Sustainability in Higher Education.
An explorative approach on sustainable behavior in two universities

Duurzaamheid in het hoger onderwijs.

Een verkennende benadering van duurzaam gedrag bij twee universiteiten

Thesis

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Dedicated to my beloved Mariana,

To future generations

EXECUTIVE SUMMARY

This study explores the research question of identifying psychological factors related to personality features which can influence sustainable behavior of individuals in higher education institutions (HEI), as well as to present the areas where these individuals work, and in which higher education for sustainability is fostered.

The challenge is to devise ways to achieve socially desirable goals, such as the ones underlying the goals of the Decade of Education for Sustainable Development (ESD), while allowing people to recognize moral norms, through latent variables as such as values, ascription of responsibility, awareness of consequences, and personal skills, as ways of explaining their behavior. This study draws on social psychology, which is the scientific study of the reciprocal influences of the individual and his or her social context through the behavioral expression of that individual's thoughts and feelings.

This investigation considers sustainable behavior to be "a set of effective, deliberate, and anticipated actions aimed at accepting responsibility for conservation and preservation of physical and cultural resources. These resources include integrity of animal and plant species, as well as individual and social well-being, and safety of present and future human generations".

The most relevant school of thought is cognitivism, emerging from cognitive science. It considers people as dynamic information-processing systems, whose internal and mental operations (the formation of beliefs, attitudes or perceptions) may be described in computational terms. This allows the use of existing attitude models and the validation of the construct of sustainable behaviour. Schwartz's moral norm-activation theory was the model selected, because it poses situations where social dilemmas are present, such as those faced by the education for sustainability. Schwartz's model is extended under the value-belief-norm by Stern *et al.*, based on the very important aspect of Schwartz's set of universal values. Also, the elements of Hines *et al.*'s meta-analysis were considered because of the importance of contextual variables. Inter-personal and intra-personal intelligences from Howard Gardner's theory of multiple intelligences were also considered; these skills applied to any culture. Gardner`s theory was analyzed through the psychological features of effectiveness, deliberation, anticipation, solidarity, and austerity as proposed by Corral-Verdugo and Pinheiro. The proposed model is shown in Figure 2.5, p. 59.

A questionnaire was prepared which consisted of 67 items in five sections according to the latent variable model. The first section of universal values includes 21 items of Schwartz's 10 value categories. The variables for moral norm activation from the second and third sections of the questionnaire were measured through nine items regarding awareness of consequences (AC) and nine regarding ascription of responsibility (AR). The fourth section on intra-personal and inter-

personal intelligences contained 20 items, sifted through five psychological dimensions of sustainability. The final section contained eight questions related to demographics such as age, gender, religious denomination, general income level, and educational training.

The questionnaire was applied to eighty individuals in a Mexican university and thirty-seven in a Germany HEI. The first is the *Universidad Autónoma Metropolitana, Azcapotzalco* (UAMA), which is located north of Mexico City and is a public university. The other university is the *Leuphana Universität Lüneburg, Institut für Umweltkommunication* (LULIfUK), a public university near Hamburg in the Federal Republic of Germany, honored with the UNESCO Chair in Higher Education for Sustainable Development.

In order to validate the proposed model, two statistical methods were applied in the following order: principal component analysis (for all data of both HEI), and the Rasch model based on Item Response Theory.

The results of this exploratory study show that not all of these key variables can be proven to be significant. However, ascription of responsibility, universal values, and personal intelligences seem to be the main factors explaining sustainable behavior. The model seems valid and stable because it was tested with reliable analytical procedures valid even for small samples. The four important latent variables are highly correlated, but the model is still in an exploratory stage. The number of participants was small, and surveys were carried out at only two HEI. Future research will require a greater number of participants and institutions. However, this model is promising because it shows, in an explanatory manner, an increase in behavioral variance.

Participants display simple traits rather than more complex traits under a given context. Anticipation seems the behavior most unlikely to be shown by students, faculty members, and administrators; effectiveness seems the dimension most likely to be shown in universities in countries with a lower socio-economic level and austerity seems the most likely for universities with a higher socioeconomic level. Students and administrators obtained the highest probability in almost every psychological dimension and faculty members obtained the lowest probability. Educational policies should be designed to encourage those psychological variables related to personality features of individuals and their motivations in order to modify their beliefs.

Also, in order to develop critical, fair, responsible, self-actualizing citizens, this study considers two areas of human intervention for changing behavior in the long run without coercion: education and community management. It also proposes four methods as alternative forms of learning and ways of strengthening group change – play, art, group therapy, and personnel management - all grounded on the principles of EfS to be included in HEI activities.

SAMENVATTING

In dit proefschrift is bestudeerd welke aan persoonlijkheid gerelateerde psychologische factoren van invloed van invloed zijn op op duurzaam gedrag van personen in instellingen voor hoger onderwijs. Daarnaast zijn de vakgebieden onderzocht waarin deze personen werken, en waarin duurzaam hoger onderwijs behartigd wordt.

 De uitdaging is om manieren te ontwikkelen om sociaal wenselijke doelstellingen te bereiken, zoals in het 'Decade of Education for Sustainable Development (ESD, initiatief van de Verenigde Naties), en mensen tegelijkertijd de gelegenheid te geven om de morele normen te onderkennen die aan hun gedrag ten grondslag liggen. Daarbij zijn het latente variabelen die hun gedrag verklaren, zoals waarden, toeschrijving van verantwoordelijkheden, bewustzijn van gevolgen en persoonlijke vaardigheden. Deze studie maakt gebruik van sociale psychologie.

Deze studie beschouwt duurzaam gedrag als 'een verzameling doelgerichte, weloverwogen en geanticipeerde acties gericht op het nemen van verantwoordelijkheid voor behoud en bescherming van fysieke en culturele hulpbronnen. Tot deze hulpbronnen behoren de integriteit van plant- en diersoorten, evenals het welzijn en de veiligheid van huidige en toekomstige generaties mensen'.

De meest relevante benadering die voortkomt uit de cognitieve wetenschappen is die van het cognitivisme. In deze benadering worden mensen gezien als dynamische informatieverwerkende systemen, met interne en mentale bewerkingsprocessen (het vormen van overtuigingen, houdingen of percepties). In deze benadering kunnen bestaande attitudemodellen gebruikt worden concepten van duurzaam gedrag te valideren. De morele norm-activatietheorie van Schwartz werd uitgekozen omdat deze situaties veronderstelt waarin sociale dilemma's bestaan zoals die zich ook voordoen in het duurzaamheidsonderwijs. Het model van Schwartz is uitgebreid met de 'waarde-geloofsnorm' van Stern et al., gebaseerd op Schartz' verzameling van universele waarden. Verder is de meta-analyse van Hines et al. gebruikt, dit vanwege het belang van contextuele variabelen, evenals de inter- en intra-persoonlijke intelligenties uit Howard Gardner's theorie van multipele intelligenties. Deze zijn van toepassing in elke cultuur. De theorie van Gardner is geanalyseerd op psycholische kenmerken als doeltreffendheid, deliberatie, anticipatie, solidariteit en austeriteit, zoals voorgesteld door Corral-Verdugo en Pinheiro (zie figuur 2.5 op pag. 59 van het proefschrift).

