors with a view to understanding the influences over transformation of the engineering curriculum for sustainable development in Vietnamese universities.

First, the chapter offered findings on the issues that hampered the current efforts in engineering curriculum for sustainable development in Vietnamese engineering universities. The issues were categorised into three areas of: understanding of ESD; planning and institutional support in engineering curriculum for sustainable development; and implementation in engineering curriculum for sustainable development. For each area of contextual issues being identified, the underlying reasons and the possibilities for change were explored. The chapter provided the visions of the research participants on how the current situation could be improved to transform the engineering curriculum towards sustainable development.

Second, the chapter explored the cultural influences over the efforts in engineering curriculum change for sustainable development in Vietnamese universities. Data analysis revealed the existence of various cultural characteristics in the case study universities related to: hierarchy; authority; dependence attitude, value of self's image; relationship; internal orientation; uncertainty avoidance and replicative.

Finally, the chapter has offered evidence of how these cultural characteristics influenced the issues and opportunities in engineering curriculum for sustainable development in Vietnamese universities. The evidence also supports the development of a framework that can assist in building culturally appropriate strategies for change.

PART IV. RESEARCH OUTCOMES AND CONCLUSIONS

This final part of the thesis presents the outcomes of the research. It details the development of a framework for building culturally appropriate strategies for transforming the engineering curriculum towards sustainable development in Vietnamese universities. The part outlines key recommendations for various stakeholder groups seeking practical contributions to engineering education for sustainable development in Vietnam. The study implications are also examined.

This part continues by providing some final reflections on the research processes and discussing the limitations of the study. Finally, it offers suggestions for future research and ends with thesis concluding remarks.

CHAPTER 8. OUTCOMES AND IMPLICATIONS OF THE STUDY, FINAL REFLECTIONS AND CONCLUSIONS

8.1. INTRODUCTION

As set out at the beginning of the thesis, the main goal of this study was to improve the contribution of higher education to sustainable development in Vietnam, specifically in the area of engineering education. This study has generated a systematic understanding of the Vietnamese experience on sustainable development and engineering in higher education. It documented through empirical research the current status of EESD in Vietnam and the implications for engineering education. This research also helped envision a transformation of engineering curriculum for sustainable development in Vietnamese universities. It emphasised the consideration of contextual and cultural influences when building change strategies aimed at the desired transformation. By looking at a specific context of change for EESD, the study has added to an emerging body of literature on change in higher education for sustainable development from a cultural perspective. Instead of the common approach in the literature that uses pre-determined cultural frameworks to guide the study into the cultural influences, the study took a grounded approach to research in which generated findings are field-based inductive and embedded in the context. Even though not seeking to provide a prescription or formula for carrying out future change efforts in other institutions or national contexts, it informs change initiatives elsewhere aimed at a transition towards EESD beyond the Vietnamese context.

The ultimate goal of the research was to develop a framework for building culturally appropriate strategies to transform the engineering curriculum in response to the challenges of sustainable development in Vietnam. In this chapter, based on the findings arising from the empirical research, the framework is constructed and its characteristics and nature discussed. The chapter also provides practical recommendations for key stakeholder groups to contribute to progressing EESD in Vietnam. The chapter then turns to delineating the contributions and implications of the study. Final reflections are synthesised and research limitations discussed. Finally, the chapter offers recommendations on further research on engineering curriculum

change for sustainable development in Vietnam, and directions for future research on higher education for sustainable development in Vietnam and EESD in general.

8.2. OUTCOMES OF THE STUDY

8.2.1. Framework for building culturally appropriate strategies for transforming engineering curriculum towards sustainable development in Vietnamese universities

The framework described in this section proposes key focal areas for building culturally appropriate strategies which can assist to transform the engineering curriculum for sustainable development in Vietnam. These themes were constructed throughout the case-studies as key elements which support EESD in Vietnamese engineering universities taking into account the contextual and cultural influences.

The framework includes six components namely resource, vision, communication, professional support, motivation and cooperation. Under each component which represents a different area for strategy building, the framework explains the considerations for and identifies the key features of the change strategies. The features are supported by an explanation as to why they are culturally appropriate in the case of Vietnamese engineering universities. To value-test and enhance the validity of the framework (see section 4.5.3), a number of key informants from stage one and two of the research were involved in the assessment of the value of the framework (see section 5.2). Feedback on the framework was solicited from the key informants which assisted in the revision and improvement of the framework.

The framework was developed from the findings arising from the empirical research at the three Vietnamese engineering universities and is characterised as:

- Targeted at university managers seeking to transform the engineering curriculum towards sustainable development in a Vietnamese university:

This target group includes professionals at management positions from the university level (e.g. rectors, vice-rectors...), to faculty/department level (e.g. directors, deans, heads of departments...) to the subject group level (e.g. heads of subject groups or subject group

managers[116]...). It also informs individual professionals (e.g. tutors and lecturers...) seeking to contribute to an ESD agenda within the university setting.

- A tool for developing strategies for transforming engineering curriculum towards sustainable development in Vietnamese universities:

The framework serves as a guidance for universities to build strategies that enables contextual and cultural influences to be taken into account and change to be managed appropriately. It does not offer ready-made strategies but provides key constructs that assist in the process of strategy building for transformation. Since each institution is different, each requires its own unique set of strategies to deal with the specific issues and opportunities for change, which must evolve through a process centred on the unique realities of the universities. Furthermore, this collection of themes is by no mean exhaustive. When implementing the framework, each university should be able to identify additional areas and/or features depending on its own circumstances using the same approach.

 - Limited to the area of formal teaching and learning for sustainable development:

The focus of this framework is on engineering curriculum that concerns the formal teaching and learning activities in the universities. However, it is important to note that the researcher does not assume that ESD in engineering higher education can be operationalised solely at the curriculum level, or that action at university level, by university managers and academic staff such as professors or lecturers, will be sufficient. Literature on ESD has proved otherwise, advocating that ESD in higher education requires a systemic change in the sector to realign all its aspects with a new paradigm that supports the attainment of sustainable development (Tilbury, 2012; Lozano, 2007) (see also section 3.2).

This study however argues that action at universities in the area of teaching and learning is necessary and could effectively contribute to progressing the ESD agenda in higher education sector, particularly in engineering in Vietnam. Therefore this study seeks to understand what

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[116] In Vietnamese engineering universities, these positions are translated into Vietnamese as "Trưởng Bộ môn" or "Phụ trách Bộ môn"

action can be taken at university level, and how professionals operating at university level might show leadership in this field.

- Contextually-based:

The framework was developed from the findings arising from the case study research conducted at the three chosen Vietnamese engineering universities. These universities are characterised as leading Vietnamese institutions in the area of engineering education and could be considered as more advanced in curriculum for sustainable development. It is recommended that other engineering higher education institutions with different contextual realities seeking to promote engineering curriculum for sustainable development seek to understand their state of play and adapt the framework to their own circumstances.

- Culturally-specific:

Being approached with a cultural perspective, the framework is deeply rooted in the cultural realities of the participant universities. Whilst some of the cultural influences being identified could be viewed as common to the general Vietnamese higher education institutions, some might be specific to the engineering higher education institutions and some more specific to the case study universities only. It is recommended that other institutions seeking to promote engineering curriculum for sustainable development analyse the relevance of the framework and select/adapt the features appropriate to their own cultural characteristics.

The framework is presented in *Table 29* below.

Table 29. Framework for building culturally appropriate strategies for transforming engineering curriculum towards sustainable development in Vietnam

Focal areas of strategy building	Considerations for change strategies in Vietnamese engineering universities	What are the key features/prerequisites for change strategies to be culturally appropriate?	How do the key features/prerequisites make change strategies culturally appropriate?
VISION	Visioning is a very important part of ESD change processes. This study found that a clear vision of ESD in Vietnamese engineering universities is in urgent need as it: • establishes the purpose of change programmes and initiatives related to ESD; • informs direction; and • motivates actions among academic staff. This study suggested that a vision of ESD	The vision of ESD is developed through engaging staff in active and collaborative processes of ESD interpretation.	This feature tackles the current issues concerning the understanding and interpretations of ESD in Vietnamese engineering universities as well as the lack of orientation from the managers with regard to ESD implementation.
		The action plan includes clear and realistic goals.	These features reflect the cynical attitude and lack of trust of the informants towards long-term and unspecific planning.
		The action plan includes both long-term and short-term targets.	

Focal areas of strategy building	Considerations for change strategies in Vietnamese engineering universities	What are the key features/prerequisites for change strategies to be culturally appropriate?	How do the key features/prerequisites make change strategies culturally appropriate?
	that is accompanied by an appropriate action plan for ESD also contribute to quality assurance and control of ESD activities especially when mechanisms for quality and control are not in place.	The action plan aims for visible results.	
RESOURCES	The lack of adequate resources for learning about ESD has been identified in this study as the main reason for a lack of ESD understanding in the Vietnamese engineering universities. It is crucial that engineering universities build strategies to develop resources for learning about ESD.	The linguistic mode of ESD materials is Vietnamese (e.g. key documents and publications on ESD in English being translated into Vietnamese).	This feature tackles the limited English proficiency of the Vietnamese academic staff. This study suggested that the academic staff preferred the use of Vietnamese over English in reading materials as it was easier to understand and remember.
	The opportunities being offered by adequate resources include: • Increased access to information about ESD; • Increased opportunities for learning about ESD for the academic staff;	The resource contains a balance of documentation on international experience and self-developed materials.	These features were identified as the characteristics of an ESD resource considered to be useful and appropriate in the Vietnamese engineering university context.

Focal areas of strategy building	Considerations for change strategies in Vietnamese engineering universities	What are the key features/prerequisites for change strategies to be culturally appropriate?	How do the key features/prerequisites make change strategies culturally appropriate?
	• Avoiding alienation of the academic staff currently being considered not concerned with ESD; • Provision for academic staff to develop tailor-made teaching materials appropriate to their own programmes/subjects; • Reducing the dependence on human resource in professional development in ESD.	The resource provides examples/case studies.	
		The resource contains illustrative teaching and learning aids.	
		The resource is open to all academic staff.	This feature conforms to the Vietnamese value of face saving. An open-access resource allows academic staff to search for information without having to ask for help from others, which helps to prevent the hiding of lack of understanding.

Focal areas of strategy building	Considerations for change strategies in Vietnamese engineering universities	What are the key features/prerequisites for change strategies to be culturally appropriate?	How do the key features/prerequisites make change strategies culturally appropriate?
COMMUNICATION	This study identified that changes are needed to be made to the current practices in communication of ESD in the Vietnamese engineering universities. The study suggested that strategies are to be built to improve the forum for communication of ESD towards: • enhancing interaction; • allowing "facing the ugly truth"; • ensuring and promoting engagement in ESD; • involving individuals who are at different levels regarding their understanding of ESD; and • influencing the management board and raising institutional profile for ESD. Strategies should also be developed aimed at improving the structure for	A specific forum for communication of ESD in a non-formal setting	Formal setting was identified as not effective for communication of ESD as it nourishes the tendency of hiding mistakes and concealing failures, as well as challenges the dominant value for harmony and keeping face. This research identified that during social and non-formal gatherings, interaction on ESD issues is more likely to occur; and the tone and voice less tense which lessens the sense of hierarchy and authority. A more natural setting for communicating ESD was also suggested to attract voluntary interest from academic staff. A forum for ESD provides opportunities for vision building and strengthening, communication, and cooperation among the institution's managers and academic staff.
		A formal structure for communication of ESD across the university that	This feature satisfies the traditional desire of Vietnamese managers for models that clearly illustrates the roles and responsibilities and the

Focal areas of strategy building	Considerations for change strategies in Vietnamese engineering universities	What are the key features/prerequisites for change strategies to be culturally appropriate?	How do the key features/prerequisites make change strategies culturally appropriate?
	communication of ESD through: • defining more clearly roles and responsibilities; • ensuring directions reach the right persons; • accurate and transparent communication; and • providing channels for feedback and interaction.	includes the top management board, the line managers who act as ESD goal-level managers and the individual academic staff	explicit process they were to follow. The formal structure with different levels of management in ESD creates conditions in which managers and their subordinates operated within two hierarchies: the traditional, vertical departmental structure, and the new multidirectional structure that flows vertically and horizontally to fulfil specific ESD strategies/goals. In addition to being aligned to the traditional values, attitudes and behaviours, this arrangement is believed to foster new, transparent and interactive behaviours.
		Specific and explicit directions	The study identified a preference of the academic staff for directions which are specific to the target individuals and explicit.

Focal areas of strategy building	Considerations for change strategies in Vietnamese engineering universities	What are the key features/prerequisites for change strategies to be culturally appropriate?	How do the key features/prerequisites make change strategies culturally appropriate?
PROFESSIONAL SUPPORT	The research confirmed the need for professional support in ESD in Vietnamese engineering universities. The research identified that support for professional development in ESD could be more effective when it is provided in a setting that: • helps to avoid the uncomfortable feeling related to authority between the trainers and the trainees; • increases the chance of trainees asking questions and seeking clarification; • encourages trainees (i.e. young staff) to be more critical; • provides additional platform/chances for ESD communication. This study also identified that observational learning contributes to	Group-based training (e.g. workshop, seminar, group-mentoring...)	The research suggested that one-on-one mentoring scheme does not work because of the prevailing cultural values and attitudes existed in Vietnamese engineering universities namely the emphasis on authority, and the dependence and uncertainty avoidance attitude. Group-based training was identified to be more appropriate as it reflects the strong attachment to groups of Vietnamese people, and the attitude that people at a lower rank in a hierarchy, when being together, might be able to challenge or break the barrier of authority. The study suggested that ESD trainers could also play a key role in the feedback channel in ESD, bridging the communication gaps between young academic staff and the institutional managers.

Focal areas of strategy building	Considerations for change strategies in Vietnamese engineering universities	What are the key features/prerequisites for change strategies to be culturally appropriate?	How do the key features/prerequisites make change strategies culturally appropriate?
	professional development in ESD and ESD implementation by: • encouraging adaptation; • motivating academic staff, especially the young lecturers; and • improving professional capacity for ESD.	Observational learning opportunities (e.g. show-lectures, champion figures…)	This feature fits within the preferred behavioural repertoire of Vietnamese academic staff which is to have a model/example to follow. This feature is founded upon the replicative value.

Focal areas of strategy building	Considerations for change strategies in Vietnamese engineering universities	What are the key features/prerequisites for change strategies to be culturally appropriate?	How do the key features/prerequisites make change strategies culturally appropriate?
MOTIVATION	Without an effective mechanism for quality assurance and control, motivation has been identified as the key factor that contributes to the success of the EESD agenda in Vietnamese engineering universities. The study suggested that effective motivation mechanisms in ESD would contribute to encouraging academic staff in ESD implementation and quality assurance.	A shift from the traditional focus on materialistic reward to public and peer appreciation	These features tackle the general contextual issues related to motivation in the Vietnamese engineering universities. These include: • poor materialistic award; • lack of financial incentive for working and improvement due to poor remuneration and working conditions; and • lack of transparency and trust in the reward practices. The features were identified to reflect the culturally based values and attitudes of the Vietnamese academic staff which include:
		Promotion of virtue-ethics	• the value which places the self's image and public appreciation over materialistic reward; • the attitude of saving face; and • the value which emphasises the virtue of the teacher.

Focal areas of strategy building	Considerations for change strategies in Vietnamese engineering universities	What are the key features/prerequisites for change strategies to be culturally appropriate?	How do the key features/prerequisites make change strategies culturally appropriate?
		A transparent, open-to-public reward scheme	The study suggested that these features contribute to ESD implementation and quality assurance: • Examples of successful ESD practices motivate staff as they provide the "how"; give a sense of "we can do it" and "it is not that complicated"; and stimulate the feeling "they can do it, then I can do even better"; • Examples of ESD practices are also useful for academic staff as a benchmark against which to adapt and improve their own work; • Public and peer appreciation is a reward for achievement and at the same time creates positive pressure to staff to maintain the quality in ESD.
		Promotion of "Guru" or "Champion" figures in ESD	

Focal areas of strategy building	Considerations for change strategies in Vietnamese engineering universities	What are the key features/prerequisites for change strategies to be culturally appropriate?	How do the key features/prerequisites make change strategies culturally appropriate?
COOPERATION	The importance of partnership for ESD has been widely argued for in the literature, and the need for cooperation for ESD in Vietnamese engineering universities has been confirmed. The study suggested that: • Cooperation with industries and NGOs provides students with real life examples and hand-on experiences related to sustainable development; • Cooperation with industries and NGOs also supports external participation in teaching activities on sustainable development topics (i.e. guest-lectures, seminars, workshops, etc.); • Inter-department and inter-institution cooperation provides opportunities for joint-training courses for academic staff and collaborative teaching	Cooperation channels being built upon established relationships (on both individual and institutional basis)	The research suggested that the institutional and individual connection and relationship with external organisations (e.g. governmental authorities, businesses, counterpart institutions...) have already existed in Vietnamese engineering universities. The study identified that individual members of staff are key in establishing and maintaining the external relationships. The study also identified that cooperative projects and activities are mainly established and developed through individual communication and negotiation. Overall, the study found that less formal approach in relationship building and maintaining is preferred in the Vietnamese culture.

Focal areas of strategy building	Considerations for change strategies in Vietnamese engineering universities	What are the key features/prerequisites for change strategies to be culturally appropriate?	How do the key features/prerequisites make change strategies culturally appropriate?
	activities; • Communication and cooperation with education authorities contributes to increased provision of support for professional development in ESD (e.g. training and grants).	Decentralisation, power given to the individual members of staff	

- **Nature of the framework:**

- The framework has been developed from a cultural perspective. It supports the formation of strategies for transforming engineering curriculum towards sustainable development that are: (i) needed for the Vietnamese engineering universities as they act on the current issues and possibilities for change towards ESD; (ii) relevant in the context of sustainable development and higher engineering education in Vietnam; and (iii) appropriate to the cultural values, attitudes and behavioural preference exist at the Vietnamese engineering universities.

- The framework identifies six areas for strategy building which are the six key themes arising from the research data that contribute to transforming the Vietnamese engineering curriculum for sustainable development. These include: resource, vision, communication, professional support, motivation and cooperation. The key features being constructed under each theme: (i) tackle the issues identified as current factors hampering the progress towards engineering curriculum for sustainable development in Vietnamese universities; (ii) enable actions for change which are appropriate to the context and culture of the Vietnamese engineering universities; and (iii) offer a certain level of flexibility which allows the universities to build their own strategic actions to address the overall objectives.

- The framework assists in building strategies that are based on three underlying epistemological assumptions:

(i) Time as incessant and diachronic:

University managers should study the current status of the institution and choose an appropriate timeline for the implementation of the strategies. There is no fixed rule of what to do be done first or when. University managers should go through an on-going cycle of processes of strategy evolvement: assessing the current state and technical opportunities, identifying key objectives, prioritising objectives, identifying tasks and actions and formalising strategies.

(ii) Interaction and reciprocal causation of the strategies:

When building strategies from the framework, interaction and multiple and mutual influences (outcomes) should be taken into account. As the framework has been developed to build strategies which are not responses to given constraints but means to influence them or create

new environments, the process and effects of strategy realisation need to be recognised at formulation. Strategy needs to be planned with its effects in mind, particularly during strategy execution when additional changes may take place and strategy itself may affects these changes in part. For example, a strategy aimed at establishing cooperation between one engineering higher education institution and another might provide the mechanism for joint-training opportunities. The strategy aimed at professional support in ESD, therefore, may consider group-based training sessions which are held for academic staff from a number of institutions sharing the same needs and similar characteristics rather than for only one individual institution.

(iii) Integrated view of strategic actions:

In addition to understanding the reciprocal causation of the strategies, there is a need for an emphasis on the eclectic views of strategy building. A single strategy could be built linking strategic features under different themes to achieve the desired outcomes. For example, a strategy which promotes the use of ESD show-lectures in the institution could serve as opportunities for learning about ESD through observation, which contributes to professional support, as well as for peer and public appreciation and scrutiny, which contributes to increased motivation of the academic staff and quality of the ESD activities.

8.2.2. Key recommendations for stakeholder groups in engineering education for sustainable development in Vietnam

In this section, recommendations from the study are offered for each stakeholder group in EESD as identified in the research design: a) governmental authorities; b) non-governmental organisations; c) engineering businesses and d) engineering universities. The recommendations are aimed at increasing the contribution of the stakeholder groups to EESD in Vietnam.

a) Governmental authorities:

This study has found that governmental authorities play the most important role in leading the way, setting the policies and providing institutional and legal supports for the implementation of ESD in Vietnam. Therefore, it is crucial that the Vietnamese government:

- Provide clarification of ESD terms in formal documents to consolidate the different ways of translating ESD terms into Vietnamese in the current formal publications on ESD. Ministry of

Foreign Affairs (MOFA) and Ministry of Education and Training (MOET) are identified as the two key authorities to take action to deal with this issue.

- Release clear statements about the critical and urgent need for ESD in higher education engineering programmes as well as all other higher education programmes; and the critical need for both education about sustainable development and education for sustainable development.

- Make more explicit the roles and responsibilities of MOFA and MOET in ESD. Being unique to other educational initiatives in Vietnam, ESD was ignited by the international community and first formally introduced into Vietnam through the launch of DESD in 2005. MOFA is therefore the coordinating ministry in ESD whilst MOET is in charge of actual implementation of ESD. This study suggested that this unique governance structure had caused difficulties in management of ESD in Vietnam due to the unclear roles and responsibilities assigned to the ministries.

- Foster better communication and cooperation between MOFA and MOET in ESD planning and implementation.

- Build partnerships which link governmental organisations, civil society organisations, businesses, and engineering higher education institutions for (i) knowledge and information sharing; (ii) improved competency in ESD planning and management and (iii) strengthened capacity for ESD implementation and skills development.

Specifically for MOET, it is recommended that the Ministry:

- Establish formal mechanisms among Vietnamese engineering universities for (i) innovative collaboration options and (ii) institution to institution peer learning and knowledge exchange for implementation of ESD.

- Hold conferences and workshops to disseminate results, partnerships and knowledge products related to ESD in general and ESD in engineering in particular.

- Provide formal opportunities for university managers and academic staff in the engineering discipline to learn about ESD. This might be in cooperation with international organisations with ESD capacity in the forms of seminars, workshops, online information and written documents explaining ESD.

- Provide research grants or financial support for universities to undertake practical research in the topic of ESD.

- Identify ways to promote the voluntary change in curriculum for sustainable development in engineering universities for example establishing standards, building codes of conduct, policy development and strategic planning.

b) Non-governmental organisations:

This study has confirmed the important catalyst role of NGOs in the area of ESD in Vietnam. International development agencies and local NGOs have the capacity and resource to make meaningful contribution to EESD in Vietnam. It is recommended that the NGOs community in Vietnam:

- Collaborate and build partnerships among one another, especially between international and national NGOs for ESD. International organisations with technical and financial capacity in ESD could play a leading role in design and implementation of ESD initiatives whilst local organisations could bring in their local understanding, relationship and expertise to deliver the tasks.

- Explore and encourage ESD practices, especially in higher education and engineering higher education through advocacy and policy intervention. Since the launch of the UNDESD in 2005, NGOs have been playing a key role in awareness and profile raising at policy level. The study recommends that attention be made to the actual implementation of ESD during the past phase of the UNDESD and beyond.

- Provide training and capacity building opportunities for engineering university managers and professionals in ESD in collaboration with the relevant governmental authorities.

c) Engineering businesses:

This study has suggested that the role of engineering businesses in EESD in Vietnam has been undermined. It is recommended that the engineering business community in Vietnam be more proactive in seeking contribution to ESD, especially in engineering higher education. Specifically, it is recommended that engineering businesses:

- Make their voices heard with regard to their needs and expectations of engineering graduates in sustainable development. This could be done through direct dialogues with engineering higher education institutions, or through formal communication between the associations of engineering businesses to the engineering higher education community at formal events or via other formal communication channels.

- Work with engineering universities to identify the mechanisms for ESD support and cooperation. Mechanisms might include the establishment of (i) distinguished lecture series in which engineering professionals come to the universities and share with the students their knowledge and experiences on issues concerning sustainable development; (ii) study-tours or visits to engineering companies for students to be exposed to real-life projects; (iii) a database of case-studies in engineering for sustainable development to be used as resource for learning and teaching about sustainable development; and (iv) collaborative research and business projects between engineering companies and engineering universities in the topic of sustainable development.

- Provide direct support to the engineering students through the provision of study programmes or study visits, internships and special vacancies (e.g summer vacancies, short-term vacancies, task-based vacancies...) for engineering students to improve their knowledge and skills for sustainable development.

d) Engineering universities:

This study has found that with regard to ESD in higher education in Vietnam, engineering has been slow in responding to calls for change, especially in comparison with other disciplines such as business, education, environmental studies and architecture and design. With the emerging expectation towards engineering professionals in the context of sustainable development, it is recommended that the engineering higher education community be more active and proactive in participating in the ESD movement in the country. The engineering universities should:

- Participating in national and sectoral events and debates on the topics of sustainable development and ESD. Some significant relevant conferences include the National Conference on Sustainable Development – Forum on Education for Sustainable Development being held bi-annually; and ESD conferences, workshops and seminars held by MOET as well as the National Committee for DESD.

- Amend their educational policies to reflect ESD integration requirement, especially in the area of curriculum design.

- Develop mechanisms and incentives for ESD activities in the universities. These may include: (i) funding for academic staff to study in a new area; (ii) curriculum development grants for academic staff to renew and innovate towards embedding sustainable development in the existing subjects; and (iii) research grants for academic staff to undertake practical research in the topics of sustainable development and ESD thus contributing to the possibility of teaching being led by research, which is currently being viewed as a weak point in Vietnamese higher education curriculum (Harman, Hayden, & Pham, 2010).

- Specifically in the area of curriculum for sustainable development, it is strongly recommended that engineering universities engage with the framework developed by this study. The framework suggests the development of culturally appropriate strategies that contribute to transforming the engineering curriculum towards sustainable development. Whilst the framework serves as a guidance, specific solution packages must evolve through a process centred on the unique realities of the universities. This study therefore proposes that universities engage with the framework through a process of action research.

8.2.3. Recommendations for implementation of the Framework

Based on the Framework (*Table 29*) and the above recommendations generated as the main deliverables of the research, further recommendations for implementation of the Framework in Vietnamese engineering universities, together with the identification of possible direct support from the key stakeholder groups, are presented in the following *Table 30*.

Table 30. Recommendations for Implementation of the Framework for transforming engineering curriculum towards sustainable development in Vietnam

Focal areas of strategy building	Recommendations on the strategic responses of the Vietnamese engineering universities	Time-frame of implementation	Possible direct support from key stakeholder groups
VISION	Release clear statements about the need for Sustainable Development to be embedded in the curriculum: - University's leaders to refer to the official document provided by MOET and the National Action Plan for Education for Sustainable Development 2011-2015 to reflect the need for ESD in the formal university's policies.	To be done as soon as possible, and before the beginning of the coming academic year.	MOET to send the reminding letter to universities to foster the implementation of the guidance on ESD in Vietnamese Higher Education (i.e. the official document on "Requirement for sustainable development to be included in the curriculum", 2008) and the National Action Plan for Education for Sustainable Development 2011-2015.
	Organise ESD envisioning workshop to define the visions and goals for ESD: - University's leaders to organise envisioning workshop for managers and key academic staff of faculties and departments to define the visions and goals for ESD in the	To be done at the beginning of the coming academic year. The visions and goals should be reviewed every 4 years or at times when there are new ESD-related official documents by the	MOET to provide guidance/directions to guide the envisioning and planning activities of the universities. NGOs to provide technical assistance to the universities (in the forms of, for example, experts or training workshop

Focal areas of strategy building	Recommendations on the strategic responses of the Vietnamese engineering universities	Time-frame of implementation	Possible direct support from key stakeholder groups
	university.	governmental authorities being released (e.g. official documents by MOET, new National Action Plan for Education for Sustainable Development...)	for universities' leaders) to support the universities in identifying their visions and goals and developing their action plans for ESD.
	Develop action plans for embedding sustainable development into the curriculum: - University's leaders to work with managers of faculties and departments to develop an action plan for the whole university with short-term (yearly) and long-term (forth-yearly) targets and a set of criteria for monitoring and evaluation; - Managers of each faculty and department to hold workshop with the participation of all academic staff to develop an action plan for ESD for each faculty/department which reflects the University's ESD action plan.	To be done at the beginning of the coming academic year, following the envisioning workshop. The action plans should be reviewed every year.	

Focal areas of strategy building	Recommendations on the strategic responses of the Vietnamese engineering universities	Time-frame of implementation	Possible direct support from key stakeholder groups
RESOURCES	Stocktaking of key documents and materials on ESD topic: - Managers of faculties/departments of the university to assign a member of staff to be in charge of collecting and archiving the documents related to ESD; - Academic staff to collect ESD documents (including authoritative documents, research papers, reports of case studies/working projects...) and share with the staff-in-charge; - All materials being collected to be translated into Vietnamese and be stored in both languages (English and Vietnamese) for reference; - The materials to be converted into electronic versions and be made open to all academic staff.	To be done as soon as possible. The materials should be updated and reviewed on a regular basis (preferably every semester).	MOET, NGOs and engineering businesses to proactively provide the relevant materials/documents to the universities/departments to enrich their resources for ESD. For authoritative documents and international materials on ESD, it is suggested that the providers (e.g. MOET, NGOs) provide the professionally translated versions to ensure the accuracy and consistency of the documents.

Focal areas of strategy building	Recommendations on the strategic responses of the Vietnamese engineering universities	Time-frame of implementation	Possible direct support from key stakeholder groups
COMMUNICATION	Set up a specific forum for communication of ESD: - Managers of faculties/departments of the university to set up a non-formal forum for academic staff to communicate about ESD using times of regular social and non-formal gatherings.	Gatherings for ESD could be organised with flexible schedule based on the needs for ESD communication and the arisen opportunities. At least one ESD gathering should be organised every month.	Not applicable
	Establish a clear structure for communication of ESD in the university: - University's managers to establish a structure for communication of ESD in the university which includes four levels: member(s) of the university management board as top ESD manager (at whole university level); member(s) of the faculties/departments management board as department-level ESD manager; ESD goal-level managers; and individual academic staff;	To be done at the beginning of the coming academic year, following the envisioning workshop. The structure should be reviewed every year when the action plans are renewed or reviewed; or when there are changes to the personnel.	Not applicable

Focal areas of strategy building	Recommendations on the strategic responses of the Vietnamese engineering universities	Time-frame of implementation	Possible direct support from key stakeholder groups
	- Persons at each level in the structure should be assigned with clear roles and responsibilities; and the channels for communication from top to bottom and across the structure clearly defined.		
PROFESSIONAL SUPPORT	Organise training activities for academic staff: - Managers of faculties and departments to organise regular training sessions for academic staff on a group basis (e.g. workshop, mentoring...); - Managers of the university, and/or faculties and departments to organise seminars for sharing and exchanging knowledge and experiences of ESD among members of staff; - Managers of the university, and/or faculties	Training activities should be organised on a regular basis that suits the faculties/departments' work plans and professional support plans (i.e. professional meeting schedules[117]). Ad hoc activities (e.g. seminars, show-lectures...) should be planned at the beginning of each semester.	MOET, NGOs and engineering businesses to proactively provide the relevant opportunities to the universities/departments to enrich their professional capacity for ESD (e.g. organise conferences, seminars, workshops, visit tours...) for academic staff from engineering universities.

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[117] In Vietnamese, these meetings are called "Sinh hoạt chuyên môn".

Focal areas of strategy building	Recommendations on the strategic responses of the Vietnamese engineering universities	Time-frame of implementation	Possible direct support from key stakeholder groups
	and departments to organise show-lectures of ESD champions and invite academic staff to attend.		
MOTIVATION	Establish a motivation scheme for ESD: - University's managers to establish a transparent and open-to-public reward scheme, focussing on public appreciation of ESD champions; - Managers of faculties and departments to announce the ESD champions/good practices during formal meetings of the faculties/departments, and during formal communication with stakeholders (i.e. students, governmental authorities, industries...)	The reward scheme specific for ESD should be established as soon as possible, preferably at the beginning of the coming academic year. Appreciation of ESD champions and good practices should be done as soon as possible, for example at the next professional meeting of the faculties/departments.	MOET, NGOs and engineering businesses: - To provide financial support to the motivation schemes of the universities/departments; - To set up awards/schemes to recognise and commend the universities/individual professionals in ESD.

Focal areas of strategy building	Recommendations on the strategic responses of the Vietnamese engineering universities	Time-frame of implementation	Possible direct support from key stakeholder groups
COOPERATION	Officially establish cooperation with external organisations for ESD: - Managers of the university and faculties/departments to build formal cooperation channels upon the established relationships with external organisations (e.g. other engineering universities, governmental authorities, businesses, counterpart institutions...); - Managers of universities and faculties/departments to set up a mechanism to ensure that the cooperation could be established and maintained on both institutional and individual basis.	The review of the current relationships with external organisations should be done as soon as possible, preferably at the next meeting of the management board. The mechanism for cooperation establishment and maintenance should be set up as soon as possible, preferably at the beginning of the coming academic year.	MOET to facilitate the cooperation among universities and between universities and NGOs and communities at national, regional and local levels. NGOs and engineering businesses to proactively seek and offer cooperation opportunities with universities/departments and individual professionals.