Een enquete werd voorbereid met 67 onderdelen in vijf secties naar het model van latente variabelen. De eerste sectie van universele waarden bevat 21 onderdelen uit de 10 categorieën bij Schwartz. De variabelen voor morele normactivatie uit de tweede en derde sectie van de survey werden gemeten met negen onderdelen over bewustzijn van gevolgen (*awareness of consequences, AC*) and negen onderwerpen over ascriptie van verantwoordelijkheid (*ascription of responsibilities,*

AR). De vierde sectie over inter- en intrapersoonlijke intelligenties bevatte 20 onderdelen, naar vijf psychologisdche dimensies van van duurzaamheid. De laatste sectie bevatte acht vragen over demografische kenmerken als leeftijd, geslacht, religie, inkomens- en onderwijsniveau.

De vragenlijst werd afgenomen bij tachtig personen in een Mexicaanse universiteit en 37 in een Duitse. De eerste is de *Universidad Autónoma Metropolitana Azcapotzalco* (UAMA), een openbare universiteit ten noorden van Mexico Stad. De andere universiteit is de *Leuphana Universität Lüneburg*, *Institut für Umweltcommunication (*LULIfUK*)*, een openbare universiteit bij Hamburg. Deze universiteit heeft de UNESCO Leerstoel voor Hoger Onderwijs voor Duurzame Ontwikkeling.

Voor de validatie van het model zijn twee analytische methoden gebruikt: principale componentenanalyse (voor de data van beide universiteiten), en het model van Rasch, dat gebaseerd is op de *'Item Response Theory'* (slechts voor de data over persoonlijke intelligentie die gerelateerd zijn aan dimensies van duurzaamheid).

De resultaten van deze verkennende studies geven aan dat niet alle bechouwde sleutelvariabelen significant zijn. Ascriptie van verantwoordelijkheid, universele waarden en persoonlijke intelligenties lijken de belangrijkste factoren te zijn die duurzaam gedrag verklaren. Het model lijkt valide en stabiel omdat het getest is met twee betrouwbare analytische procedures. De vier belangrijkste latente variabelen zijn in hoge mate gecorreleerd, maar het model is nog in een verkennende fase van ontwikkeling. Het aantal deelnemers was klein, en de survey vond plaats op slechts twee instellingen voor hoger onderwijs. Toekomstig onderzoek zal een groter aantal deelnemers en instellingen vereisen. Niettemin is dit model potentieel waardevol, omdat het meer verklaring levert van de verschillen in duurzaam gedrag dan tot nu toe mogelijk.

In een gegeven context zijn de eenvoudige kenmerken belangrijke dan de complexe. Anticipatie lijkt het minst waarschijnlijk bij studenten, wetenschappelijke en administratieve staf. Doeltreffendheid lijkt de dimensie die het meest waarschijnlijk voorkomt in universiteiten in landen met een lager sociaal-economisch niveau; Austeriteit lijkt het meest waarschijnlijk op universiteiten in landen met een hogere sociaal-economsiche status. Studenten en administratieve staf vertoonden de hoogste waarschijnlijkheid in bijna elke psychologische dimensie, terwijl wetenschappelijke staf daar het minst waarschijnlijk scoorde. Onderwijsbeleid zou ontworpen moeten worden om de psychologische variabelen te ontwikkelen de gerelateerd zijn aan persoonlijkheidskenmerken van individuën en hun motivatie om hun opvattingen aan te passen.

Voor de ontwikkeling van kritische, eerlijke, verantwoordelijke en zichzelf verwerkelijkende burgers ziet deze studie twee gebieden van menselijke interventie als het belangrijkste voor het zonder dwang veranderen van gedrag op de lange termijn: onderwijs en

'community management'. De studie stelt vier methoden voor als onderscheiden vormen van leren, en manieren om groepsverandering te versterken: spel, kunst, groepstherapie en personeelsbeleid. Deze zouden deel moeten uitmaken van de activiteiten aan instellingen voor hoger onderwijs, en gefundeerd in de prinicipes van onderwijs voor duurzaamheid (Education for Sustainability, EfS).

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ABBREVIATIONS

AC – Awareness of (adverse) consequences

AR – Ascription of responsibility to self

CTT – Classical Test Theory

DESD – Decade of Education for Sustainable Development

EE – Environmental Education

ESD – Education for Sustainable Development

HEI - Higher Educational Institutions

IRT – Item Response Theory or Latent Trait Theory

NAT – Norm-Activation Theory

PCA – Principal Component Analysis

PEB - Pro-environmental behavior

TCHA - Theory of Cultural-historical psychology or Vigotsky's School

TMI – Theory of Multiple Intelligences

TPB – Theory of Planned Behavior

VT – Value Theory

VBNT – Value-Belief-Norm Theory

UNEP – United Nations of Environmental Program

UNDP – United Nations of Development Program

UNESCO – United Nations Educational, Scientific and Cultural Organization

UNIDO - United Nations Organization for Industrial Development

USAID - U.S. Agency for International Development

UV – Universal values

PREFACE

In 1998, I participated in the First Demonstrative Project of the Mexican Cleaner Production Center, whose goals included reducing contamination at the source, increasing businesses' economic gains, improving worker safety, optimizing productive processes, and incorporating more efficient technologies. During this project, and later in reviewing the results, I was continually dismayed by the lack of interest and involvement of a majority of the project's six participant entrepreneurs of the electroplating industry.

The project was supported by the United Nations Organization for Industrial Development (UNIDO) in collaboration with one of the most renowned technical higher educational institutions (HEI) in Mexico City, the *Instituto Politécnico Nacional*, and fully financed by the U.S. Agency for International Development (USAID). Consequently, the only requirement for members of small and medium size companies was a willingness to work with national and international electroplating cleaner production (CP) specialists, with whom they would document and implement environmentally and economically sound CP options.

Companies were selected based on their representativeness of the electroplating industry and according to number of employees, production volume, type of process, and financial capacity for investing in change. They were selected by well known members of the Electroplating Industrial Association's technical committee. Prior to initiating, company leaders participated in a course on the scope, methodology, and expected outcomes of the project.

It seemed like a perfectly well planned project, with its' history of success in other countries, availability of financial and technical resources, and willingness of company leaders to participate. However, during the initial phase aimed at implementing suggested changes, two companies made no changes, and two others made only minor modifications. Only two companies made all suggested changes and even more, and achieved greater savings than expected.

I continually asked myself, "What happened? "How is it possible that a majority of the companies had such a lack of interest in a project with free consulting and committed company leaders confident that they would financially benefit from CP changes?"

What impeded company leaders from implementing changes to their processes if they knew in return they would not only get their money back and increase savings, but also minimize environmental impacts and improve company processes and worker health and safety? What motivated them to participate in the CP project in the first place? Did company leaders initially act on behalf of their own interest, hoping for personal profit? Or did they act for the sake of others - the environment, workers, and the industrial association - encouraged by an altruistic spirit?

While these questions remain, I currently raise them with a deeper understanding as a result of decades as a professor in Higher Educational Intuitions as well as my doctoral research. Furthermore, my research led me to apply the same questions to HEI: What drives decision-makers' efforts in HEI? Do similarities exist between the behavior of individuals in higher education and that of company leaders? What factors determine the behavior of decision makers in HEI? Do decision makers foster the concept of sustainability in their activities, particularly when these activities take into account long term implications for the institution and for social and cultural aspects of society?

In recent decades, higher educational institutions (HEI) have increasingly been forced to create, disseminate, and apply knowledge as a private property instead of a shared social construct or public good. This changing vision has sidetracked governments from their responsibility the principal providers of education and, to some extent, HEI are more interested in obtaining profits than in resolving long-term problems such as environmental and social issues.