8.3. CONTRIBUTIONS AND IMPLICATIONS OF THE STUDY

This section discusses the contributions of the study taking into account the knowledge gaps and the needs for the study as defined in chapter 1. For each contribution, the section outlines the implications of this research project in the context of engineering education for sustainable development in general and in the particular case of Vietnam.

Contribution	Implications of the study
Conceptualising the transformation of engineering curriculum for sustainable development	Comprehensive review of the recent publications on the topic of EESD has generated a better understanding of the transformation of engineering curriculum towards sustainable development being sought by the international engineering higher education community. This transformation is characterised by an integration of change to the engineering curriculum in three dimensions: Coverage of sustainable development themes; Emphasis on sustainable development knowledge and skills; and Strategic approach to curriculum change.
Contextualising the current EESD experience in Vietnam	This study was the first empirical research to document the EESD experience in Vietnam and the first attempt to define the needs and expectations concerning EESD in Vietnam. It has provided a systematic view of the stakeholders' understanding, the drivers and influencing factors, as well as the current actions and activities with regard to engineering and higher education for sustainable development. It confirmed the emergence of societal expectations towards graduate engineers and identified a new set of knowledge, skills and values of engineers for sustainable development in Vietnam.
Promoting the transformation of engineering curriculum for sustainable development in Vietnam	The framework developed by this study sought to assist the engineering universities in Vietnam in building culturally appropriate strategies to transform the curriculum towards sustainable development. This study has also generated practical recommendations for key stakeholder groups seeking to contribute to progress EESD in Vietnam. Furthermore, by engaging the research participants in the research which included cyclical processes of critical questioning and reflection, it was assumed that change may happen in the participants' perception

	of EESD and, eventually, in their actions beyond the research process.
Methodological contribution to studies in the area of higher education for sustainable development	This study advocated for a culturally appropriate approach to change towards sustainable development including in the area of higher education. Instead of pre-determined cultural frameworks to guide the study into the cultural influences, the study took a grounded approach to research in which generated outcomes are field-based inductive and embedded in the context but at the same time, represent holistic understanding and are transferable.

Table 31. Contributions and implications of the study

8.3.1. Conceptualising the transformation of engineering curriculum for sustainable development

Over the last decade, different approaches to change in engineering curriculum have been taken by engineering higher education institutions and professionals to direct engineering education towards sustainable development and/or to empower engineering students to address sustainable development challenges. These approaches are labelled with various terms[118] and despite the widespread use, it was apparent that there is little consensus regarding what could be understood as engineering curriculum for sustainable development (see section 3.4).

This research has offered a theoretical clarification on the transformation towards engineering curriculum for sustainable development being sought after by engineering higher institutions around the globe. It suggests that such transformation requires an integration of change to the engineering curriculum in three dimensions: Coverage of sustainable development themes; Emphasis on sustainable development knowledge and skills; and Strategic approach to curriculum change.

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[118] Such as "embedding Sustainable Development in the curriculum", "integrating Sustainable Development in the curriculum", "curriculum design for sustainable futures" , "curriculum renewal for Sustainable Development", "problem-based learning", "multi- and inter-disciplinary approach", and "teaching for ethical responsibility"
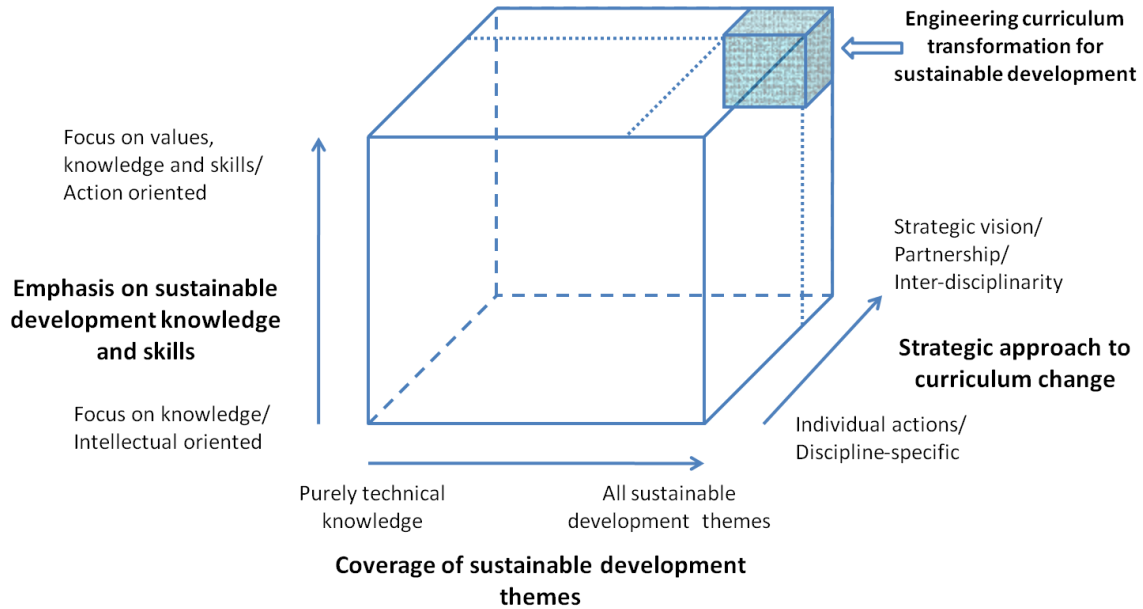
Figure 15. Conceptual model of engineering curriculum transformation for sustainable development

By applying the three-dimensional model, approaches in engineering curriculum change for sustainable development can be positioned relative to one another. This should be done by referring to the features that are described rather than the terminology used. The discipline of "unpacking" the features according to the axes enables comparison on the basis of substance rather than semantics, which is helpful in a field where the use of terminology is inconsistent and sometimes, confusing. Besides facilitating common understanding across jurisdictions, the model can be of practical use in any particular jurisdiction by revealing gaps and hence, the enhancements needed to achieve a transformation of engineering curriculum for sustainable development.

On the surface, the model may appear somewhat trivial in that it does not introduce any new or complex ideas. However, it is believed that the lack of clarity concerning these fundamental features may hamper constructive debate between practitioners/researchers from various jurisdictions, "schools of thought" and disciplinary backgrounds. While the model endeavours to capture the wide spectrum of features promoted in the EESD literature, it does not represent consensus regarding the degree to which it is practical or desirable for any particular approach in engineering curriculum change to progress along the axes. In any particular context, it will be necessary to determine: the themes that should be covered, the extent to which knowledge and

skills for sustainable development should be emphasised (in compared to the required technical knowledge and skills of the engineering disciplines), and the practicality of certain elements of strategic approach.

8.3.2. Contextualising the current EESD experience in Vietnam

Little research has been documented on the movement of higher education for sustainable development in Vietnam, especially in engineering higher education. First, there was a lack of research that provided an understanding of the societal needs and expectations towards the engineering professionals in the context of sustainable development in Vietnam. Second, little has been known about the current practices of ESD in Vietnamese engineering universities: how Vietnamese engineering universities understand and interpret sustainable development and ESD; the drivers or factors influencing their engagement with ESD; and the current actions and activities of ESD especially with regard to the engineering curriculum. This study found no research on the effectiveness of the current practices of engineering curriculum change for sustainable development in Vietnam, and/or how these practices could be improved to address the emerging needs and expectations. This study is an attempt to make a contribution to all these areas.

This research has responded to the need for an empirical study on EESD in Vietnam. The research has provided a systematic view of the stakeholders' understanding, the drivers and influencing factors, as well as the current actions and activities with regard to engineering and higher education for sustainable development. It confirmed the emergence of societal expectations towards graduate engineers and identified a new set of knowledge, skills and values of engineers for sustainable development in Vietnam. The research also uncovered the need for improvement in the relationship between engineering universities and the community of practice that they serve and the call for the engineering education community in Vietnam to engage in the national efforts towards education for sustainable development, especially through a profound change in the engineering curriculum.

Not only providing data to generate understanding on EESD in Vietnam, it was the researcher's intention to document in detail the current understanding and actions for sustainable development of the stakeholder groups. The aim was to provide useful data for future research in the areas of sustainable development and engineering in higher education in Vietnam.

8.3.3. Promoting the transformation of engineering curriculum for sustainable development in Vietnam

Literature review suggests that development interventions that are responsive to the cultural context and the particularities of a place and community, and advance a human-centred approach to development, are believed to be most effective, and likely to yield sustainable, inclusive and equitable outcomes (UNESCO, 2012) . This study argued that a culturally appropriate approach is particularly relevant to change towards sustainable development including higher education for sustainable development for its contribution to accessibility, empowerment and criticality of ESD change effort (see section 1.3.2).

Seeking to improve the contribution of higher education for sustainable development in Vietnam, specifically in the area of engineering education, this study developed the framework to assist the engineering universities in Vietnam in building culturally appropriate strategies to transform the curriculum towards sustainable development (see section 8.2.1). The framework constructed emphasises the need for Vietnamese engineering universities seeking a curriculum transformation for sustainable development to build strategies in response to the need for change in the areas of resource, vision, communication, professional support, motivation and cooperation of ESD. Whilst stating the overall objectives for the strategies, the framework offers a range of key features needed for the strategies to be culturally appropriate in the context of Vietnamese universities and makes explicit the outcomes expected.

The findings of this research have also enabled the generation of practical recommendations for key stakeholder groups seeking to contribute to progressing EESD in Vietnam. In a way, the research follows the acupuncture method, a traditional remedy for health problems in Vietnam: whilst attempting to solve a certain health problem, an acupuncturist looks at the body as a whole with the aim of finding the hot-spots to intervene. Similarly, the research looked at the whole Vietnamese experience on sustainable development and engineering in higher education in order to find the hot-spots concerning the EESD effort happening in Vietnamese universities. The research has identified various actions and changes that key stakeholder groups can take to improve their contribution to EESD in Vietnam (see section 8.2.2).

Finally, the research also contributed to promoting the transformation of engineering curriculum for sustainable development through its engagement of research participants (i.e.

university managers and academic staff) in the implementation process. Within the scope of this research, methodology and activities were designed with a central view, that was, to allow for the opportunity of emancipation and transformation. At the centre of the research methodology and design lied the intention of providing opportunities for the informants, either on individual or group basis or both, to critically reflect and appraise the constructed interpretive accounts (see sections 4.4 and 5.2). As argued by Gallagher (1992), interpretivist research (in education) does not deny the possibility of emancipation and subsequent transformation, because emancipation "is an ongoing process within educational experience, rather than the end result of critical reflection" (p. 272). Especially with the focus of the research, that is to seek transformation for sustainable development, it was assumed and intended that the cyclical process of critical questioning and reflection could lead to change in the participants' perception and, eventually, in their actions beyond the research process.

8.3.4. Methodological contribution to studies in higher education for sustainable development

This research, through the literature review on current examples of engineering curriculum change for sustainable development, has generated an important finding among others. That is, since successful change could be initiated and managed with no single formula approach, either top-down, middle-out or bottom-up (see section 3.4), the success in design and implementation of curriculum change in EESD depends on each institution's characteristics and circumstances, and on the wider context and culture in which it exists and functions. This observation is aligned to those views on the general efforts in ESD in higher education including criticisms of the approach that looks for universal models (Corcoran, Walker, & Wals, 2004), and proposals for consideration of contextual relevance and cultural appropriateness (Fien, 2002). This finding has strengthened the fundamental assumption upon which this research was based (see sections 1.5 and 4.2.1). It emphasises the need for a culturally appropriate approach to change towards sustainable development including in the area of higher education.

In the literature of studies that follow a cultural perspective to research, many researchers use pre-determined frameworks to identify culturally appropriate strategies[119]. In a critical review of

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[119] For example, Dimmock and Walker (2000b), based on the synthesis of the models developed by Hofstede (1991) and Trompenaars and Hampden-Turner (1997), propose a cultural framework which

the literature of organisations in cultural contexts especially the comparative study of national cultures, Cray and Mallory (1998) point out the underlying weaknesses of all the studies as: lacking coherence, lacking a theoretical base, and that the factor analysis and survey methods used are culture-dependent social constructs. Critiques of positivist approaches and the methodology used in understanding societal cultural influences also come from authors such as Dorfman (1996), Lowe et al (2007) and Fang (2005-6). Instead of the common approach in the literature which uses pre-determined cultural frameworks to guide the study into the cultural influences, the study took a grounded and interpretivist approach to research in which generated outcomes are field-based inductive and embedded in the context but at the same time, represent holistic understanding and are transferable (see chapter 4).

8.4. FINAL REFLECTIONS

8.4.1. Challenges and limitations of the research

Undertaking empirical research in Vietnam was a challenging process. It was challenging due to both the general context for research in Vietnam (i.e. lack of documented research and unavailability of data, lack of a culture for research) and the specific issues related to this research (i.e. topic being sensitive during the research time; time constraints; language difference)[120]. Another challenge being faced during the research process was to manage the researcher's own cultural assumptions[121]. Reflexivity was used as a strategy to deal with this issue (see section 5.5.3).

Engaging representatives from different stakeholder groups in stage one and using three in-depth case studies in stage two to generate data raised the first limitation of this study:

- The study recognised that the findings generated from the survey (i.e. stage one) represent the subjective view of the research participants and their contextual settings.

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according to the authors, helps facilitate cultural sensitivity when policy, theory and practice are transported between education systems. Even though defining cultural dimensions as "core axes around which significant sets of values, beliefs and practices cluster", the authors, in agreement with Hofstede's cautionary remarks, note that the proposed framework's dimensions, whilst being tools for analysis, are also constructs that should not be reified (Dimmock & Walker, 2000b, p. 308).

[120] Please refer to chapter 5 where the lessons learnt and the challenges faced during the research process are explained in detail.

[121] Please refer to section 1.6 where this issue is discussed in detail.

The findings provided in-depth insight into the stakeholders' understanding, the drivers and influencing factors, as well as the current actions and activities with regard to engineering and higher education for sustainable development. However, the study did not claim that such insights provide a complete and consistent picture of the EESD experience in Vietnam.

- The study also recognised that the findings of the case study research (i.e. stage two) are context-specific. The case study universities are located in the area of Hanoi and represent the most distinguished engineering universities. In principle, the findings are not able to be generalised as reflecting the situation and characteristic of all Vietnamese engineering universities. As discussed in chapter 4, taking a grounded approach to research and being guided by the interpretivist assumptions, the study sought transferability rather than generalisability. Even though not seeking to provide a prescription or formula for carrying out future change efforts in other institutions or national contexts, the study informed change initiatives elsewhere aimed at a transition towards EESD beyond the case study universities and Vietnamese context. Readers are encouraged to judge this study carefully taking into account the context in which it was framed and the challenges being faced. Academic professionals and university managers interested in this research should identify those insights that can be useful and relevant to their own realities.

The other limitation being faced was that the overall picture captured of current ESD practices as well as the web of cultural influences existed in the case study universities were drawn by few staff who brought to the research their assumptions, values and knowledge regarding the research topic. Not all participants had a full or accurate understanding of sustainable development and ESD issues at their institutions. Their individual cultural outlook and the combination of their understanding of the contextual and cultural influences might not truly reflect the whole cultural realities of the universities. To enhance the validity of the research, the researcher looked to triangulate the data through various data collection techniques such as participant observation, documentary review and informal interaction (see section 5.4).

Specific to this study is the limitation concerning the current higher education context of Vietnam. This research was undertaken at the time when education system including higher

education in Vietnam had been going through a time of crisis. Furthermore, it is suggested that greater experience with a market economy might turn the higher education in Vietnam towards more market-oriented and greater autonomy (Pham T. N., 2010; Harman, Hayden, & Pham, 2010). Changes were expected to happen in all areas of higher education including the governance and management structure, the curriculum and the practice of operation. In this study, the issues and possibilities for change, as well as the contextual and cultural influences over change in Vietnamese engineering universities being identified were for this particular moment in time. Therefore, such findings as well as the strategic responses drawn from them might need to be revisited over time as the contexts change, cultural foundations moderate and new values replace some of those from a previous era. Having said that, it is believed that such changes will come slowly. Whilst this study recommends that the users of the framework take into account the possible change to the system in the future, it is trusted that the framework will remain valuable as a first generation framework which can inform future activities in this area of concern.

Overall, as in other qualitative studies, this study acknowledged the social construction of knowledge. It recognised that the findings were generated by the social interactions among the participants and with the researcher. Similar studies conducted by other researchers in the same or different contexts can potentially generate some different findings. The readers are encouraged to engage with the study and its findings with a critical mind and interrogate the findings of this research with a view to providing alternative exploratory constructs relevant to their own contexts.

8.4.2. Reflection on the use of theories in this research

Deciding to locate the research in the interpretive paradigm and take the grounded approach to research methodology, the researcher understood from the very beginning that there was a need for a theory or theories that would guide her data collection and analysis, clarify her ideas, unify her work, and justify her research role as observer participant, especially during the research stage two. As a novice researcher, the researcher knew that tackling multiple case study research in three Vietnamese universities involved observing and analysing a series of events and a complex web of relationships. The researcher recognised the need for a lens that would help her filter the input and develop a defensible interpretation. For this study, theories, most notable of Goodenough (1981) and Strauss and Corbin (1990, 2008) provided the

researcher with that lens and influenced many aspects of her work. Goodenough's (1981) model of culture and change guided the organisation of the case studies, and the thinking about data analysis and interpretation (see section 4.3.3). Strauss and Corbin (1990, 2008) and other grounded theorists influenced the research on a methodological level by guiding the research design and processes, and data analysis and interpretation (see sections 4.4.1, 5.5.2, and 5.5.5). Both aided the researcher in defending her research role.

Goodenough' s Culture, Language and Society (1981) provided the basis of the organisation of the case studies into three major categories: the social group of Vietnamese engineering universities as a whole, smaller subgroups of participating engineering universities, and the individual informants (i.e. managers and key academic staff) operating within the universities. When reviewing the research on cultural influences in ESD and EESD, it was found that most work discussed higher education institutions as a single culture (Corcoran & Wals, 2004). Because subtle differences exist among universities in Vietnam, the researcher wanted her study to expose the variations in universities at the same time as she described the commonalities of culture in Vietnamese universities. Goodenough's concept of Culture, culture pool and propriospect provided the framework for looking at both the big picture and the subtleties.

When entering the field with the role of an observer participant, the researcher worked to ensure that she was able to collect data that represented all three major categories. When seeking to identify the issues underpinning a transformation of the engineering curriculum for sustainable development at the universities, the guiding questions were also derived directly from Goodenough's theory (1981). By asking the questions of "what is?", "what can be?", "how one feels about it?", "what to do about it?" and "how to go about doing it?", the researcher sought to discover the common understandings on the cultural factors influencing the transformation for EESD in Vietnamese engineering universities. Sections 7.3.2 and 7.3.3 describe the relevant characteristics of the culture pool, and the Framework (*Table 29*) was built from the standards that were understood by members of the culture pool.

The concept of prospriospect was valuable to observation, analysis and description in the case studies. At each university, four or five individuals were chosen to be key informants for the research, who represented the propriospects in the Culture. Using the concept of propriospect, the researcher was able to analyse the operating culture of individuals without being evaluative of the world view. Propriospect was a tool for understanding the partial overlap of viewpoints

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of managers and academic staff from different universities without contradicting the discussions of their different cultural orientations. Because propriospect is a collection of all experiences, informants from each case did share a number of experiences; their propriospects however, were not identical since they each had experiences unique to their universities.

Strauss and Corbin's (1990, 2008) theory influenced the research on a methodological level, which was not surprising when considering the grounded approach that the study took. Starting with a lack of literature on the Vietnamese experience of ESD and EESD, the researcher was drawn to the authors' emphasis on using empirical field research instead of relying on prior concepts or theories. Strauss and Corbin's (1990) concept of emergent design influenced the way the researcher designed her study and undertook the research activities. For both the two research stages, the researcher used the method of purposeful/theoretical sampling and an opportunistic and flexible data collection strategy (see sections 4.4.1 and 5.4.1). The researcher also followed Corbin and Strauss's (2008) guidance on the use of multiple data collection methods for stronger substantiation of constructs and sources for validation. Conciously working to provide interpretations that were grounded in the context, the researcher used the method of constant comparison (Corbin & Strauss, 2008; Glaser & Strauss, 1967; Strauss , 1987) for data analysis (see section 5.5.2).

8.5. FUTURE RESEARCH

Several directions for further work and research emerge from this study. Firstly, this exploratory research project suggests that further research be conducted building upon the findings of this study to value-test the study outcome and report the experience in a systematic manner. This study therefore proposes that universities engage with the framework through a process of action research. Secondly, this study suggests that future research explore other areas in which engineering education can contribute to sustainable development beside teaching and learning. Examples include university management for sustainability or university-business-community partnership for sustainability. Thirdly, whilst this study has identified how the contextual and cultural factors existing at the Vietnamese engineering universities influence change efforts in engineering curriculum for sustainable development, it was limited to the three case study institutions. This study suggests that further study be conducted in other engineering universities in Vietnam to develop theory on change towards engineering education for sustainable development, perhaps using the grounded theory approach. Fourthly, this study has

pointed the role of a cultural perspective in HE change strategies for sustainable development. The recommendation is that research in higher education for sustainable development in other disciplines such as business, health and social care, and transport in Vietnam explore a similar approach to building culturally appropriate strategies for change towards ESD. Finally, in the wider context of international efforts towards EESD, it is recommended that researchers in EESD extend the research beyond the topic of single champions or teams discussing individual initiatives in the subject area. There is a need to focus on systematic documentation of the extent to which engineering education practices have changed towards ESD, as well as on addressing how practice and learning from on institution can become transferable and transformative beyond the context in which the case was developed, both within and across institutions.

8.6. CONCLUDING REMARKS

This chapter has offered the research outcomes, contributions and reflections on building strategies for change towards EESD from a cultural perspective. The chapter has firstly outlined and explained the framework developed by the study to assist Vietnamese universities in this task, and provided a list of practical recommendations for key stakeholder groups seeking contribution to EESD in Vietnam. The chapter also discussed the implications of the study and offered the reflections on the limitation of the research. Finally, the chapter proposed some potential avenues for future research.

The distinctive contribution of this study is that it has addressed the need for empirical research on the EESD in higher education in Vietnam. It has argued for, and contributed to, an emerging international dialogue about how to accelerate progress towards engineering curriculum transformation for sustainable development in different cultural contexts. This research has shown that understanding the cultural values, attitudes and behavioural repertoires existed in the higher education institutions of a specific context has much to offer in improving the contribution of (engineering) higher education to sustainable development. It is hoped that the findings from this study will motivate other ESD researchers and practitioners in Vietnam and in other cultural contexts to use a similar methodological framework. This is because any strategies for change, especially in sustainable development and ESD, cannot be successful without the adequate consideration of the contextual and cultural conditions. It involves understanding the real needs and current situations, and seeking out the contextually relevant and culturally

appropriate solution packages in response to challenging and complex sustainable development issues.

This research does not end here. It is an invitation to the readers, especially those concerning EESD in Vietnam, to further question, extend and act on the findings of this research so as to make a contribution to the transformation of the engineering higher education curriculum for sustainable development in Vietnam.

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APPENDICES

APPENDIX 1. OVERVIEW OF THE VIETNAM HIGHER EDUCATION SYSTEM

Since the early 1990s, there have been landmark commitments made by the Vietnam's Communist Party Central Committee about the importance of education in the social and economic development of country, and to the need for higher education system to be reformed and expanded. The higher education in Vietnam, therefore, has undergone significant changes which result in a number of significant achievements. Under a unified national higher education system since 1993, there is now a more diverse range of institutions and there are far more opportunities for young people to participate in higher education than at any time in Vietnam's past. However, the challenges of poor quality and inadequate infrastructure have signalled the need for further wide-ranging reforms and, ultimately, transformation of the current system. This section seeks to provide an overview of the Vietnam Higher Education system. This includes a review of the development history of the Vietnam Higher Education system since its beginning to present, and an introduction to the current Higher Education system in Vietnam. This section also presents the national agenda for higher education reform, the most important authoritative document at the time of this research, and discusses the challenges and issues associated with this ambitious plan.

The development of the Higher Education System in Vietnam

The fondness for learning, the eagerness for knowledge and the respect for morality in education have been the enduring traits in Vietnam and also, the important traditional Vietnamese values throughout its history. These values have contributed to the shaping of Vietnamese culture and society, and have made education the utmost priority of families and individuals. The beginning of higher education in Vietnam can be traced back to the early eleventh century with the establishment of Quoc Tu Giam – the Imperial Academy, known as the oldest institution of higher education in the Southeast Asia region. Since then until the mid 1980s, under the domination of the Chinese imperial regimes, the French colonisation and the influences of the Soviet model, Vietnam's higher education system had evolved and developed

from a system with a small number of public institutions available to only small and elite groups of people in urban areas, to a system of highly specialised mono-disciplinary institutions modelled after those in the Soviet Union or Eastern Europe. Since its inception, the Vietnamese higher education system has had vast experience of changing under external influences and has developed capacity to seek ways to adapt foreign ideas to Vietnamese context and Vietnamese values (Dang, 2009).

In 1986, a policy of Doi Moi, introduced following the historic decision of the Communist Party of Vietnam to replace central planning in the Soviet tradition with a regulated market economy, has been largely responsible for Vietnam's recent economic success. Under this policy, widespread privatisation of public property, especially in the rural and manufacturing sectors, was sanctioned, and regulatory control on prices and foreign investment were significantly eased. The Doi Moi policy has brought about major changes in every aspect of Vietnamese society, first and foremost in the economy, and many changes in the lives of the Vietnamese. The high economic growth rate and greater openness to foreign trade and investment have led to an increase in social demand for higher education to prepare young people for jobs in new and modern sectors (Dang, 2009; Hayden & Lam, 2010). The government first turned its attention to reform the higher education system in the early 1990s, following the collapse of the socialist systems of the Soviet Union and Eastern Europe. The Soviet model of higher education upon which the system was founded in the late 1950s was largely abandoned. At the same time, documents, books and curricular materials from the West were introduced into Vietnamese Universities as part of an "open door" strategy.

Earlier, under the old Soviet model of thinking, education was conceptualised as a form of social welfare, dependent on economic development for its existence (St. George, 2003). The Soviet model of higher education separated teaching activities from research activities and left the governance of institutions to particular line ministries. Every student received a scholarship while studying and was provided with a job by the state after graduation. This began to change, however, in 1991 with education along with science and technology being considered as a primordial state policy (Pham M. H., 1998). Pham, then Vietnamese Vice-Minister for Education, argues that "it is necessary to do away with the opinion regarding investment for education merely as a kind of welfare fund to which one may allocate at will any amount of money. Investment in education is investment in development, being the fundamental investment in the

socio-economic strategy. Subsequently, especially as from 1991 and since the fourth Plenum of the Party Central Committee (in 1993), the view has become clearer and education is regarded as part of the socio-economic infrastructure" (1998, p. 29).

The fourth Plenum of the Party Central Committee in 1993, mentioned in the quote above by Pham, was considered a landmark for education in Vietnam (St. George, 2010). It was the first time a plenum had been devoted solely to the education sector, and it resulted in a specific resolution "On the continued renovation of education and training". The resolution offered general principles for the development of the education sector, including:

1. education is a priority policy and investment in education is investment in production;
2. develop education to raise the intellectual standard of the people, train manpower and foster talent;
3. link education closely to the developmental needs of the country, and actual progress and ensure continuing education for everyone; and
4. diversify forms of training, ensure the payment of fees and principles of equality (Vietnam Ministry of Education and Training, 1995, p. 402).

The resolution in 1993 has marked a turning point for the education sector in Vietnam and set the stage for the higher education sector in particular. Education policy makers would no longer look to the labour market requirements and the predictions of the Ministry of Planning to make decisions about the shape of the education sector, but 'could argue for investment in education as an investment in development in its own right' (St. George, 2010, p. 37).

The current Higher Education System in Vietnam

Several important changes have occurred since the introduction of Doi Moi and the resolution in 1993, and these have impacted the education sector in many important ways. The Soviet model of small, specialised colleges and institutes was replaced by a unified national system of large, comprehensive, research-oriented universities. The government also allowed public higher education to levy tuition fees, within strict limits, thereby introducing an element of market demand to the provision of higher education. Even more significant was the introduction of two new sectors into the system, a semi-public sector, comprised of state-owned institutions, and a non-public sector, comprised of community-owned institutions, both funded entirely from tuition-fee income.

Since 1993, the system has expanded at a dramatic rate. In 1992-1993, there were 162,000 higher education students in Vietnam, representing a gross enrolment rate of about 2-3 percent (Hayden & Lam, 2010). By 2006-2007, the number of students has increased to 1.54 million, representing a gross enrolment rate of 13 percent (The World Bank, 2008). While the figures indicate a positive trend, it is important to acknowledge that the current rate still falls well below the OECD average, which is now over 50 percent, and is lower than the fast-rising rate of China, currently being 20 percent.

The system has become much more diverse. In 1992-1993, there were 103 higher education institutions, nearly all of which were small, specialised and teaching-only in focus. The largest university of that time had an enrolment of only a little over 3000 students (Sloper & Le, 1995). There was one non-public higher education institution. By 2006-2007, there were 369 higher education institutions, of which 160 were universities, and there were 64 non-public universities and colleges[122]. Six of the public universities had enrolments in 2006 well in excess of 40,000 students, and the average enrolment size of universities was 8,500 students (Hayden & Lam, 2010).

In 1998, the government decreed that higher education programmes could only be undertaken at a designated university or college[123]. This decision helped officially shape the higher education in Vietnam. The government also drew a distinction between degree-granting institutions (universities) and institutions that were restricted to awarding associate degrees (colleges). During the earlier era when the system was influenced by the Soviet model, research training belonged largely to specialist research institutes, and the linkage between teaching and research in the small mono-disciplinary institutions were very limited. The decree in 1998 has marked the major departure from the old model by giving all universities and research institutes the permission, subject to state approval on the basis of satisfying certain criteria, to award degrees at master's and doctoral levels. In 2004, a select group of 14 universities was identified as comprising the "key" higher education institutions in Vietnam[124]. The group included all five universities designated in 1993 as forming the core of a renovated higher education system, and

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[122] See http://moet.gov.vn/?page=11.5&view=930 for details (Vietnam Ministry of Education and Training website)
[123] Decree No. 90/CP dated 2 December 1998
[124] Decision 1269/CP-KG dated 6 September 2004

nine other large universities, several of which had formerly been amalgamated with one or other of the two national universities[125].

There are three broad types of universities in Vietnam, two of which are more traditional forms meaning that they rely on classroom lectures as their principal medium of instruction. The first of this type are the "specialised universities", each of which focuses on a single area of study, such as economics, engineering, fine arts, or law. The second of this type are the "multi-disciplinary universities", including five newly established national and regional universities in some of Vietnam's largest cities. The specialised universities system has been inherited from the era of central planning when higher education was segmented by economic sectors. Although several smaller public institutions have been consolidated into larger multi-disciplinary institutions (national and regional universities), the remaining long-established and large institutions still exist and are considered 'key' alongside the multi-disciplinary ones. The third and newest category of university education in Vietnam is the "open university" system in Hanoi and Ho Chi Minh City. Open universities offer a range of specialties designed for intellectual enrichment, rather than professional development. Students' access to these courses is based on their ability to pay fees, in some cases almost irrespective of the academic credentials. Students who complete the open mode degree receive a graduation diploma but these degrees do not usually have a high status and are not normally accepted for entry to postgraduate programmes.

In Vietnam, the state is the source of all official authority in relation to higher education, even the non-public sector[126]. This authority is exercised through various ministries, some of which have responsibilities across the system, and some of which have line-management responsibilities for individual universities and colleges. Three ministries with responsibilities across the system are the Ministry of Education and Training (MOET), the Ministry of Finance (MOF) and the Ministry of Planning and Investment (MPI). Working within the Office of Government, these ministries participate in advising the government about national policy formulation, national target setting and sectoral financing for higher education. MOET has, in

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[125] In 1993, the two national universities designated by the government were the Vietnam National University of Hanoi and the Vietnam National University of Ho Chi Minh city.
[126] National Assembly, Education Law no. 38/2005/QH11 dated 14 June 2005, Article 14

addition, an important system-wide responsibility for the allocation of enrolment quotas. Quotas apply both to the overall student load of an institution and to the student load within individual programmes of study. This indicates the control of MOET over the rate of growth possible for all higher education institutions and particularly the allocation of block grants and scholarship support to institutions in the public sector. MOET is also responsible for approving curriculum frameworks for all programmes of study across the higher education system. These frameworks prescribe for each specialised study area the necessary objectives, the minimum knowledge requirements, the structural curriculum components and the necessary allocations of time to theory, practice and internship experience (Hayden & Lam, 2010).

Except for the two national universities which report directly to the Cabinet, all public higher education institutions in Vietnam must report to the state through a ministry[127], or through one or other of the provincial governments. During the Soviet period of influence, these institutions were arms of the state bureaucracy, with relevant ministries or provincial governments providing funds and management based on their needs for trained labour. During the early 1990s, an attempt was made to bring these institutions under the control of MOET, but the initiative was only partially successful. MOET currently has direct responsibility for the management of over 50 universities and colleges, including all key universities[128]. Other ministries have smaller numbers of higher education institutions reporting to them. The two national universities operate under charters given directly to them by the government. These universities enjoy special privileges including being given greater academic and financial autonomy and making budgetary decisions without reference to a ministry. They can also choose to depart from the MOET-approved national curriculum frameworks even though in practice, it seems that "they generally conform to these frameworks" (Hayden & Lam, 2010, p. 20).