During the second year of my Ph.D. program, I realized the importance of individual behavior in catalyzing and guiding decisions to implement change within organizations. During that period, I read a book on environmental policy and technological innovation titled, "Why Do Firms Adopt or Reject New Technologies?" by Carlos Montalvo-Corral. This book helped me begin to understand diverse aspects of individuals' resistance to change and gave me insight into some reasons for the lack, or slowness, of change with regard to environmental protection and implementation of CP approaches in industrialized and industrializing nations. Furthermore, I discovered theoretical frameworks which could help me identify and work with the principal factors guiding human behavior in relation to resistance to change.

In addition, my awareness of the growing importance of education for sustainable development led me to the conclusion that education should be adapted to local contexts in order to attend to global problems. For the past thirty years, my professional life has been linked to environmental protection, both as a university professor and as an industrial consultant. Therefore, I have followed the evolution of the environmental education movement as well as new approaches such as that proposed by the document 'Our Common Future', published in 1987 (UN, 1987). Along with national and international pressure to bring about change in HEI, the support of international organizations such as the UNESCO is helping to influence education at all levels to improve human life for present and future generations and to influence the general public to be more responsible for SD. The Decade of Education for Sustainable Development (DESD) (UNESCO, 2005) initiative has stressed the importance of involving faculty, administrators, other staff members, students, and alumni as agents of change. It is essential for academic leaders and

other decision makers to increasingly support new ways to foster Sustainable Development (SD) in education, research, outreach, and campus management.

It is urgent that the many decision makers of HEI in nations with varied cultural and economic structures become more aware of attitudes, policies, procedures, and practices which must be modified in order to help ensure that HEI truly foster SD. All those involved must work together to ensure that HEI faculty possess the knowledge and tools to educate present and future generations of students, and to ensure that decision makers become responsible in a rapidly changing world which is currently heading in unsustainable directions.

CHAPTER 1

INTRODUCTION

Due to current widespread ecological degradation and a lack of ethical considerations in a world where resources are unequally distributed, Higher Educational Institutions (HEI) worldwide are beginning to include sustainable development concepts in their activities. Efforts in education for sustainable development may be traced back several decades. This chapter explores the history of current sustainability efforts in development and education.

In 1990, 318 HEI participated in the Presidents` Conference in France and signed the Talloires Declaration (IISD, 1996; AULSF, 2002), stating that environmental changes threaten the survival of humans and thousands of other species, the earth's integrity and biodiversity, the security of nations, and the heritage of future generations.

In 1991, another 33 universities of 10 countries in all continents attended and signed the declaration of the Sustainable Development University Action Conference in Halifax, Canada (IISD, 1996). The Halifax Declaration expressed dismay regarding continuing widespread degradation of the earth's environment and the pervasive influence of poverty on such environmental degradation as well as current widespread unsustainable environmental practices.

In 1991, an initial 29 universities, and two years later another 213 universities, signed the Copernicus Charter at the European Rectors Conference in Barcelona, Spain (IISD, 1996). This charter expresses a collective commitment and represents an effort to mobilize the resources of higher education institutions in order to clarify the concept and further sustainable development objectives.

In 1993, four hundred universities of 47 countries in the Association of Commonwealth Universities attended the Fifteenth Quinquennial Conference in Swansea, Wales (IISD, 1996). Focusing on the topic of people and the environment, they sought ways these universities could respond appropriately to the environmental challenge.

In November 1993, the International Association of Universities, in its 8th Round Table meeting in Japan, issued a clarion call to its 650 university members on the topic of sustainability in the Kyoto Declaration (IISD, 1996). In October 2001, the International COPERNICUS Conference on Higher Education for Sustainability, organized by the European University Association took place at the University of Lüneburg in Germany. Participants adopted the Lüneburg Declaration (AULSF, 2002) which calls for HEI, NGO`s, governments, and United Nations Agencies to support and ensure the introduction of sustainability in their programs and, research.

The UNESCO has promoted the Decade of Education for Sustainable Development (DESD), which, implemented in January 2005, emphasizes the importance of quality basic education and

stresses that education must provide specific skills such as learning to know, learning to live together, learning to do, and learning to be (Delors, 1998; Gonzalez, 2004). According to the DESD, educational curricula (Lozano-Ross, 2003) from nursery school through university must be thoroughly revised to promote sustainability.

The far-reaching DESD initiative reflects social, economic, and environmental challenges facing humanity and the planet. This initiative aims to prepare people in all professions and under all social conditions to cope with and find solutions to problems threatening planetary sustainability. Environmental issues such as water and waste affect every nation, as do social issues such as employment, human rights, gender equity, peace, and security. All countries must also address economic issues such as poverty reduction and corporate responsibility and accountability. Major concerns which have demanded global attention such as HIV/AIDS, migration, climate change, and urban sprawl nowadays involve several spheres of sustainability: environment, society, and economy. The initiative is broad-reaching because its goals integrate values related to dignity, human rights, equity, care for the environment, and sustainable development, along with human diversity, inclusiveness, and participation. In the economic realm, the initiative includes sufficiency for all, and equity of economic opportunities. The DESD is a transformational undertaking because it entails that Education for Sustainable Development (ESD) focus on underlying principles and values conveyed through education. As such, ESD is concerned with the content and purpose of education, and, more broadly, with all types of learning. ESD is a challenge for all forms of education, and includes pedagogical processes, validation of knowledge, and the functioning of educational institutions.

Regardless of the number of HEI which signed the aforementioned declarations, a real commitment to incorporating education for sustainable development in higher education must be encouraged worldwide. The Decade of Education for Sustainable Development is the most recent step of a series of international resolutions organized by the United Nations.

1.1   BACKGROUND OF HIGHER EDUCATION AND SUSTAINABLE DEVELOPMENT

Sustainable development has its roots in the environment movement. Many important events have addressed sustainable development, including the 1972 World Summit on Human Environment held in Stockholm. Since then, numerous environmental protection agencies have been established, as well as the United Nations Environmental Program. While new programs studied social and economic aspects to some extent, greater priority was given to ecological incidents due to increasing uncontrolled development (UNEP, 1972). Many nations realized that

such generalized increased environmental degradation now required not only national approaches and solutions, but international attention and collaboration.

In 1975, UNESCO, with the Belgrade Charter (UNESCO, 1975), established a framework for environmental education to take into account environmental protection mandates of the Stockholm World Summit (Orellana, 1998). Such environmental education included the fundamental elements of the concept of sustainability:

- Formulation of basic concepts such as quality of life and human happiness, according to each particular culture;
- Re-formulation of the concept of development to focus on the satisfaction of needs and pursuits of all world citizens on the basis of social equality, justice, societal pluralism, and equilibrium between humans and the environment;
- A new universal economic order based on equality, absence of exploitation, peace, and disarmament;
- Addressing environmental and social problems on a global scale;
- Taking into account future generations;
- Change in value systems, life attitudes, and in relationships between humans and nature and among humans (Flogaitis, 1998).

During the Tbilisi Conference in Russia in 1978, the UNESCO reaffirmed the guiding principles of environmental education (EE) to include environmental, social, moral, economic, political, and cultural dimensions (Orellana, 1998), thus reaffirming principles such as economic, political, and ecological interdependence; the relationships between economy, development, and environment; local and global perspectives; social and ecological responsibility; and solidarity among peoples and consideration for future generations (Sauvé, 1996; Flogaitis, 1998).