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[127] Currently, there are thirteen ministries who have line-management responsibilities for public higher education institution.
[128] According to the missions stated on the official website of the Vietnam Ministry of Education and Training http://moet.gov.vn/

Higher Education Reform Agenda and its critiques

Since the Doi Moi process began in 1987, Vietnam has made significant progress in increasing the size and diversity of its higher education system. However, international assessments of the current situation of the system, for example those of the World Bank (2008) and the World Economic Forum (2009), have reported sobering results. Significant deficiencies remain, particularly in the areas of governance, curricula, teaching methods, research capacity, infrastructure and equity of access, etc. (Hayden, 2005a; Pham T. N., 2010).

Recognising a need for further radical reform of the system, in 2005 the government promulgated Resolution 14 on the "Fundamental and Comprehensive Reform of Higher Education in Vietnam 2006-2020" (also known as the Higher Education Reform Agenda, or HERA). HERA presents a vision of what the Vietnam's higher education system should become, and it has, since then, been the most important strategic document, being central to many discussions and workshops on policy making and planning in higher education. The general aim of HERA is expressed as follows:

> "To carry out fundamental and comprehensive reform of higher education; undertake a process of profound renews in the area of the quantity, quality and effectiveness in order to meet all the demands of industrialisation, modernisation, global economic integration and society's demand for learning opportunities. By 2020, Vietnam aims to have a higher education system that is advanced by international standard, highly competitive, and appropriate to the socialist-oriented market mechanism." (HERA, 2005)

Box 1. Main elements of the Vietnam Higher Education Reform Agenda (HERA)

- A sizable expansion of enrolments in higher education, the effect of which will be to increase the gross enrolment rate by 2020 to about 45 percent (three times the present level);

- the development of an enrolment profile by 2020 whereby 20 percent of students attend selective research-oriented institutions, while the rest attend institutions providing professionally oriented training programmes (at present, this distinction exists only in a de facto way);

- a significant increase in the number of qualified higher education staff, sufficient to ensure a staff/student ratio of 1:20 by 2020 (the ratio is currently about 1:30), with at least 35 percent of academic staff having a doctoral qualification (up from 15 percent at present);

- the private sector to be greatly expanded, with enrolments at "non-public" universities and colleges to account for 40 percent of all higher education enrolments by 2020 (up from about 13 percent at present);

- the development of an advanced research and development culture, with research and development activities to account for 25 percent of the higher education system's revenue by 2020 (currently it accounts for less than 2 percent);

- the comprehensive reform of governance and management arrangements, with line-ministry control of public higher education institutions to be replaced by a system of governance within which these institutions have legal autonomy and greater rights in relation to their training programmes, research agendas, human resource management practices and budget plans;

- the renewal, restructuring and internationalisation of the higher education curriculum; and

- the development of a more internationally integrated higher education system, involving more international commitments and agreements, improvements in the teaching and learning of foreign languages (especially English), and the development of conditions favourable to increased foreign investment in the higher education system.

Sources: Vietnam's Higher Education Reform Agenda (HERA), 2005; Harman, Hayden, & Pham, 2010

HERA is believed to face enormous challenges: those relate to the intrinsic difficulty of a relatively poor country with the strong social demand for higher education; and those relate more to aspects of the system that simply do not function effectively (Pham T. N., 2010; Hayden & Lam, 2007; Harman & Nguyen, 2010). While assessing the current situation of the higher education system in Vietnam, in the reports for the World Bank in 2005-2006 (Hayden, 2005a; Hayden, 2005b; Hayden, 2006), Professor Martin Hayden – then the consultant to MOET, groups the major challenges facing Vietnamese Higher Education into four categories: finance, management (governance), quality and equity to access. These challenges were later incorporated as problems and barriers of the Vietnam higher education in the World Bank's comprehensive report "Vietnam: Higher Education and Skills for Growth". With such problems and the current resources, HERA has been criticised for being too ambitious and there have been great doubts over its ability to fulfil all the objectives in due time.

The first problem relates to finance and human resources: The centrally determined structure of funding proves to be inefficient and counterproductive, and the human capacity for teaching and research in serious lack. Higher education institutions are inactive in finding other financial resources, or if they are active, their limited research capacity prevents them from generating significant income. The level of government funding for higher education is small, only 0.41% of GDP in 2002 out of a total of 4.22% of GDP for all levels of education[129]. In terms of expenditure on higher education, Vietnam compares poorly to the rest of the region and the rest of the world (the average is 1.22%) (Dang, 2009). As a result, the system has poorly equipped facilities, lacks sufficient space and has few financial incentives for the development of academic staff or for the renovation of academic programmes (Pham T. N., 2010; Harman & Le, The research role of Vietnam's Universities, 2010). More profoundly, there is a serious lack of sufficient teaching staff. During 20 years of renovation, the number of student increased almost tenfold (from about 135,000 to about 1.4 million) while the number of teaching staff managed only to double. The mismatch explains for the experienced decline in the quality of the system. With the rate of student enrolment currently still below that of other countries in the region (The World Bank, 2008), HERA sets out the target of 45% of gross student enrolment, three times the current rate. The World Bank estimates that in order to meet the above target by 2020, total expenditure on

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[129] The World Bank's report "Vietnam: Higher Education and Skills for Growth"

higher education will have to reach at least 2.34% of GDP. In addition, academic staff numbers, if calculated on the requirement of a student/lecturer ratio not greater than 20, are already short by about 30,000 persons. With existing plans for expansion of the system, 170,000 new academic staff will be required. In reality, it is difficult to see how the funds for such plans might come from, while the National Assembly has on several occasions rejected attempts to raise more funds by increasing tuition fees or by seeking more contributions from the private sector (Pham T. N., 2010). The objectives of HERA, therefore, appear to be unachievable unless the government found far greater sources of funds.

The second problem relates to governance and management. The World Bank has highlighted this centrally planned and vertically organised governance structure as a significant issue, which limits the ability of the higher education system to respond to the needs of the growing market economy (The World Bank, 2008). According to Pham (2010), the efficacy of higher education has been hampered by the resilience of this outmoded and extremely conservative management mechanism. Within the framework of the Higher Education Reform Agenda, the government has made a significant commitment to reform in the way the system is governed. This includes measures to confer legal autonomy on public higher education institutions and to eliminate line-ministry control. More broadly, HERA has signalled that the relationship between the state and the higher education system must change, from one characterised by state control of the system to one characterised by state supervision. Some experts in the field have considered this objective as the most serious challenge for HERA (Dao & Hayden, 2010). Following the establishment of HERA, some initial steps have been taken towards decentralisation in the administration of Vietnam higher education, but the process is slow because of the absence of a clear schedule and the inertia created by the long existence of centralised mechanisms in higher education management (Pham T. N., 2004). At the lower level of governance are the questions about the management capacity and accountability of individual institutions. One could observe that Vietnamese universities have little experience in managing themselves or pursuing their own goals (Hayden & Lam, 2007; Nguyen X. T., 1997), and a severe lack of close links between higher education institutions and scientific research, business, industries and employers persists (Harman & Le, 2010; Fatseas, 2010). Dao and Hayden (2010) argue that most public higher education institutions in Vietnam do not have adequate administrative systems for the purposes of being able to exercise institutional autonomy effectively.

The third problem concerns quality of the higher education system. In addition to the issue related to limited research capacity and lack of academic staff which have been mentioned previously, the technological and administrative infrastructure is widely argued to be inadequate, curricula do not meet the requirements of the society, teaching methods are backward, the level of articulation and global integration is low (Harman, Hayden, & Pham, 2010; Pham M. H., 1998; Nguyen X. T., 1997). There remained much doubt over HERA's objective to improve the quality of the system: Apart from the financial challenges faced in the attempt to enhance both the volume and quality of human resources, there is a lack of properly designed and implemented quality appraisal policies (Harman & Nguyen, 2010; Nguyen & McInnis, 2002). As noted by Nguyen and McInnis (2002, p. 151) "...the lack of incentive results in a reduction of the quality of the work of academics, their dedication, and their performance in general". Quality is also affected by high student/staff ratio. These are high not only by international standards by in comparison with neighbouring Asian nations (The World Bank, 2008). Other threats to quality are the problems of ageing teaching staff (Tran, 1999) and the practice of moonlighting which leaves little time for staff to engage in research and professional development activities (Harman & Nguyen, 2010). The other reasons for the slow progress of renovation have also been the slow-changing mindsets of lecturers and their heavy teaching loads (The World Bank, 2008; Hayden, 2005a; Dang, 2009). Many of the lecturers received their qualifications in former Soviet bloc countries and have had few chances to upgrade their skills. At this time, less than 20 percent of academic staff in Vietnamese higher education had a doctoral degree and only 31 percent a master's degree (Welch, 2007) while HERA's goal is to have 35 and 60 percent respectively in 2020.

The fourth problem relates to equity of access (Hayden, 2005a). Certain groups, such as ethnic minorities, the less socially privileged, and those from particular regional areas (rural and upland), are not presented in higher education proportionately to their numbers in the population. Critical areas of need are identified by Evans and Rorris (2010) as including more educational institutions, more qualified teachers in schools (especially teachers from ethnic backgrounds) and more and better-quality teaching staff in universities. Evans and Rorris also observe that the national policy of decentralising financial autonomy to provincial and institutional levels may be counterproductive in equity terms since poorer regions become less well able to support colleges and universities in the regions. General critique about HERA in this area is that it does not consider inequality as a problem or weakness of the higher education

system in Vietnam (Dang, 2009), and there is no objective in HERA that concerns specifically the issues of equity.

APPENDIX 2. PARTICIPATION INFORMATION AND CONSENT FORM –

STAGE ONE

1. Interviews (in English):

Participant Information and Consent Form

Project Title: **Engineering Education for Sustainable Development in Vietnamese Universities: Building culturally appropriate strategies for transforming the engineering curriculum towards sustainable development**

_____

You are invited to participate in a study about Education for Sustainable Development in Vietnamese Engineering Universities. The key research objectives of the study are:

- To map the current movements towards sustainable development in Vietnam and the implications for engineering education.
- To assess the issues and identify the possibilities for change in engineering education for sustainable development in Vietnamese universities.
- To critically review contextual and cultural factors with a view to understanding the influences over transformation of the engineering curriculum for sustainable development in Vietnamese universities.
- To develop a framework for building culturally appropriate strategies for transforming the engineering curriculum towards sustainable development in Vietnam.

The study is being conducted by Phuong Nguyen (Email: phuongnguyen@connect.glos.ac.uk; Tel: (44) 01242715395) to meet the requirements for the degree of Doctorate of Philosophy (PhD) under the supervision of Professor Daniella Tilbury (Email: dtilbury@glos.ac.uk; Tel: (44) 01242714690), Professor Walid El Ansari (E-mail: walidansari@glos.ac.uk; Tel: (44) 01242715274) and Bland Tomkinson (Email: ctomkinson@glos.ac.uk; Tel: (44) 07745405117) from the University of Gloucestershire, England.

The PhD student would like to seek your kind collaboration as a key informant to specifically inform objective 1 and 2, and part of objective 3. If you decide to participate, you will be asked to join an interview regarding sustainable development and engineering education. This semi-structured interview (with an interview guide of key themes to be investigated) lasts approximately one hour in length. However, please feel free to expand on the topic or talk about related ideas if you wish. If there are any questions you would rather not answer or that you feel uncomfortable answering, please say so and the interview will be stopped or will move to the next questions, whichever you prefer.

The participation in this interview is voluntary. Prior to the interview, the PhD student will explain to you the intents and purposes as well as the social benefits and risks of this research. If you decide to participate, you are free to withdraw from the interview session at any time without having to provide an explanation and without consequence. You also have the right to review, comment on, and/or withdraw information prior to the doctoral thesis submission.

Any information or personal details gathered in the course of the study are strictly confidential. No individual will be identified in any publication of the results. All information will be kept confidential. The interview session will be recorded only if you are happy for the PhD student to do so. Upon completion of this project, all data will be stored in a secure location.

I, ... have read *(or, where appropriate, have had read to me)* and understand the information above and any questions I have asked have been answered to my satisfaction. I agree to participate in this research, knowing that I can withdraw from the research at any time without consequence. I have been given a copy of this form for my own records.

Participant's Name: ....

Participant's Signature: ....   Date: ....

Investigator's Name: PHUONG NGUYEN

Investigator's Signature: .... Date: ....

The ethical aspects of this study have been approved by the University of Gloucestershire. If you have any complaints or reservations about any ethical aspect of your participation in this research, you may contact the Chair of Research Ethics Sub-Committee (RESC) at the University of Gloucestershire (Email: mmaclean@glos.ac.uk; Tel.: (44) 01242715158). Any complaint you make will be treated in confidence and investigated, and you will be informed of the outcome.

(PARTICIPANT/INVESTIGATOR'S COPY)
(delete as appropriate)

This participant information and consent form is available both in English and Vietnamese

2. Interviews (in Vietnamese):

Phiếu thông tin và xác nhận đồng thuận tham gia

Tên đề tài: **Giáo dục Phát triển bền vững trong các trường đại học kỹ thuật công nghệ ở Việt Nam: Xây dựng các chiến lược thích hợp để thay đổi chương trình giảng dạy phục vụ mục tiêu phát triển bền vững.**

_____

Trân trọng kính mời anh/chị tham gia vào nghiên cứu về Giáo dục Phát triển bền vững trong các trường đại học kỹ thuật công nghệ ở Việt Nam. Mục tiêu chính của nghiên cứu bao gồm:

- Điều tra khảo sát các chương trình, hoạt động liên quan đến Phát triển bền vững ở Việt Nam, từ đó xác định những thách thức đối vớ giáo dục trong các ngành kỹ thuật và công nghệ.

- Đánh giá các vấn đề và xác định các cơ hội thực hiện giáo dục Phát triển bền vững trong các trường đại học kỹ thuật và công nghệ ở Việt Nam.

- Xem xét đánh giá các yếu tố bối cảnh và văn hóa tác động đến quá trình thay đổi chương trình giảng dạy về kỹ thuật công nghệ, phục vụ mục tiêu phát triển bền vững trong các trường đại học ở Việt Nam.

- Thiết lập khung hướng dẫn xây dựng các chiến lược thích hợp để thay đổi chương trình giảng dạy phục vụ mục tiêu phát triển bền vững.

Nghiên cứu này do Nghiên cứu sinh Nguyễn Hoàng Ái Phương (Email: phuongnguyen@connect.glos.ac.uk; ĐT: (84) 0916185570) thực hiện trong chương trình nghiên cứu lấy học vị Tiến sỹ, dưới sự hướng dẫn của Giáo sư Daniella Tilbury (Email: dtilbury@glos.ac.uk; ĐT: (44) 01242714690), Giáo sư Walid El Ansari (Email: walidansari@glos.ac.uk; ĐT: (44) 01242715274), và Bland Tomkinson (Email: ctomkinson@glos.ac.uk; ĐT: (44) 07745405117) thuộc trường Đại học Gloucestershire, Vương quốc Anh.

Nghiên cứu sinh rất mong có sự tham gia của anh/chị trong nghiên cứu này. Nếu đồng ý, anh/chị sẽ được mời tham gia một buổi thảo luận (giữa anh/chị và nghiên cứu sinh) nhằm thu thập thông tin cho mục tiêu 1 và 2, và một phần mục tiêu 3 của nghiên cứu. Buổi thảo luận được thiết kế dưới dạng mở trong khoảng thời gian 1 tiếng. Ngoài 1 số câu hỏi chính mà nghiên cứu sinh mong muốn được đề cập, anh/chị có thể mở rộng hoặc nói thêm về các vấn đề liên quan mà anh chị quan tâm. Trong buổi thảo luận, nếu có câu hỏi hoặc chủ đề nào anh/chị không muốn đề cập, anh/chị có thể từ chối trả lời và nghiên cứu sinh sẽ chuyển sang chủ đề tiếp theo, hoặc dừng buổi thảo luận (tùy theo ý muốn của anh/chị).

Việc tham gia vào nghiên cứu này là hoàn toàn tự nguyện. Trước buổi thảo luận, nghiên cứu sinh sẽ cung cấp đầy đủ các thông tin liên quan đến nghiên cứu. Nếu anh/chị đồng ý tham gia, anh/chị có quyền dừng buổi thảo luận bất cứ lúc nào mà không cần đưa ra lời giải thích, cũng như không phải chịu bất cứ trách nhiệm gì. Anh/chị cũng có quyền kiểm tra lại, đưa ra nhận xét hoặc thu hồi lại những thông tin cung cấp trước khi nghiên cứu sinh nộp kết quả nghiên cứu.

Mọi thông tin cá nhân hoặc thông tin liên quan đến nghiên cứu này đều được giữ bí mật tuyệt đối. Kết quả và các xuất bản phẩm của nghiên cứu sẽ không đưa ra danh tính của bất cứ cá nhân nào. Mọi thông tin sẽ được bảo quản và giữ tuyệt mật. Buổi thảo luận sẽ được ghi âm chỉ trong trường hợp có sự đồng ý của anh/chị. Khi nghiên cứu kết thúc, bản ghi âm sẽ được lưu theo quy định về an toàn thông tin.