All these ideas and goals place EE in the context of a movement of radical social, economic, and political change and educational reform with a global, interdisciplinary, problem-solving approach, values clarification and integration, critical thinking, experiential learning, and connection between schools and the broader community (Flogaitis, 1998).

Within 10 years after the Stockholm summit, the world community began to realize that treating environmental concerns in isolation of development needs was not benefiting either the environment or people (UNESCO, 2005). Hence, by the mid-eighties, the United Nations launched a search for a broader strategy which could address both social and environmental needs. In 1987 with the Brundtland Commission Report, "Our common future" (UN, 1987), sustainable

development was endorsed as an overarching framework for future development policy at all governmental levels.

In the 1992 World Summit on Environment and Development in Rio de Janeiro, EE was inextricably linked with sustainability (Orr, 1992). As such, EE was recognized as a fundamental tool for achieving environmental goals. However, several studies (Gonzalez-Gaudiano, 1997; Flogaitis, 1998, UNEP, 2003; Bravo-Mercado, 2005; Eschenhagen, 2007; Dieleman & Juarez-Najera, 2007) show that the majority of EE programs have traditional environmental studies, naturalist approach. Such EE promotes concepts and tools which tend toward technocratic solutions, with no connection to the root cause of environmental and social problems. This approach involves an absence of questioning and critical consideration of political, social, and economic issues relevant to environmental issues, and therefore cannot play an essential role in fomenting changes required to achieve sustainable development (Flogaitis, 1998).

This misguided EE approach stems from the social and educational *status quo*, including inadequate teacher training, difficulties in the design and practice of interdisciplinary approaches, and isolation of schools from their communities. EE, as part of the environmental movement, touches on social, political, and ideological confrontations arising from environmental issues, thus requiring a variety of solutions and priorities. Since a technical, managerial approach governs society in general, and environmental issues in particular, this reflects the type of environmental education ultimately put forward (Flogaitis, 1998). The challenge of sustainability demands reconsideration and reorientation of the conformist approaches to EE and reinforcement of a critical, participatory environmental education toward social, political, and educational changes.

The concept of education for sustainability was initially included in Chapter 36 of UNESCO`s 1992 Agenda 21: "Promoting Education, Public Awareness, and Training". In addition, education as a strategy to promote and implement environmental change was embedded in each of the 40 chapters of the Agenda (Keating, 1995) and in each of the post-Rio United Nations Conferences in the 1990`s.

The World Summit on Higher Education, which focused on higher education, was organized at Paris in 1998. This conference reinforced the mission of higher education "to educate, train, carry out research and, particularly, contribute to sustainable development and improve society as a whole". The mission states that education in general, and higher education in particular, is the fundamental pillar of human rights, democracy, sustainable development, and peace (UNESCO, 1998).

The 2002 Johannesburg World Summit on Sustainable Development reaffirmed the importance of sustainable development as a basis for overcoming poverty and improving quality of

life worldwide, especially in the so-called "developing" world. As a follow-up to ´Johannesburg´, in December, 2002, the United Nations General Assembly adopted the resolution "Decade of Education for Sustainable Development (DESD)", proposed by Japan and co-sponsored by 46 countries. The resolution was ratified by the UNESCO in April, 2003.

The DESD resolution is based on chapter 36 of Agenda 21, emphasizing that education for all is a vital condition for sustainable development. The crucial message of the ´Decade´ to the world is that "education is the primary agent of transformation toward sustainable development" (UNESCO, 2005). Education has the capability of increasing people's capacity to transform their visions for society into reality. Education not only provides scientific and technical skills, but also provides the motivation, justification, and social support for pursuing and applying these skills (Juarez-Nájera *et al.*, 2006a).

1. 2   KEY CHARACTERISITICS OF EDUCATION FOR SUSTAINABLE DEVELOPMENT

The UNESCO (2005) initiative emphasizes that no universal models exist; rather, education depends on local contexts, priorities, and approaches. This initiative recommends that goals, emphases, and processes must therefore be locally defined to meet local environmental, social, and economic conditions in culturally appropriate manners. It also states that education for sustainable development is essential to all nations, regardless of their greatly varied cultures and socio-economic structures.

In order to achieve ESD, the UNESCO (2005) identifies four principal ways in which education may support a sustainable future: (1) improving access to quality basic education, (2) reorienting existing educational programs, (3) developing public understanding and awareness of sustainability, and (4) providing training in sustainability issues.

The UNESCO resolution points out essential characteristics of ESD which may be implemented in a variety of culturally appropriate ways (UNESCO, 2005). The list below presents some of the features of such education along with an explanation for each and references to selected bibliography.

1. Education for Sustainable Development is based on principles and values which underlie sustainable development, including the tenet that education is a human right based on four pillars: learning to know, learning to do, learning to live together, and learning to be (Delors *et al.*, 1998).

2. ESD deals with economic, social, and cultural sustainability (Elkington, 1998), that is, a just, equitable, and peaceable world in which social tolerance and gender equity is practiced

and people care about the environment and thus contribute to natural resource conservation, intergenerational equity, and poverty alleviation (UNESCO, 2005).

3. ESD promotes lifelong learning (UNESCO, 2005), which, broadly understood, describes a process in which individuals, with the help of others, diagnose their needs for learning and education, formulate their goals, identify their resources, select and implement their strategies, and evaluate their educational outcomes (Castrejón, 1974; Commission of the European Communities, 2000; Ramnarayan, 2005).

4. ESD is locally relevant and culturally appropriate, based on local needs, perceptions, and conditions, and acknowledges that fulfilling local needs often has international effects and consequences (UNESCO, 2005).

5. ESD engages formal, non-formal, and informal education (UNESCO, 2005). Formal education takes place within educational institutions, and leads to the acquisition of grades and diplomas. Non-formal learning occurs in a formal learning environment, but is not officially recognized within a curriculum. Informal learning occurs through experiences in daily situations. Both types of education are compatible with formal education and normally do not lead to certificates. Informal learning is unintentional and the learner is often un-aware of the process. Nowadays, formal learning dominates political thought, establishing the manner in which education is provided. Non-formal and informal learning are typically under-valued (Castrejon, 1974).

6. ESD must be adapted to the evolving nature of the concept of sustainability, not only to environmental, social and economic areas, but the sustainability concept must include seven dimensions, as explained by Morin (2001, 2002) and summarized by Dieleman (2005): (1) thematic dimension: ecology, economy, and social equity; (2) spatial dimension: north-south dialogue; (3) temporal dimension: relevant to the present and preparing individuals for the future; (4) spiritual dimension: a sense of belonging to the whole; (5) institutional dimension: social change; (6) esthetic dimension: beauty, use of materials; and (7) knowledge dimension: systemic thinking.

7. ESD takes into consideration global problems and national priorities and adjusts the syllabus to these unique conditions (UNESCO, 2005).

8. ESD builds civic capacity for community based decision-making, social tolerance, environmental stewardship, and high quality of life; ESD also promotes competency of the learner as an individual, a family member, a community member, and a global citizen (UNESCO, 2005).

9. ESD is interdisciplinary, building knowledge, life skills, perspectives, attitudes, and values (UNESCO, 2005).

10. ESD uses a variety of pedagogical techniques which promote participatory learning and higher-order thinking, makes use of playful learning, and provides tools to transform actual societies into more sustainable societies (UNESCO, 2005).

11. ESD is measurable (UNESCO, 2005).

12. ESD focuses on performance and seeks collective success, development, and well being or quality of life; ESD is flexible and liberating (Benavides, 1998).

ESD, based on humanistic principles, is capable of educating people to become more humanistic, thus learning to live together. Such positive interaction leads to strengthening appreciation for human dignity, the desire for social well-being, support of ideals such as fraternity, equal rights for all, abolition of privilege according to race, religion, gender, or other individual qualities, and the implementation of international solidarity and sustainability (Benavides, 1998).

ESD is fundamentally about *values* (UNESCO, 2004), with the fundamental pillar being consideration and respect for others, including present and future generations, respect for cultural and societal difference and diversity, for the environment, and for planetary resources. Education enables us to understand ourselves and others and our links with the broader natural and social context (Benavides, 1998), and this understanding serves as a basis for building respect.

Table 1.2 shows ESD principles and characteristics. ESD is based on a holistic vision and is an interdisciplinary, values driven, critical thinking approach focused on problem solving in local, participatory decision-making, taking advantage of pedagogical, recreational, and artistic methods. Education for sustainability must enable students to understand the complexity of global environmental, social, and cultural settings. ESD proposes sustainable alternatives to current practices. Students must understand that in order to attend to the current situation, they must develop a critical, responsible, and participatory attitude based on sustainability and that the analysis and solutions are transdisciplinary.

1.3   DEFINITION OF SUSTAINABLE BEHAVIOR

The idea for this study of sustainable behavior arises from two viewpoints: environmental psychology, and sustainability as an evolving concept. Environmental psychology explores the interaction between people and their physical setting (Corral-Verdugo & Pinheiro, 2004), or in other terms, the relationship between people (human well-being) and the broader environment (socio-physical context) (Corral-Verdugo, 2001). The concept of sustainability has its roots in the "green" movement of the United States and Europe since the late 1960's. During this period,

western society has become more conscious of living in harmony with nature, the limits to natural resources, and the worsening environmental problems (Bonnes & Bonaiuto, 2002).

Table 1.1 Principles of education for sustainability
(adapted from UNESCO guidelines, 2004, 2005)

PRINCIPLE	CHARACTERISTICS
Interdisciplinary and based on systems thinking	Learning for sustainable development embedded in the whole curriculum, research, outreach and management campus programs, not as a separate subject.
Values-driven	Sharing the values and principles underpinning sustainable development.
Critical thinking and problem solving	Leading to confidence in addressing the dilemmas and challenges of sustainable development.
Multi-methods	Art, debate, drama, playful experiences, different pedagogies, etc. which model the learning processes.
Participatory decision-making	Learners participate in decisions on how they are to learn.
Locally relevant, effective and contextual	Addressing local as well as global issues, and using the languages which learners most commonly use.

All this has caused a change in world views regarding *Human Exception*, by which the human being is conceived as a special organism - an exception among animal species. Animals basically depend on their instincts in order to survive. Humans, on the other hand, have markedly different learning mechanisms, act with deliberation, and are capable of dominating other organisms (Corral-Verdugo, 2001; Corral-Verdugo & Pinheiro, 2004). This world vision has shifted toward a *New Environmental Paradigm* (Dunlap and van Liere, 1978), which holds that humans are part of the natural world and subject to rules of nature, and are governed by the interdependence of species. Earlier *behavioral* theoretical approaches such as Skinner's contingency model stated that conditions which exist when a response is followed by a reinforcement action enable a range of environment-behavior relationships to satisfy a contingency (Corral-Verdugo, 2001). The newer *cognoscitivism* model aims to study the information determinants of thought processes and related events. That is, behavior is influenced by the information an organism stores in the brain and the brain's information processing systems (Von Eckardt, 1996). Finally, this new paradigm moves from a *disciplinary* approach (see the Merrian-Webster online dictionary: http://www.m-w.com/dictionary/discipline) towards an *interdisciplinary* approach, which transcends disciplines to address any problem.

 Human behavior in general, according to Corral-Verdugo & Pinheiro (2004), is composed of many facets. For example, those aspects dealing with problem resolution are considered to be related to *competence or performance;* those dealing with choice or preference are called *motives* or *attitudes*; those facets related to objects or events according to cultural norms are called *beliefs*;

ideosincracies, or aspects which reflect the individual's peculiarities, are considered to be related to *personality*. All facets are involved in intentional and irrational actions.

According to the Merrian-Webster online dictionary (see: http://www.m-w.com/dictionary/behavior), the word "behavior" has three definitions: 1) the manner of conducting oneself, 2) anything that an organism does involving action and response to stimulation, and 3) the response of an individual, group, or species to their environment. For this study, the third definition is most appropriate, since the first is not related to the environment and the second responds to a theoretical framework which has provided many ideas toward the formulation of studies of pro-environmental conduct, but which few authors currently consider.

Several authors (Kantor, 1967; Kaiser, 1998; Corral-Verdugo, 2001) consider behavior to be the interaction between organisms and objects. Specifically, pro-environmental behavior (PEB) is defined as actions contributing to environmental conservation, or human activity intended to protect natural resources or at least reduce environmental deterioration.

These definitions include a deliberate component, or intentionality, and expect a result. In conclusion, sustainable behavior has three main characteristics: 1) it is an outcome or result; 2) it is effective, and 3) it is complex.

PEB is effective because it consists of actions which generate visible changes in the environment. PEB is also a product or outcome, since it is a response to requirements or a solution to problems. This means that PEB must be analyzed as competencies, that is, as effective responses facing demands for environmental protection, and also as behavior, that is, as deliberate effective responses taking responsibility for environmental protection. These demands may be individual attitudes or motives, or social norms. Therefore, the study of beliefs and attitudes is indispensable. PEB has a high level of complexity because it allows us to anticipate a situation and plan ahead in order to achieve effective results. This reinforces the need to study norms and values which an individual establishes as a framework for carrying out pro-environmental actions on a continual basis.

Considering the previous characteristics, PEB can be defined as a "set of deliberate and effective actions which respond to social and individual requirements for protecting the environment", and sustainable behavior as an intentional behavior aimed at protecting the environment and encouraging human well-being and security.

According to the aforementioned, and adapted from the definition by Corral-Verdugo & Pinheiro, sustainable behavior is "*a set of effective, deliberate, and anticipated actions aimed at accepting responsibility for prevention, conservation and preservation of physical and cultural resources. These resources include integrity of animal and plant species, as well as individual and*

social well-being, and safety of present and future human generations". This extensive definition provides a point of reference for determining sustainable human behavior in this study.

Three main differences exist between this definition and that considered by Corral-Verdugo & Pinheiro (2004):

1) This definition considers responsibility, that is, the capacity for responding or acting instead of competing.

2) It addresses prevention and conservation, not only preservation.

3) It includes individual and societal material safety.

These modifications to the definition, according to the author of this study, make the definition more complete. First, they are directed toward an effective disposition toward problem solving with the taking of responsibility by individuals; that is, individuals are willing to resolve problems through actions or behavior. These behaviors are considered in the characteristics of ESD in order to educate citizens capable of responding to future demands (Juarez-Nájera, 2007).

Second, this definition considers not only the conservation and preservation of physical environment, but also prevention.
These aspects have been controversial topics since the mainstream environmental protection movement began to address environmental deterioration. Preservation consists of covering up damage or danger, but can sometimes be an essential, if not sufficient, element of conservation. Conservation, on the other hand, refers to maintaining the environment in its original state. Both aspects are important. However, the principle of prevention has never been explicit. This principle draws on knowing, preparing, and taking action in order to avoid environmental deterioration. This definition takes into account conservation, preservation, and prevention.