Tôi, ... đã đọc (hoặc, được nghe đọc) và hiểu rõ những thông tin cung cấp ở trên, và mọi câu hỏi của tôi đã được giải đáp thỏa đáng. Tôi đồng ý tham gia vào nghiên cứu này, với điều kiện tôi được rút khỏi nghiên cứu bất cứ lúc nào và không chịu bất cứ trách nhiệm gì. Tôi đã được nhận bản sao của phiếu đồng thuận này

Tên người tham gia: ....

Chữ ký người tham gia: .... Ngày ký: ....

Nghiên cứu sinh: Nguyễn Hoàng Ái Phương

Chữ ký: .... Ngày ký: ....

Các yếu tố liên quan đến nguyên tắc đạo đức của nghiên cứu này đã được Trường Đại học Gloucestershire thông qua. Nếu anh/chị có điều gì chưa hài lòng hoặc nghi ngờ về vấn đề này, xin liên lạc với Chủ tịch Hội đồng Research Ethics Sub-Committee (RESC) của trường (Email: mmaclean@glos.ac.uk; ĐT: (44) 01242715158). Mọi liên lạc của anh/chị sẽ được giữ bí mật, và các khiếu nại sẽ được giải quyết.

(BẢN SAO CHO NGƯỜI THAM GIA/NGHIÊN CỨU SINH GIỮ)
(xóa phần tên không phù hợp)

Phiếu thông tin và xác nhận đồng thuận tham gia này có cả bản tiếng Anh và tiếng Việt

3. Questionnaires (in English):

Participant Information and Consent Form

Project Title: **Engineering Education for Sustainable Development in Vietnamese Universities: Building culturally appropriate strategies for transforming the engineering curriculum towards sustainable development**

_____

You are invited to participate in a study about Education for Sustainable Development in Vietnamese Engineering Universities. The key research objectives of the study are:

- To map the current movements towards sustainable development in Vietnam and the implications for engineering education.
- To assess the issues and identify the possibilities for change in engineering education for sustainable development in Vietnamese universities.
- To critically review contextual and cultural factors with a view to understanding the influences over transformation of the engineering curriculum for sustainable development in Vietnamese universities.
- To develop a framework for building culturally appropriate strategies for transforming the engineering curriculum towards sustainable development in Vietnam.

The study is being conducted by Phuong Nguyen (Email: phuongnguyen@connect.glos.ac.uk; Tel: (44) 01242715395) to meet the requirements for the degree of Doctorate of Philosophy (PhD) under the supervision of Professor Daniella Tilbury (Email: dtilbury@glos.ac.uk; Tel: (44) 01242714690), Professor Walid El Ansari (E-mail: walidansari@glos.ac.uk; Tel: (44) 01242715274) and Bland Tomkinson (Email: ctomkinson@glos.ac.uk; Tel: (44) 07745405117) from the University of Gloucestershire, England.

The PhD student would like to seek your kind collaboration as a key informant to specifically inform objective 1 and 2, and part of objective 3. If you decide to participate, you will be asked to provide answers to a questionnaire regarding sustainable development and engineering education. The questionnaire consists of open-ended questions and will take approximately 30 minutes to complete. However, please feel free to expand on the topic or talk about related ideas in the space provided at the end of the questionnaire if you wish. If there are any questions you would rather not answer or that you feel uncomfortable answering, please leave the boxes blank and move to the next questions.

The participation in this survey is voluntary. Prior to the survey, the PhD student will explain to you the intents and purposes as well as the social benefits and risks of this research. If you decide to participate, you are free to withdraw from the survey at any time without having to provide an explanation and without consequence. You also have the right to review, comment on, and/or withdraw information prior to the doctoral thesis submission.

Any information or personal details gathered in the course of the study are strictly confidential. No individual will be identified in any publication of the results. All information will be kept confidential. The interview session will be recorded only if you are happy for the PhD student to do so. Upon completion of this project, all data will be stored in a secure location.

I, ... have read *(or, where appropriate, have had read to me)* and understand the information above and any questions I have asked have been answered to my satisfaction. I agree to participate in this research, knowing that I can withdraw from the research at any time without consequence. I have been given a copy of this form for my own records.

Participant's Name: ....

Participant's Signature: .... Date: ....

Investigator's Name: PHUONG NGUYEN

Investigator's Signature: .... Date: ....

The ethical aspects of this study have been approved by the University of Gloucestershire. If you have any complaints or reservations about any ethical aspect of your participation in this research, you may contact the Chair of Research Ethics Sub-Committee (RESC) at the University of Gloucestershire (Email: mmaclean@glos.ac.uk; Tel.: (44) 01242715158). Any complaint you make will be treated in confidence and investigated, and you will be informed of the outcome.

(PARTICIPANT/INVESTIGATOR'S COPY)
(delete as appropriate)

This participant information and consent form is available both in English and Vietnamese

4. Questionnaires (in Vietnamese):

Phiếu thông tin và xác nhận đồng thuận tham gia

Tên đề tài: **Giáo dục Phát triển bền vững trong các trường đại học kỹ thuật công nghệ ở Việt Nam: Xây dựng các chiến lược thích hợp để thay đổi chương trình giảng dạy phục vụ mục tiêu phát triển bền vững.**

_____

Trân trọng kính mời anh/chị tham gia vào nghiên cứu về Giáo dục Phát triển bền vững trong các trường đại học kỹ thuật công nghệ ở Việt Nam. Mục tiêu chính của nghiên cứu bao gồm:

1) Điều tra khảo sát các chương trình, hoạt động liên quan đến Phát triển bền vững ở Việt Nam, từ đó xác định những thách thức đối với giáo dục trong các ngành kỹ thuật và công nghệ.

2) Đánh giá các vấn đề và xác định các cơ hội thực hiện giáo dục Phát triển bền vững trong các trường đại học kỹ thuật và công nghệ ở Việt Nam.

3) Xem xét đánh giá các yếu tố bối cảnh và văn hóa tác động đến quá trình thay đổi chương trình giảng dạy về kỹ thuật công nghệ, phục vụ mục tiêu Phát triển bền vững trong các trường đại học ở Việt Nam.

4) Thiết lập khung hướng dẫn xây dựng các chiến lược thích hợp để thay đổi chương trình giảng dạy phục vụ mục tiêu Phát triển bền vững.

Nghiên cứu này do Nghiên cứu sinh Nguyễn Hoàng Ái Phương (Email: phuongnguyen@connect.glos.ac.uk; ĐT: (84) 0916185570) thực hiện trong chương trình nghiên cứu lấy học vị Tiến sỹ, dưới sự hướng dẫn của Giáo sư Daniella Tilbury (Email: dtilbury@glos.ac.uk; ĐT: (44) 01242714690), Giáo sư Walid El Ansari (Email: walidansari@glos.ac.uk; ĐT: (44) 01242715274), và Bland Tomkinson (Email: ctomkinson@glos.ac.uk; ĐT: (44) 07745405117) thuộc trường Đại học Gloucestershire, Vương quốc Anh.

Nghiên cứu sinh rất mong có sự tham gia của anh/chị trong nghiên cứu này. Nếu đồng ý, anh/chị sẽ được mời tham gia một chương trình điều tra nhằm thu thập thông tin cho mục tiêu 1 và 2 của nghiên cứu. Phiếu điều tra được thiết kế dưới dạng các câu hỏi mở với thời gian trả lời khoảng 30 phút. Anh/chị có thể mở rộng hoặc nói thêm về các vấn đề liên quan mà anh chị quan tâm trong phần cuối của phiếu điều tra. Nghiên cứu sinh rất mong anh/chị sẽ trả lời tất cả các câu hỏi để có kết quả nghiên cứu tốt nhất. Tuy nhiên, nếu có câu hỏi hoặc chủ đề nào anh/chị không muốn đề cập, anh/chị có thể không trả lời và chuyển sang câu hỏi tiếp theo.

Việc tham gia vào nghiên cứu này là hoàn toàn tự nguyện. Trước khi gửi phiếu điều tra, nghiên cứu sinh sẽ cung cấp đầy đủ các thông tin liên quan đến nghiên cứu. Nếu anh/chị đồng ý tham gia, anh/chị có quyền ngừng tham gia chương trình điều tra bất cứ lúc nào mà không cần đưa ra lời giải thích, cũng như không phải chịu bất cứ trách nhiệm gì. Anh/chị cũng có quyền kiểm tra lại, đưa ra nhận xét hoặc thu hồi lại những thông tin cung cấp trước khi nghiên cứu sinh nộp kết quả nghiên cứu.

Mọi thông tin cá nhân hoặc thông tin liên quan đến nghiên cứu này đều được giữ bí mật tuyệt đối. Kết quả và các xuất bản phẩm của nghiên cứu sẽ không đưa ra danh tính của bất cứ cá nhân hay tổ chức nào. Mọi thông tin sẽ được bảo quản và giữ tuyệt mật. Phiếu điều tra sẽ được lưu và bảo quản theo quy định về an toàn thông tin.

_____

Tôi, ... đã đọc (hoặc, được nghe đọc) và hiểu rõ những thông tin cung cấp ở trên, và mọi câu hỏi của tôi đã được giải đáp thỏa đáng. Tôi đồng ý tham gia vào nghiên cứu này, với điều kiện tôi được rút khỏi nghiên cứu bất cứ lúc nào và không chịu bất cứ trách nhiệm gì. Tôi đã được nhận bản sao của phiếu đồng thuận này

Tên người tham gia: ....

Chữ ký người tham gia: .... Ngày ký: ....

Nghiên cứu sinh: Nguyễn Hoàng Ái Phương

Chữ ký: .... Ngày ký: ....

Các yếu tố liên quan đến nguyên tắc đạo đức của nghiên cứu này đã được Trường Đại học Gloucestershire thông qua. Nếu anh/chị có điều gì chưa hài lòng hoặc nghi ngờ về vấn đề này, xin liên lạc với Chủ tịch Hội đồng Research Ethics Sub-Committee (RESC) của trường (Email: mmaclean@glos.ac.uk; ĐT: (44) 01242715158). Mọi liên lạc của anh/chị sẽ được giữ bí mật, và các khiếu nại sẽ được giải quyết.

(BẢN SAO CHO NGƯỜI THAM GIA/NGHIÊN CỨU SINH GIỮ)
(xóa phần tên không phù hợp)

Phiếu thông tin và xác nhận đồng thuận tham gia này có cả bản tiếng Anh và tiếng Việt

APPENDIX 3. PARTICIPATION INFORMATION AND CONSENT FORM –

STAGE TWO

1. English version:

Participant Information and Consent Form

Project Title: **Engineering Education for Sustainable Development in Vietnamese Universities: Building culturally appropriate strategies for transforming the engineering curriculum towards sustainable development**

_____

You are invited to participate in a study about Education for Sustainable Development in Vietnamese Engineering Universities. The key research objectives of the study are:

- To map the current movements towards sustainable development in Vietnam and the implications for engineering education.
- To assess the issues and identify the possibilities for change in engineering education for sustainable development in Vietnamese universities.
- To critically review contextual and cultural factors with a view to understanding the influences over transformation of the engineering curriculum for sustainable development in Vietnamese universities.
- To develop a framework for building culturally appropriate strategies for transforming the engineering curriculum towards sustainable development in Vietnam.

The study is being conducted by Phuong Nguyen (Email: phuongnguyen@connect.glos.ac.uk; Tel: (44) 01242715395) to meet the requirements for the degree of Doctorate of Philosophy (PhD) under the supervision of Professor Daniella Tilbury (Email: dtilbury@glos.ac.uk; Tel: (44) 01242714690), Professor Walid El Ansari (E-mail: walidansari@glos.ac.uk; Tel: (44) 01242715274) and Bland Tomkinson (Email: ctomkinson@glos.ac.uk; Tel: (44) 07745405117) from the University of Gloucestershire, England.

The PhD student would like to seek your kind collaboration as a key informant to specifically inform objective 2 and 3, and part of objective 4. If you decide to participate, you will be asked to join a series of research activities which include individual interviews, informal conversations, focus groups and groups discussions. The research activities will take place from end of April to beginning of July 2011. Specific dates and times for the activities will be negotiated and set to ensure convenience for you and all the other informants.

The participation in this research is voluntary. Prior to the research activities, the PhD student will explain to you the intents and purposes as well as the social benefits and risks of this research. If you decide to participate, you are free to withdraw from the research process at any time without having to provide an explanation and without consequence. You also have the right to review, comment on, and/or withdraw information prior to the doctoral thesis submission.

Any information or personal details gathered in the course of the study are strictly confidential. No individual will be identified in any publication of the results. All information will be kept confidential. The interview, and group discussion sessions will be recorded only if you are happy for the PhD student to do so. Upon completion of this project, all data will be stored in a secure location.

I, ... have read *(or, where appropriate, have had read to me)* and understand the information above and any questions I have asked have been answered to my satisfaction. I agree to participate in this research, knowing that I can withdraw from the research at any time without consequence. I have been given a copy of this form for my own records.

Participant's Name: ....

Participant's Signature: .... Date: ....

Investigator's Name: PHUONG NGUYEN

Investigator's Signature: .... Date: ....

The ethical aspects of this study have been approved by the University of Gloucestershire. If you have any complaints or reservations about any ethical aspect of your participation in this research, you may contact the Chair of Research Ethics Sub-Committee (RESC) at the University of Gloucestershire (Email: mmaclean@glos.ac.uk; Tel.: (44) 01242715158). Any complaint you make will be treated in confidence and investigated, and you will be informed of the outcome.

(PARTICIPANT/INVESTIGATOR'S COPY)
(delete as appropriate)

This participant information and consent form is available both in English and Vietnamese

2. Vietnamese version:

Phiếu thông tin và xác nhận đồng thuận tham gia

Tên đề tài: **Giáo dục Phát triển bền vững trong các trường đại học kỹ thuật công nghệ ở Việt Nam: Xây dựng các chiến lược thích hợp để thay đổi chương trình giảng dạy phục vụ mục tiêu phát triển bền vững.**

_____

Trân trọng kính mời anh/chị tham gia vào nghiên cứu về Giáo dục Phát triển bền vững trong các trường đại học kỹ thuật công nghệ ở Việt Nam. Mục tiêu chính của nghiên cứu bao gồm:

- Điều tra khảo sát các chương trình, hoạt động liên quan đến Phát triển bền vững ở Việt Nam, từ đó xác định những thách thức đối vớ giáo dục trong các ngành kỹ thuật và công nghệ.

- Đánh giá các vấn đề và xác định các cơ hội thực hiện giáo dục Phát triển bền vững trong các trường đại học kỹ thuật và công nghệ ở Việt Nam.

- Xem xét đánh giá các yếu tố bối cảnh và văn hóa tác động đến quá trình thay đổi chương trình giảng dạy về kỹ thuật công nghệ, phục vụ mục tiêu phát triển bền vững trong các trường đại học ở Việt Nam.

- Thiết lập khung hướng dẫn xây dựng các chiến lược thích hợp để thay đổi chương trình giảng dạy phục vụ mục tiêu phát triển bền vững.

Nghiên cứu này do Nghiên cứu sinh Nguyễn Hoàng Ái Phương (Email: phuongnguyen@connect.glos.ac.uk; ĐT: (84) 0916185570) thực hiện trong chương trình nghiên cứu lấy học vị Tiến sỹ, dưới sự hướng dẫn của Giáo sư Daniella Tilbury (Email: dtilbury@glos.ac.uk; ĐT: (44) 01242714690), Giáo sư Walid El Ansari (Email: walidansari@glos.ac.uk; ĐT: (44) 01242715274), và Bland Tomkinson (Email: ctomkinson@glos.ac.uk; ĐT: (44) 07745405117) thuộc trường Đại học Gloucestershire, Vương quốc Anh.

Nghiên cứu sinh rất mong có sự tham gia của anh/chị trong nghiên cứu này. Nếu đồng ý, anh/chị sẽ được mời tham gia các hoạt động nghiên cứu nhằm thu thập thông tin cho mục tiêu 2 và 3, và một phần mục tiêu 4 của nghiên cứu. Các hoạt động bao gồm: phỏng vấn trực tiếp, các buổi nói chuyện mở, và thảo luận nhóm, diễn ra trong khoảng từ cuối tháng 4 đến đầu tháng 11 năm 2011. Thời gian cụ thể cho các hoạt động này sẽ được thống nhất và lựa chọn để phù hợp với khung thời gian của anh/chị.

Việc tham gia vào nghiên cứu này là hoàn toàn tự nguyện. Trước các hoạt động nghiên cứu, nghiên cứu sinh sẽ cung cấp đầy đủ các thông tin liên quan. Nếu anh/chị đồng ý tham gia, anh/chị có quyền dừng các buổi thảo luận bất cứ lúc nào mà không cần đưa ra lời giải thích, cũng như không phải chịu bất cứ trách nhiệm gì. Anh/chị cũng có quyền kiểm tra lại, đưa ra nhận xét hoặc thu hồi lại những thông tin cung cấp trước khi nghiên cứu sinh nộp kết quả nghiên cứu.