Third, the original definition considers only human well being, not future security of natural resources. Nevertheless, in order to assure long-term sustainability, according to Gardner & Stern (2002), the following must be accomplished:

1) Exponential human population growth must be halted.

2) Economic and material growth must be controlled, and such growth must be oriented toward qualitative development rather than physical expansion, and toward material sufficiency and security for all.

3) Profound changes must be made in core societal beliefs, values, and ethics concerning population growth, material growth, wealth, and well-being, as well as in basic conceptions of the relationship between humans and the rest of nature, acknowledging the complexity of global systems and humanity's inability to manage these systems solely for our own purposes.

1.4   RESEARCH GOAL

International agencies are shifting their support toward education for sustainable development (ESD), rather than environmental education (EE). For 30 years, environmental education has focused mainly on environmental issues as separate from social and ethical problems. Although the founding documents of EE include elements of the concept of sustainability, the UNESCO (2005) resolution of the Decade of Education for Sustainable Development clarifies and updates the goal of such education, based on results of the Tbilisi Summit (1977). For example, ESD principles are holistic and interdisciplinary, directed toward values and the development of critical thinking; they focus on problem solving, are based on methods such as playing games and art appreciation, and involve actor participation in decision making regarding local conditions.

In order to propose an alternative higher education, it is important to understand and identify ways in which behavior may be affected. Factors involved in achieving the determinants of human behavior toward a responsible citizenry who seek equality, justice, peace, and the public good should be reviewed. The UNESCO (1998, 2004, & 2005) has pointed out that education in general, and higher education in particular, is the cornerstone of human rights, democracy, sustainable development, and peace.

This study aims to address personal factors which influence behavior toward sustainability of decision-makers within Higher Educational Institutions (HEI) in nations with greatly varying cultures and socio-economic structures, as well as to present the educational area, or themes or concepts, with which these individuals (student, faculty, staff, and administrators) work, and in which higher education for sustainability can be fostered.

Personal factors in this study refer to those psychological variables related to individual personality features and their motivations to act. Spheres or areas of work of those individuals are potential areas of intervention for changing people's beliefs and values within education, research, outreach, and campus management.

To begin, it is important to define the meaning of sustainable behavior. In this study, it is considered to be the set of effective and deliberate actions directed toward conservation and /or preservation of physical and cultural resources, integrity of animal and plant species, and individual and social well being and safety of present and future generations.

This definition leads us to a theoretical framework based on current psychological developments in cognitive psychology in order to explore people's changing attitudes. The cognitive science approach, developed in the 60s, suggests that learning and cognition depend on individuals' cognitive information processing.

Within social psychology, two main conceptual frameworks explain human behavior: that which is based on self-interest and that based on altruism (Kaiser *et al.*, 2005). J. J. Rousseau, in his Eighteenth-Century "Discourse on Inequality," states that humans act either based on egoism or selflessness, but regardless, human goodness should be fostered so that individuals continue to be humane (Neuhouser, 2008). This study considers the conceptual framework of norm activation, based on moral norms grounded within individuals. That is, personal norms, if activated, are experienced among individuals as feelings of personal obligation, either denying or not denying the consequences of their behavioral choices regarding the welfare of others.

In order to propose a model to test behavior, specifically sustainable behavior, two models for modifying behavior toward pro-environmental action were studied: the meta-analysis by Hines *et al.* (1988), and the model proposed by Stern *et al.* (1999) based on motivational values and two personality traits of norm activation. Also, two of the seven types of human intelligence inter- and intrapersonal intelligence described by Gardner (2001) in his theory of multiple intelligences demonstrated in all cultures were added. These aspects were chosen due to the ease of demonstrating these qualities through a written test. These two skills were then analyzed through the five Corral-Verdugo & Pinheiro's (2004) psychological dimensions, which are based on the notion of sustainability: effectiveness, deliberation, anticipation, solidarity, and austerity. Consequently, the model focuses on values and moral norms rather than on rational choice and self-interest.

This study draws on social psychology, which is the scientific study of the reciprocal influences of the individual and his or her social context through the behavioral expression of that individual's thoughts and feelings. Therefore, the model presented here addresses a range of contexts, from intrapersonal processes and interpersonal relations to inter-group behavior and societal analyses.

In order to operationalize the proposed model, a 67-item questionnaire was developed based on the model of Stern *et al.* (1999). This model was updated to include the four types of motivational values proposed by Schwartz & Boehnke (2004). These authors suggest that these four types of values are present in all humans worldwide. Two variables, the New Ecological Paradigm and cultural models, were omitted because they showed low reliability in previous studies (Kaiser *et al.*, 2005). Also, two personality traits, (ascription of responsibility and consciousness of consequences) were considered by asking about environmental topics. Twenty of the 72 items for emotional competencies of Boyatzis *et al.* (2002) were sifted and adapted through five psychological dimensions. Finally, 6 demographic items (gender, age, income, religious denomination, activity, and level of education) were added. The purpose of the model was to

improve the explanation of behavioral variance compared to previous models, as pointed out by Corral-Verdugo, 2001; Harland, 2001; and Stern, 2000.

In order to identify the areas in which key individuals within HEI work and the ways in which ESD is fostered, two areas of intervention in which people may plausibly modify their beliefs without coercion for the long-run (Gardner, 2002) were presented: education and community management. These areas include four HEI activities: teaching, research, outreach, and campus physical operations, and may potentially make use of alternative learning methods and group projects, play, art, psychotherapy groups, and labor management as ways to foster behavior toward sustainability (Juarez-Nájera *et al.*, in press). Play is fun, relaxing, and holistic, and failure does not cause damage; art inspires awe, which also comes into play in the appreciation of nature, and is a necessary step in experiencing a desire to take care of the environment. These are helpful tools, because achieving sustainability requires changes in pedagogy, and play and art provide holistic ways of learning about reality, while science, with its analytical rationality, when applied to grasp reality, cannot express desires, emotions, fears, lifestyles, identities, and intuitive notions. In the community management area, psychotherapy groups and labor management can foment self-esteem in order to achieve self-assured citizens able to work for a better, more sustainable world.

1.5   GUIDES TO THE READER

In order to answer the principal research question and present the outcomes of this study, chapter one provides an introduction to historical backgrounds, features, and underlying principles of ESD, as well as a definition of sustainable behavior in order to explore the main characteristics of ESD for present and future generations. Furthermore, the research goals and guides to the reader are presented in this chapter.

Subsequently, the manuscript is divided into two sections according to the main research topics: personal factors and areas of change. Part A is devoted to personality factors and part B to spheres of human intervention.

Part A explores people's motivations for acting in favor of the common good, as mentioned in the Decade of Education for Sustainable Development: environmental conservation and protection, human rights, social security, gender equity, poverty reduction, health promotion, intercultural understanding and peace, sustainable consumption and production, and rural transformation. Also it explores theoretical approaches suitable for devising a model for sustainable behavior and ways in which this model may be operationalized, tested, and validated.

Part A includes two chapters. Chapter two presents the theoretical framework, information processing approaches which are part of cognitive theory, and some socio-psychological theories

for determining factors of behavioral change. Additionally, a model to determine sustainable behavior is proposed. Chapter three describes the methodology for applying and testing the sustainable-behavior model developed by three groups of key participants - students, faculty, and administrators - at two higher educational institutions in two countries with greatly different cultures and socio-economic structures. Also, outcomes for validating the proposed model are discussed.