Mọi thông tin cá nhân hoặc thông tin liên quan đến nghiên cứu này đều được giữ bí mật tuyệt đối. Kết quả và các xuất bản phẩm của nghiên cứu sẽ không đưa ra danh tính của

bất cứ cá nhân nào. Mọi thông tin sẽ được bảo quản và giữ tuyệt mật. Các buổi thảo luận, phỏng vấn sẽ được ghi âm chỉ trong trường hợp có sự đồng ý của anh/chị. Khi nghiên cứu kết thúc, bản ghi âm sẽ được lưu theo quy định về an toàn thông tin.

Tôi, ... đã đọc (hoặc, được nghe đọc) và hiểu rõ những thông tin cung cấp ở trên, và mọi câu hỏi của tôi đã được giải đáp thỏa đáng. Tôi đồng ý tham gia vào nghiên cứu này, với điều kiện tôi được rút khỏi nghiên cứu bất cứ lúc nào và không chịu bất cứ trách nhiệm gì. Tôi đã được nhận bản sao của phiếu đồng thuận này

Tên người tham gia: ....

Chữ ký người tham gia: .... Ngày ký: ....

Nghiên cứu sinh: Nguyễn Hoàng Ái Phương

Chữ ký: .... Ngày ký: ....

Các yếu tố liên quan đến nguyên tắc đạo đức của nghiên cứu này đã được Trường Đại học Gloucestershire thông qua. Nếu anh/chị có điều gì chưa hài lòng hoặc nghi ngờ về vấn đề này, xin liên lạc với Chủ tịch Hội đồng Research Ethics Sub-Committee (RESC) của trường (Email: mmaclean@glos.ac.uk; ĐT: (44) 01242715158). Mọi liên lạc của anh/chị sẽ được giữ bí mật, và các khiếu nại sẽ được giải quyết.

(BẢN SAO CHO NGƯỜI THAM GIA/NGHIÊN CỨU SINH GIỮ)
(xóa phần tên không phù hợp)

Phiếu thông tin và xác nhận đồng thuận tham gia này có cả bản tiếng Anh và tiếng Việt

1. English version:

Questionnaire for Vietnamese Engineering Companies

(*CONFIDENTIAL*)

This survey, which is a part of Phuong Nguyen's PhD research, will produce findings about (1) the current movements towards sustainable development in Vietnam and the implications for Vietnamese engineering education; and
(2) the issues and possibilities for change in engineering education for sustainable development in Vietnamese universities.

Please complete the following questions. If you wish to comment on any questions, or provide any feedback that may be relevant and aid me in my study, please use the space provided on the last page. Please be assured that any information or personal details gathered in this survey are strictly confidential.

Your help is very much appreciated. Thank you very much.

Return of the Questionnaire or any inquiries, please contact:

Miss Phuong Nguyen

Telephone: +84 (0) 916185570

Email: phuongnguyen@connect.glos.ac.uk

(This questionnaire is available in both English and Vietnamese)

SECTION 1 – GENERAL INFORMATION ABOUT YOUR COMPANY AND YOURSELF

	YOUR COMPANY	
1	What engineering sector is your company in?	
2	What are your company's main products and services?	
3	Is your company a member of any engineering associations? If yes, please specify.	
	YOURSELF	
4	What is your position in the company?	
5	How long have you been with the company? (number of years)	
6	What is your background (e.g., engineering, business management)? What is your qualification?	

SECTION 2 – YOUR COMPANY'S COMMITMENT TO SUSTAINABLE DEVELOPMENT

Question 1: What are the key policy documents and initiatives related to sustainable development in Vietnam which are relevant to your business?
Answer:
Question 2: The Vietnamese Government, at the 9th Congress of the National Communist Party of Vietnam in 2001, established the national development goal as 'fast, efficient and sustainable development which ensures economic growth, social advancement and equality, and environment conservation'. **How does your company contribute to sustainable development in Vietnam?**
Answer:
Question 3: Is there a vision for sustainable development in the company's strategy? If so, how is this vision expressed and implemented?

Answer:

SECTION 3 – IMPLICATIONS FOR ENGINEERING EDUCATION

Question 4: What knowledge and understanding of sustainable development does your company look for in its engineering staff/employees?

Answer:

Question 5: What are the skills for sustainable development your company looks for in its engineering staff/employees?

Answer:

Question 6: How can the knowledge and skills identified in questions 4 and 5 help deliver your company's vision for sustainable development, and improve its products and services?

Answer:

Question 7: How would you rate the current knowledge and skills for sustainable development of your engineering staff/employees?

Answer:

Question 8: How would you suggest engineering education be improved to better address your company's needs?

Answer:

ADDITIONAL QUESTION:

Which of the following knowledge and skills for sustainable development do you consider to be most important to your company? (Please tick the appropriate boxes)

☐ Environmental pollution issues (e.g., Air pollution, Solid waste, Wastewater)

☐ Biodiversity   ☐ Climate change

☐ Depletion of Natural Resources   ☐ Ecosystems

☐ Environmental legislation, policy and standards (e.g., Environmental law, ISO 14001)

☐ Clean technology   ☐ Industrial ecology

☐ Life cycle assessment/analysis (LCA)   ☐ Clean Development Mechanism
(CDM)

☐ Social responsibility   ☐ Precautionary principle

☐ Components of Sustainable Development   ☐ Stakeholders' participation

☐ Systems thinking   ☐ Futures thinking

☐ Critical thinking   ☐ Ethical issues

☐   Others (please specify):

SECTION 4 – YOUR FURTHER COMMENTS AND FEEDBACK

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THANK YOU VERY MUCH! Your contribution to this survey is very greatly appreciated.

Please return your questionnaire to Phuong Nguyen via email
(phuongnguyen@connect.glos.ac.uk)

A copy of the report compiled from this survey will be sent to all participating companies upon request.

2. Vietnamese version:

Phiếu điều tra dành cho các doanh nghiệp Việt Nam

(TUYỆT MẬT)

Trân trọng kính mời anh/chị tham gia vào điều tra về Giáo dục vì sự phát triển bền vững các ngành công nghiệp Việt Nam. Mục tiêu chính của điều tra bao gồm:

- Khảo sát các chương trình, hoạt động liên quan đến Phát triển bền vững các ngành công nghiệp ở Việt Nam, và xác định những thách thức đối với giáo dục trong các ngành kỹ thuật và công nghệ.

- Đánh giá các vấn đề và xác định các cơ hội thực hiện giáo dục Phát triển bền vững cho các kỹ sư và cán bộ kỹ thuật của Việt Nam.

Mời anh/chị trả lời các câu hỏi trong phiếu điều tra này. Nếu anh/chị có ý kiến bổ sung hay đóng góp thêm cho nghiên cứu, xin dùng trang cuối của phiếu. Mọi thông tin cung cấp, các thông tin về cá nhân và doanh nghiệp sẽ được giữ bí mật tuyệt đối.

Xin chân thành cảm ơn sự tham gia quý báu của anh/chị.

Xin gửi lại phiếu này trước ngày 04/12/2010. Mọi thông tin liên hệ:

Nguyễn Hoàng Ái Phương

Điện thoại: +84 (0) 916185570

Email: phuongnguyen@connect.glos.ac.uk

(Phiếu điều tra này có cả bản tiếng Việt và tiếng Anh)

PHẦN 1 – THÔNG TIN CHUNG VỀ CÔNG TY VÀ CÁ NHÂN ANH/CHỊ

	CÔNG TY	
1	Công ty của anh/chị thuộc nhóm ngành công nghiệp gì?	
2	Các sản phẩm/dịch vụ chính của công ty?	
3	Công ty của anh/chị có là thành viên của hiệp hội hay tổ chức nào không? Nếu có, xin ghi rõ tên.	
	CÁ NHÂN	
4	Vị trí của anh/chị trong công ty?	
5	Thời gian công tác của anh/chị tại công ty? (số năm làm việc)	
6	Chuyên môn của anh/chị (ví dụ, kỹ thuật, quản lý, kinh tế…)? Bằng cấp chuyên môn (Cử nhân, kỹ sư, thạc sỹ, tiến sỹ)?	

PHẦN 2 – CAM KẾT CỦA CÔNG TY ĐỐI VỚI PHÁT TRIỂN BỀN VỮNG

Câu hỏi 1: Liên quan đến Phát triển bền vững ở Việt Nam, anh/chị có thể cho biết các văn bản pháp lý, chính sách, chương trình và dự án có liên quan/tác động trực tiếp đến hoạt động của công ty?
Trả lời:
Câu hỏi 2: Tại đại hội Đảng lần thứ IX năm 2001, Đảng và Nhà nước đã khẳng định mục tiêu phát triển kinh tế xã hội của Việt Nam là "phát triển nhanh, hiệu quả và bền vững, tăng trưởng kinh tế đi đôi với thực hiện tiến bộ, công bằng xã hội và bảo vệ môi trường". **Ở cấp độ công ty, công ty của anh/chị có các chương trình và hoạt động cụ thể gì để góp phần vào việc thực hiện mục tiêu phát triển này ở Việt Nam?**
Trả lời:
Câu hỏi 3: Công ty có xác định tầm nhìn/định hướng chiến lược cho phát triển bền vững không? Nếu có, tầm nhìn/định hướng này được cụ thể hóa trong chiến lược kinh doanh như thế nào và thực hiện ra sao?

Trả lời:

PHẦN 3 – THÁCH THỨC ĐỐI VỚI GIÁO DỤC TRONG NGÀNH KỸ THUẬT CÔNG NGHỆ

Câu hỏi 4: Hãy cho biết những <u>kiến thức và hiểu biết</u> về phát triển bền vững mà công ty mong muốn từ các cán bộ kỹ thuật/kỹ sư của mình?

Trả lời:

Câu hỏi 5: Hãy cho biết những <u>kỹ năng</u> phục vụ phát triển bền vững mà công ty mong muốn từ các cán bộ kỹ thuật/kỹ sư của mình?

Trả lời:

Câu hỏi 6: Các kiến thức và kỹ năng nói trên giúp ích như thế nào cho công ty trong việc thực hiện chiến lược phát triển bền vững, và nâng cao chất lượng sản phẩm/dịch vụ của công ty?

Trả lời:

Câu hỏi 7: Anh/chị đánh giá thế nào về mức độ hiểu biết và kỹ năng cho phát triển bền vững của các cán bộ kỹ thuật/kỹ sư trong công ty hiện nay?

Trả lời:

Câu hỏi 8: Anh/chị có gợi ý gì cho giáo dục đại học ngành kỹ thuật và công nghệ để đáp ứng tốt hơn các nhu cầu của công ty?

Trả lời:

CÂU HỎI PHỤ:

Hãy lựa chọn trong danh sách dưới đây những kiến thức và kỹ năng của các cán bộ kỹ thuật/kỹ sư mà anh/chị cho là quan trọng nhất đối với công ty của anh/chị (ngoài kiến thức chuyên môn)? (Đánh dấu vào các ô phù hợp)

☐ Các vấn đề liên quan đến ô nhiễm môi trường (ví dụ, ô nhiễm không khí, chất thải rắn, nước thải)

☐ Đa dạng sinh học ☐ Biến đổi khí hậu

☐ Suy giảm tài nguyên thiên nhiên ☐ Hệ sinh thái

☐ Luật, quy định, chính sách và tiêu chuẩn môi trường (ví dụ, Luật bảo vệ MT, ISO 14001)

☐ Công nghệ sạch ☐ Sinh thái công nghiệp

☐ Phân tích/đánh giá dòng đời sản phẩm (LCA) ☐ Cơ chế phát triển sạch (CDM)

☐ Trách nhiệm xã hội ☐ Nguyên tắc phòng ngừa

☐ Các yếu tố cấu thành phát triển bền vững quan ☐ Sự tham gia của các bên liên

☐ Tư duy/Suy nghĩ hệ thống ☐ Tư duy tương lai/dài hạn

☐ Tư duy logic/phản biện (critical thinking) nghiệp   ☐ Các vấn đề đạo đức nghề

☐ An toàn sức khỏe nghề nghiệp

☐ Khác (xin ghi rõ):

PHẦN 4 – CÁC Ý KIẾN, GÓP Ý VÀ PHẢN HỒI

Xin chân thành cảm ơn sự hợp tác quý báu của anh/chị!

Xin gửi phiếu điều tra này về địa chỉ phuongnguyen@connect.glos.ac.uk

Để nhận được báo cáo kết quả của điều tra, xin anh chị ghi rõ yêu cầu này trong email.

APPENDIX 5. INTERVIEW AGENDA FOR THE GOVERNMENTAL AND NON-GOVERNMENTAL ORGANISATIONS – STAGE ONE

1. English version:

Proposed Agenda of the Interview

(<u>CONFIDENTIAL</u>)

This interview, which is a part of Phuong Nguyen's PhD research, will produce findings about: (1) the current movements towards sustainable development in Vietnam and the implications for Vietnamese engineering education; (2) the issues and possibilities for change in engineering education for sustainable development in Vietnamese universities; and (3) the contextual and cultural factors as influences over the transformation of engineering curriculum for sustainable development.

The agenda of the interview is proposed as follows:

1. The PhD student introduces the research and provides any clarifications, if required.
2. The participant provides information about the organisation and the participant's background and role.
3. The main part of the interview seeks to cover the following main themes: The organisation's vision for Sustainable Development in Vietnam and the current movements; practicalities of decision making and implementation of sustainable development activities/projects; the challenges and envisioning future; implications for engineering education and the influencing factors.
4. Further ideas and comments.

Any information or personal details gathered in the course of the study are strictly confidential. No individual will be identified in any publication of the results. The interview session will be audio-recorded upon your agreement.

Your help is very much appreciated. Thank you very much.

Any inquiries please contact:

Miss Phuong Nguyen

Telephone: +84 (0) 916185570; Email: phuongnguyen@connect.glos.ac.uk

(This interview agenda is available in both English and Vietnamese)

2. Vietnamese version:

Đề xuất nội dung buổi thảo luận

(MẬT)

Trân trọng kính mời anh/chị tham gia buổi thảo luận (giữa anh/chị và nghiên cứu sinh) với những nội dung chính như sau:

1. Nghiên cứu sinh giới thiệu về nghiên cứu và giải đáp các thắc mắc, nếu có.
2. Anh/chị cung cấp các thông tin về cơ quan/tổ chức của anh/chị, và các thông tin cá nhân liên quan đến vai trò của anh/chị trong tổ chức.
3. Phần chính của buổi thảo luận sẽ tập trung vào các nội dung: tầm nhìn/chiến lược phát triển bền vững (PTBV) của tổ chức, và các chương trình, hoạt động liên quan đến PTBV của tổ chức; quá trình ra quyết định và việc triển khai các chương trình, hoạt động này; thách thức khó khăn, và kế hoạch trong tương lai; thách thức đối với giáo dục trong các ngành kỹ thuật và công nghệ, và các yếu tố (bối cảnh, văn hóa) tác động đến quá trình thay đổi chương trình giảng dạy, phục vụ mục tiêu phát triển bền vững trong các trường đại học kỹ thuật công nghệ Việt Nam.
4. Các nội dung quan tâm khác, và các ý kiến đóng góp.

Mọi thông tin cá nhân hoặc thông tin liên quan đến nghiên cứu này đều được giữ bí mật tuyệt đối. Kết quả và các xuất bản phẩm của nghiên cứu sẽ không đưa ra danh tính của bất cứ cá nhân hay tổ chức nào. Buổi thảo luận sẽ được ghi âm khi có sự đồng ý của anh/chị. Khi nghiên cứu kết thúc, bản ghi âm sẽ được lưu theo quy định về an toàn thông tin.

Xin chân thành cảm ơn sự tham gia quý báu của anh/chị.

Mọi thông tin liên hệ:

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(Bản đề xuất nội dung buổi thảo luận này có cả bản tiếng Việt và tiếng Anh)

APPENDIX 6. INTERVIEW AGENDA FOR THE ENGINEERING UNIVERSITIES –

STAGE ONE

The agenda was initially developed to be used as a questionnaire for the university managers. When the decision to replace questionnaire by direct interview was made, the questionnaire was used to guide the interviews. The content of the questionnaire is presented below:

SECTION 1 – GENERAL INFORMATION ABOUT YOUR UNIVERSITY AND YOURSELF

	YOUR UNIVERSITY	
1	What engineering disciplines does your university specialise in?	
2	What is the total number of students at your university? How many are engineering students?	
3	Is your university a member of any associations? If yes, please specify.	
	YOURSELF	
4	What is your position in the university?	
5	How long have you been with the university? (number of years)	
6	What is your background (e.g., engineering, management)?	

SECTION 2 – YOUR UNIVERSITY'S COMMITMENT TO SUSTAINABLE DEVELOPMENT

Question 1: What are the key policy documents and initiatives related to sustainable development in Vietnam which are relevant to your university?
Answer:
Question 2: The Vietnamese Government, at the 9th Congress of the Vietnam National Communist Party in 2001, established the national development goal as 'fast, efficient and sustainable development which ensures economic growth, social advancement and equality, and environment conservation'. **How does your university contribute to sustainable development?**
Answer:
Question 3: In 2005, UNESCO launched the Decade of Education for Sustainable Development (UNDESD) 2005 -2014 and since then, the Vietnamese government has expressed a high level political commitment in the implementation of UNDESD. The National Committee for the Decade highlighted the need to 'integrate sustainable development elements into education system at all levels in order to encourage changes in behaviour for a more sustainable future for all' (Action Plan of ESD for 2010-2014). **How does your university contribute to Education for Sustainable Development in Vietnam?**
Answer:
Question 4: Is there a vision for sustainable development in the university's key documents and strategies? If yes, please describe.

Answer:

SECTION 3 – TEACHING AND LEARNING FOR SUSTAINABLE DEVELOPMENT IN THE INSTITUTION

Question 5: Does the university's teaching and learning policy/framework/strategy include reference to Education for Sustainable Development? Please specify how.

Answer:

Question 6: Where and how in the curriculum do students learn about sustainable development in engineering courses at your university?

Answer:

Question 7: What are the issues/themes of sustainable development being taught in engineering courses at your university? What are the pedagogical approaches being used?

Answer:

Question 8: How much autonomy do teaching staff have in setting the engineering curriculum? Do opportunities exist for teaching staff to integrate sustainable development into the current engineering curriculum?

Answer:

Question 9: Do opportunities to link real-life industrial businesses/engineering practices with engineering curriculum development exist? If yes, please specify how.

Answer:

SECTION 4 – CURRENT ACTIVITIES AND THE CHALLENGES

Question 10: What current activities related to education for sustainable development in the engineering departments exist across your university? What opportunities do they offer?

Answer:

Question 11: What are the difficulties and challenges faced by these activities?

Answer:

Question 12: How could the curriculum development to enhance Education for Sustainable Development be best supported?
Answer:

SECTION 5 - YOUR FURTHER COMMENTS AND FEEDBACK

APPENDIX 7. LIST OF INTERVIEWS AND QUESTIONNAIRES – STAGE ONE

1. Interviews:

Interview number	Date of interview	Informant's organisation group
1	20/05/2010	IDAs
2	21/05/2010	Governmental authority
3	25/10/2010	Governmental authority
4	27/10/2010	Engineering university
5	28/10/2010	Education organisation
6	29/10/2010	NGOs
7	03/11/2010	Education organisation
8	05/11/2010	NGOs
9	05/11/2010	IDAs
10	05/11/2010	Governmental authority
11	10/11/2010	Governmental authority
12	10/11/2010	Governmental authority
13	12/11/2010	Engineering companies (Oil and gas industry)

14	12/11/2010	Engineering universities
15	19/11/2010	IDAs
16	19/11/2010	IDAs
17	30/11/2010	Engineering universities
18	30/11/2010	Engineering universities
19	30/11/2010	Engineering universities
20	30/11/2010	Governmental authority
21	02/12/2010	Engineering universities
22	07/12/2010	Governmental authority
23	15/12/2010	Engineering universities
24	15/12/2010	Engineering universities
25	15/12/2010	Engineering universities
26	17/12/2010	IDAs
27	17/12/2010	NGOs
28	17/12/2010	Governmental authority
29	06/01/2011	Governmental authority
30	10/01/2011	Engineering universities

31	10/01/2011	Engineering universities
32	10/01/2011	Engineering universities

2. Questionnaires:

Questionnaire Number	Date of Receipt	Industry
1	28/10/2010	Textile
2	05/11/2010	Consumer goods
3	12/11/2010	Food processing
4	29/11/2010	Automobile
5	04/12/2010	Electronics
6	07/12/2010	Petrol
7	09/12/2010	Construction materials
8	20/12/2010	Cosmetics/Chemical products

APPENDIX 8. INFORMATION OF THE RESEARCH INFORMANTS –
STAGE TWO

Informant (pseudonym)	Case study (University)	Position at the university	Time with university	Engagement with the research
1A	1	Former Director of Department/ Key lecturer	30 years	1 initial meeting; 1 group discussion; 1 interview; 1 conversation
1B	1	Head of Subject group/ Key lecturer	20 years	1 initial meeting; 2 group discussions; 2 interviews
1C	1	Head of Subject group/ Key lecturer	12 years	1 initial meeting; 2 group discussions; 1 interview, 1 conversation
1D	1	Young lecturer/ Researcher	5 years	1 initial meeting; 2 group discussions; 2 interviews
2A	2	Young lecturer	5 years	1 initial meeting; 1 group discussion, 1 focus group; 2 interviews
2B	2	Young lecturer	4 years	1 initial meeting; 1 group discussion, 1 focus group; 1 interview; 1 conversation
2C	2	Deputy Director of Department/ Key lecturer	17 years	1 initial meeting; 1 group discussion, 1 focus group; 1 interview; 1 conversation

2D	2	Head of faculty/ Key lecturer	26 years	1 initial meeting; 1 focus group; 1 interview, 1 conversation
2E	2	Young lecturer/ Researcher	6 years	1 initial meeting; 1 group discussion, 1 focus group; 2 interviews; 1 conversation
3A	3	Deputy Director of Department/ Key lecturer	21 years	1 initial meeting; 1 group discussion, 1 focus group; 2 interviews
3B	3	Young lecturer	7 years	1 initial meeting; 1 group discussion, 1 focus group; 2 interviews; 1 conversation
3C	3	Director of Department/ Key lecturer	24 years	1 initial meeting; 1 group discussion; 1 interview; 1 conversation
3D	3	Deputy Director of Department/ Key lecturer	15 years	1 initial meeting; 1 focus group; 2 interviews
3E	3	Young lecturer	3 years	1 initial meeting; 1 group discussion, 1 focus group; 1 interview; 1 conversation

APPENDIX 9. LIST OF RESEARCH ACTIVITIES – STAGE TWO

1. Interviews and Individual Conversations:

Interview/Conversation	Informant	Date
Int. 1A-1	1A	15/05/2011
Int. 1D-1	1D	15/05/2011
Int. 3A-1	3A	16/05/2011
Int. 3C-1	3C	16/05/2011
Int. 1B-1	1B	18/05/2011
Int. 1C-1	1C	18/05/2011
Int. 3B-1	3B	18/05/2011
Int. 3E-1	3E	23/05/2011
Int. 3D-1	3D	23/05/2011
Int. 2D-1	2D	30/05/2011
Int. 2C-1	2C	31/05/2011
Int. 2A-1	2A	31/05/2011
Int. 2B-1	2B	31/05/2011
Int. 2E-1	2E	31/05/2011

Int. 2E-2	2E	02/06/2011
Int. 2D-2	2D	02/06/2011
Int. 3B-2	3B	06/06/2011
Int. 3A-2	3A	06/06/2011
Int. 3E-2	3E	06/06/2011
Int. 2A-2	2A	08/06/2011
Int. 2B-2	2B	08/06/2011
Int. 3C-2	2C	08/06/2011
Int. 3D-2	3D	09/06/2011
Int. 3B-3	3B	10/06/2011
Int. 1A-2	1A	13/06/2011
Int. 1B-2	1B	15/06/2011
Int. 1D-2	1D	15/06/2011
Int. 1C-2	1C	16/06/2011
Int. 2E-3	2E	21/06/2011
Int. 2C-2	2C	21/06/2011

2. Focus groups and Group discussions:

Focus groups/Group discussions	Case study (University)	Date	Attendants
FG1 (group discussion)	1	18/05/2011	1B, 1C, 1D
FG2	3	23/05/2011	3A, 3B, 3D, 3E
FG3	2	31/05/2011	2A, 2B, 2C, 2D, 2E
FG4 (group discussion)	3	06/06/2011	3A, 3B, 3C, 3E
FG5 (group discussion)	1	16/06/2011	1A, 1B, 1C, 1D
FG6 (group discussion)	2	21/06/2011	2A, 2B, 2C, 2E

3. Events:

Event type	Description	Date	Attendants
Department meeting	At university 2, Faculty of Environmental Ecology and Technology	31/05/2011	2A, 2B, 2C, 2E and other department members of staff
Lecture	University 3	16/05/2011	3E
	University 1	18/05/2011	1B
	University 1	20/05/2011	One young lecturer
	University 2	23/05/2011	2A
Student research conference	University 2	08/06/2011	2A, 2B, 2C and other university members of staff
	University 1	15-16/06/2011	1B, 1C, 1D and other faculty members of staff

APPENDIX 10. SAMPLE OF DATA ANALYSIS

Analysis of questionnaire data through coding

Form of data: Qualitative Questionnaire

Informant group: Engineering businesses

Full coding tree for group of engineering companies

Root Node

Base data (1)

Answers to questions (2)

Interpretations and actions (3)

View over engineering employees (4)

Documents (1.3)

Interview (1.2)

Questionnaires (1.1)

Additional question (2.9)

Question 8 (2.8)

Question 7 (2.7)

Question 6 (2.6)

Question 5 (2.5)

Question 4 (2.4)

Question 3 (2.3)

Question 2 (2.2)

Question 1 (2.1)
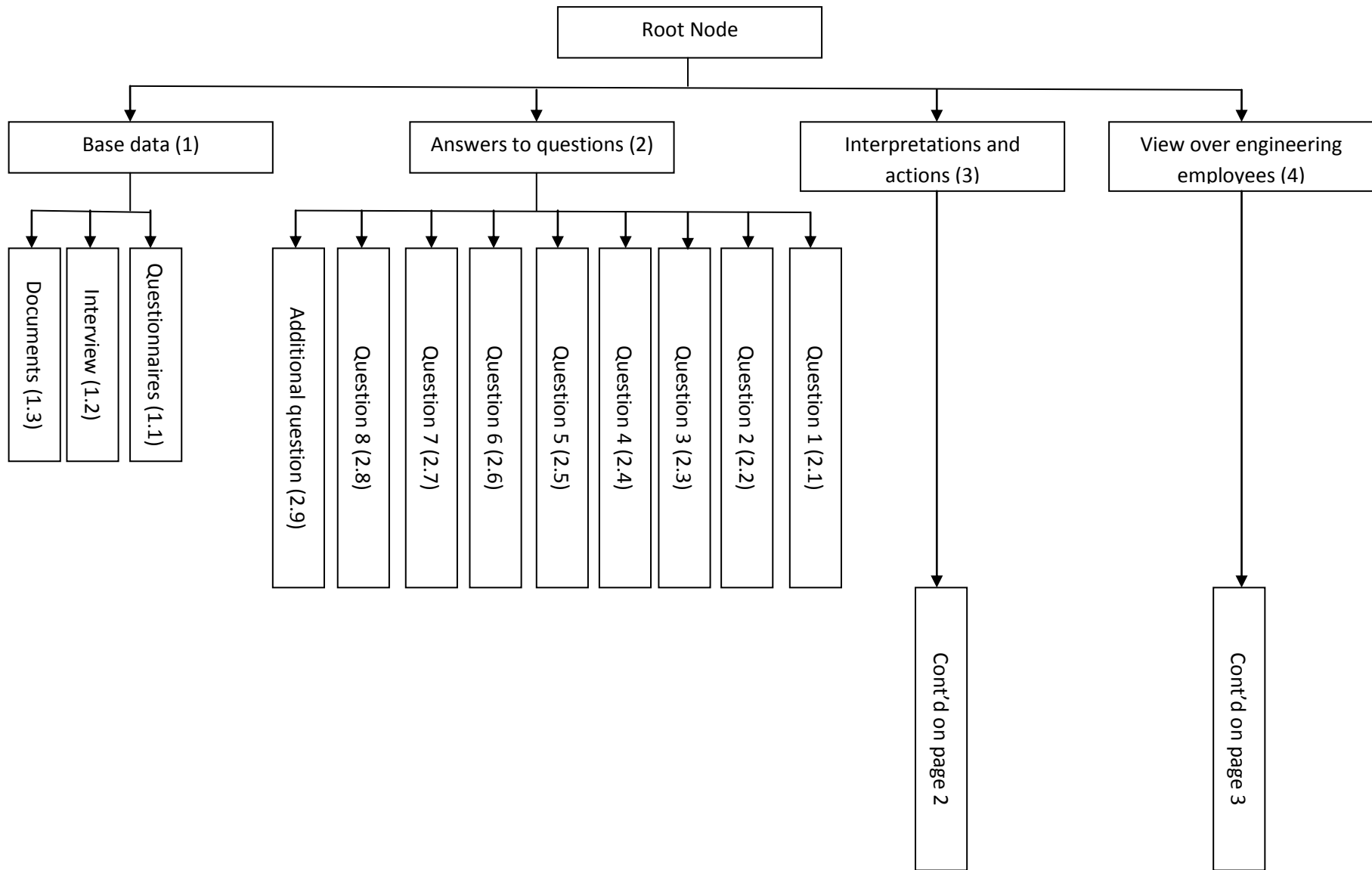
Interpretations and actions of engineering companies (3)

- Perceptions on SD (3.1)
  - Don't know (3.1.5)
  - Environmental Protection along with Occupational Health & Safety (3.1.4)
  - Triple-bottom line (3.1.3)
  - Improve business while reducing impact to the environment (3.1.2)
  - Environmental Management (3.1.1)

- Compliance (3.2)
  - Monitor & control environmental performance (3.2.6)
  - Pay environmental protection fees (3.2.5)
  - Comply with all sector's specific regulations (3.2.4)
  - Comply with all environmental regulations (3.2.3)
  - Comply with all occupational health & safety regulations (3.2.2)
  - Comply with all labour laws (3.2.1)

- Well-being of employees (3.3)
  - Ensure employees' benefits and healthy working space (3.3.2)
  - Implement policy on equality and discrimination & harassment (3.3.1)

- Business performance (3.4)
  - Continue to improve products and service quality as in line with SD (3.4.1)

- Community Development (3.5)
  - Award prizes and sponsor for student's SD projects (3.5.5)
  - Provide scholarships and financial support for students (3.5.4)
  - Hold or attend seminars in universities to share expertise (3.5.3)
  - Establish CSR department to look after community development (3.5.2)
  - Provide jobs, donate money and construct roads, houses & schools for local community (3.5.1)

- Environmental Initiatives (3.6)
  - Hold seminars on environmental protection for staff & community (3.6.8)
  - Volunteer to go beyond regulation compliance (3.6.7)
  - Participate in energy efficiency projects (3.6.6)
  - Design and manufacture green products (3.6.5)
  - Design and construct green offices (3.6.4)
  - Choose environmentally friendly materials (3.6.3)
  - Reuse and recycling within the company (3.6.2)
  - Minimise raw materials, energy and water consumption (3.6.1)

- Responsible Supply Chain (3.7)
  - Purchase material/products from environmentally compliant suppliers (3.7.1)

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View over engineering employees (4)

Satisfaction level (4.1)

Expected knowledge for SD (4.2)

Expected skills for SD (4.3)

Suggestions for Engineering Education (4.4)

Engineers view SD as environmental protection (4.1.4)

The specialised engineering knowledge and skills is good (4.1.3)

At medium level (4.1.2)

The knowledge and skills for SD is very limited (4.1.1)

Clean technologies (4.2.10)

Precautionary approach (4.2.9)

Environmental laws, regulations and standards (4.2.8)

Understand the balance between 3 pillars of SD (4.2.7)

Go beyond personal work and benefit to broader context and care for the benefit of the society (4.2.6)

Environmental Protection and the financial benefits (4.2.5)

Environmental impacts on the business operation (4.2.4)

Work ethics (4.2.3)

Corporate Social Responsibility (4.2.2)

Occupational Health and Safety (4.2.1)

Don't know (4.3.15)

Critical thinking (4.3.14)

Creative thinking (4.3.13)

Systems thinking (4.3.12)

Decision making (4.3.11)

Leadership (4.3.10)

Planning (4.3.9)

Communication skills (4.3.8)

Solving non-technical problems (4.3.7)

Collaboration/Group-work (4.3.6)

Future/Long-term thinking (4.3.5)

Maximise resource efficiency (4.3.4)

Apply theories into practices (4.3.3)

Analysis and Synthesis Skills (4.3.2)

Stakeholder Participation (4.3.1)

Reduce/Eliminate some unnecessary modules (4.4.6)

Establish closer links to businesses and industries to identify needs (4.4.5)

Provide opportunities for students to participate in real-life projects (4.4.4)

Organise SD seminars and invite experts to deliver speech (4.4.3)

Include SD related subjects in the curriculum (4.4.2)

Focus more on practices rather than mere theories 4.4.1)