Part B explains the principles underlying education for sustainability in the UNESCO mandate of the Decade of Education for Sustainable Development These principles include those areas of intervention in which people's beliefs may be modified in the long term without coercion; factors which must be taken into account in order to achieve self-fulfilled citizens who are critical thinkers, equitable, fair, and responsible with respect to their environment, others, and themselves; and those activities which may be integrated into teaching, research, outreach, and campus managing within HEI in order to develop a way of life which foments education for sustainability.

Part B (chapter four) points to differences between human needs and desires, and ways in which citizens may achieve self fulfillment. Also, education and community management are described as two areas in which human behavior may be changed in the long-term without coercion.

Chapter five includes additional findings and comments on the scientific and practical value of the model developed, and a brief political reflection on these results.

Annex A and B include a complete list of universal values and personal intelligences. Annex C shows the English version of the questionnaire used at HEI when the original questionnaires (available by request to the author) were applied in Spanish and German. Annex D briefly explains multivariate statistical techniques used. Annex E shows the probability calculations for two HEI, and five psychological dimensions among three participants. Finally, the bibliography is presented.

PART A

SOCIO-PSYCHOLOGICAL MODEL TO DETERMINE SUSTAINABLE BEHAVIOR

CHAPTER 2

THEORETICAL EXPLANATORY BEHAVIORAL FRAMEWORKS AND

PROPOSED MODEL TO DESCRIBE SUSTAINABLE BEHAVIOR

In the previous chapter, the discussion focuses on the definition of sustainable behavior, underlying principles, and the background of education for sustainable development (ESD). This chapter discusses the cognitive theory which models sustainable behavior under the information-processing approach. Additionally, in this section, the most widely known social-psychology models for explaining attitudes which promote the study of sustainable behavior and the factors associated with them are shown. This provides conceptual frameworks which identify the factors explaining sustainable behavior (specifically in situations in which social dilemmas exist, as is the case for many environmental problems and their economic, social and cultural contexts as indicated in ESD). The chapter ends with a proposed model to identify sustainable behavior.

2.1   THEORETICAL FRAMEWORKS WHICH EXPLAIN SUSTAINABLE BEHAVIOR

Virtually all conceptual schemes which have been used in psychology have been applied to explain sustainable behavior and pro-environmental behavior (PEB). Some of the known explanatory frameworks are behaviorism, psychoanalysis, cognoscitivism, evolutionary psychology, and interdisciplinary systemic approaches, and many variations may be found within each framework.

According to Corral-Verdugo (2001), behaviorists maintain that sustainable behavior, like any behavior, is under control of both external stimuli and an individual's circumstances. Behavior is activated shortly after a conditioned stimulus, or after a primary reward if no conditioned stimulus exists. The core tools of operant conditioning are positive and negative reinforcers. Positive reinforcement is a consequence of a given behavior which causes that behavior to occur with greater frequency. Negative reinforcement, or punishment is a consequence of a behavior which causes that behavior to occur with less frequency. A lack of any consequence following a behavior leads to the cessation of that behavior. Whenever a behavior is inconsequential, producing neither favorable nor unfavorable consequences, it will occur with less frequency. When a previously reinforced behavior is no longer reinforced with either positive or negative reinforcement, it leads to a decline in the response. For behaviorists, no internal phenomenon significantly explains behavior because internal phenomena are intangible and subjective and therefore may not be scientifically studied.

By contrast, cognitive science indicates that internal or mental phenomena lead to behavior. People's knowledge, attitudes, or beliefs are variables which they form based on their interaction with their environment. These may be expressed in the form of ecological habits. Cognitive science is the study of the nature of intelligence, and emphasizes algorithms (mathematical operations) intended to simulate human behavior on a computer (Von Eckardt, 1996).

Psychoanalysts see the dichotomy between environmental conservation and environmental degradation as a result of a struggle between creative (Eros) and destructive (Thanatos) impulses of the human unconscious, or between biophilia (love for living systems), and death wishes. Currently there is a high rate of degradation which would seem to indicate that Thanatos (the destructive) prevails over Eros (the creative), which conforms to Freud's pessimistic explanation of psychological mechanisms of human aggressiveness (Fromm, 1973). Although psychoanalysts have offered many proposals to counter the effect of destructive impulses toward the environment, little or no research has been carried out from a psychodynamic perspective to corroborate the relevance of these proposals.

Evolutionary psychology ensures that conservation of the environment and biodiversity can be understood as a necessity for maintaining a safe, high quality environment and the perpetuation our species. This is useful to understand as we manipulate the environment according survival needs. However, some evolutionary biologists believe that actions toward environmental conservation can be explained by reputation-based models which demonstrate an individual's genetic quality by his ability to look after him/herself (selfishness), his/her family (genetic altruism), or others in hopes of retribution (reciprocal altruism). Helping others at a small cost to oneself is a signal of genetic quality because this characteristic is costly to maintain, and only high quality individuals can afford the cost*. Some evolutionary psychologists argue that altruism evolves into a form of behavior which enables the preservation of the social group, and therefore of individuals and their genes. Other evolutionists (Fromm, 1973) suggest a human biophilia which is an affinity of our natural love for life and which helps sustain life.

Models which take a systemic approach, by trying to gain further inclusiveness in explaining why people behave in a pro-ecology manner, include effects of situational variables (physical and regulatory contexts) and other variables of an extra-psychological nature (Weisbuch, 2000). Some variables included are individual characteristics such as age, sex, social class, income, educational level, or contextual factors such as social norms. Table 2.1 summarizes the explanatory frameworks presented above.

Table 2.1 Explanatory theoretical frameworks for sustainable behavior and their fundamental elements (adapted from Corral-Verdugo, 2001)

Theoretical framework	Fundamental elements	Explanation of Sustainable Behavior (SB)
BEHAVIORISM Developed by Skinner in 1938.	Operant conditioning	SB is generated and maintained by its positive and immediate consequences.
COGNITIVE PSYCHOLOGY "Revolution of cognition" in the sixties.	Information processing Variant: • Theory of planned behavior • Norm-activation theory • Habit formation • Cognitive dissonance	Individual generates sustainable provisions that are processed, stored and used in his or her brain and mind.
PSYCHOANALYSIS Developed by Freud in 1900.	Intra- psychic apparatus	In the struggle between Eros and Thanatos (Fromm, 1973), there is a predominance of the latter.
EVOLUTIONARY PSYCHOLOGY Based on Darwin's postulates in 1859.	Genetic stress Variant: • Genes and egoistic individuals • Cooperation and altruism • Altruism and SB • Egoism and SB • Biophilia hypothesis	The effect of SB is reciprocal altruism that may become disinterested altruism or Biophilia (Fromm, 1973).
SYSTEMIC THEORIES	Interrelated factors	Sustainable behavior is a product of complex operating effects within systems of relationships between variables.

From the frameworks presented in Table 2.1, cognitive science (Von Eckardt, 1996) seems to be the most useful in explaining peoples' behavior in relation to aspects of their environment, welfare, and material and social safety within society. Cognitive science is an interdisciplinary area with contributors from various fields, including cognitive psychology, which is a branch of psychology according to which investigates internal mental processes such as problem solving, memory, and language. The most relevant school of thought emerging from this approach is known as cognitivism, which characterizes people as dynamic information-processing systems whose internal and mental operations (beliefs, attitudes, or perceptions) might be described in computational terms. The information-processing approach will be presented in the following section.

2.1.1 Information-Processing approach

The conceptual framework which brings some structure to the pandemonium of contemporary behavior research is cognitive science (Leahey & Harris, 2001). This explanation prevails today (Matthews *et al.*, 2000). The twentieth-century emergence of the conceptual framework of information processing to explain the human cognitive process was mainly due to the rapid development of computer science and the impressive demonstration of artificial intelligence in the late fifties, and formal analysis of cognition in the sixties. Since then, the dominant theory has been the cognitive information processing model which Broadbent, among other contributors, put forward. These scientists viewed mental processes as computer software inside hardware, (the brain). They referred to input as information entered into a computer, its representation, computation or processing, and output as new information.

The mind-body problem, and its modern subjective expression called "consciousness", is a topic which has been vehemently debated by philosophers for millennia, and more recently by psychologists and biologists. The question of whether consciousness plays a role in the production of behavior, or whether it is a powerless observer of the world, and the body's response to behavior, seems to present two competing approaches based on information processing: the *symbolic system hypothesis* and the *connectionist assumption* (Leahey & Harris, 2001).

The symbolic system hypothesis establishes that the mind is like a computer program. At the core of the program is a manipulation of symbols representing the world through a set of formal rules, analysis of stimuli, and selection of responses. In its simplest form, information arises from the senses, is transformed into an internal representation, and the subject produces an answer (Matthews *et al.*, 2000).

Meanwhile, the connectionist assumption makes no distinction between types of memory. Instead, this approach states that the architecture of cognition consists of multiple simple processing units, very similar to neurons in the interconnected network of the brain. Each unit is identical to all other units, and learning, memory, and thinking are all changing patterns of activity in the network as a whole (Harris & Leahey, 2001).

By analogy, the mind represents software or sequences of instructions carried out by computers or other hardware. This software does not refer to a physical machine or hardware. At the most fundamental level, brains resemble computers in their use of binary representations. The fundamental "machine code" of computers is expressed in "zeros" and "ones", and the neurons of the brain are either firing ("on") or resting ("off") (Matthews *et al.*, 2000).

Cognitive information processing between inputs and outputs is more complex. However, the number and nature of intermediate steps depend on the particular approach. That is, the internal structure of processing or the order in which processes operate and how they feed into one another are key elements to understanding existing approaches. Two approaches have been proposed: processing systems which carry out their calculations in *series* or in *parallel.* Series models assume that each operation is carried out one step at a time; the last operation must finish before the next one in the series commences, as occurs in a conventional computer program. Parallel models, however, are comprised of multiple processors operating simultaneously. Unlike conventional computers, brains are composed of thousands of massively interconnected simple computation units (neurons) operating simultaneously (Leahey & Harris, 2001).

This difference between brains and computers brings up several reasons to doubt the validity of the hypothesis of the serial processing of human cognitive symbolic processing. First, the human brain is capable of thinking and reacting quickly; many computational stages are carried out simultaneously. Secondly, the failure of traditional artificial intelligence to simulate simpler human skills such as recognizing friends' faces, reading, writing, and moving around inside a room full of objects, despite years of work and the increasing possibilities of computers, has led many psychologists to suspect that the serial processing model of the symbolic system in the human mind is incorrect, and instead of looking at the computer as our model for the mind, they should look at the brain (Leahey & Harris, 2001).

At present, there is an emerging hypothesis which could reunite the two approaches of cognition; the human mind is a hybrid of both. It is possible that the human mind in its rational aspects is a serial performance processor, especially when thoughts are transformed into awareness. For example, when we think or write, an idea and a thought appear simultaneously. Meanwhile, more automatic and unconscious aspects of the human mind would be of a connectionist nature. Consciousness is a virtual machine installed by socialization in parallel processors in the brain. Socialization nourishes us with language. However, with language, we speak and think one thought at a time, creating a serial processing of consciousness. Humans are flexible creatures who do not change their physical nature, but rather their programs. These programs are cultures that are tailored to places and times. Learning a culture raises awareness and consciousness, and consciousness is an adaptive process because it provides the ability to reflect upon one's own actions, to think about alternatives, plan in advance, acquire general knowledge, and be a member of society (Harris & Leahey, 2001).

The computational framework has attracted a variety of criticisms. First, an assortment of philosophical issues relate to traditional questions such as the mind-body problem. Further

controversies concern the experience of consciousness upon the presentation of mental states. Second, the computer metaphor may be broadly correct but unhelpful, because of the diversity of possible computational systems, constructed based on different principles, to explain any given set of data. Conversely, what computers do well – perform high-speed mathematical functions, abide by rule-governed logic - humans do poorly. And what humans do well – form generalizations, make inferences, understand complex patterns, and experience emotions - computers do poorly or not at all. Third, the computer metaphor may be appropriate to some psychological functions, but not to some of the essential attributes of humanity such as emotion, personality, creativity, and intelligence. Leaving these fundamental issues aside, cognitive models may have a surprising range of applications. Nowadays there is a well-established link between emotional disorders and particular styles of information processing, characterized by negative self-referent cognition and irrational beliefs. Personality also may relate to differences in people's internal models which the construct regarding themselves and their interactions with others. Computers do not have feelings, but emotions and personality may nevertheless have a cognitive basis. Furthermore, the computer metaphor suggests undue passivity. Computers run programs fomented by an external agent, while people pursue goals actively and flexibly within complex environments. In other words, the nature of behavior resides in the dynamic interplay between person and environment, rather than in some fixed program.

However, none of these limitations should be considered to be fundamental difficulties for the computer metaphor which has proven to be extremely useful in explaining many areas such as personality, emotional disorders, and human behavior, and has remained the only scientifically acceptable bases for conceptualizing performance (Matthews *et al.*, 2000). Considering the information-processing approach as the conceptual framework to describe human behavior generates the question: why the need to promote a study of human behavior in a world where the integrity of animal and plant species , as well as the welfare and material security of individuals and society in present and future human generations, are threatened?

The significance lies not only in promoting a study of sustainable behavior, but also in identifying factors which are capable of change. Psychologists and sociologists alike are exploring associated factors in order to understand and produce a model for human behavior which approximates in a transparent manner the current situation across diverse cultural environments.

The following section examines three dominant theoretical frameworks considering those factors which promote or limit individual behavior. These frameworks are instruments which can be helpful in analyzing determinants of sustainable behavior.

2.1.2 Socio psychological attitude-behavior models

Contemporary scholars have built complex models of relationships among several key behavioral determinants such as experience, knowledge, beliefs[1], attitudes[2], and values[3]. Despite the diversity of specific applications of attitude-related theories, they may be separated into two socio psychological models which take into account factors which promote or limit an individual's behavior (Kaiser, Hübner & Bogner, 2005).

The two general models are: (a) Theory of Planned Behavior (Ajzen, 1991) and (b) Norm-Activation Theory (NAT) (Schwartz, 1977). While the first has its basis in deliberation based on rational choice and self interest, the second is grounded in values and moral norms. Recently formulated, the value-belief-norm framework (VBN) (Stern *et al.*, 1999; Stern, 2000) is a generalization of the NAT.

A. Theory of Planned Behavior

The Theory of Planned Behavior (TPB) supposes that behavior is predicted by an individual's intention to perform. In turn, intention is seen as a function of (a) a *person's attitude* towards this behavior, (b) *subjective norms*, and (c) people's *perceived control*, shaped by their estimation of their own strength to perform a behavior which can be prevented (or facilitated) by their abilities or situational factors (Montalvo, 2002; Wehn, 2003; Kaiser, Hübner & Bogner, 2005). Figure 2.1 outlines attitudinal relationships of sustainable behavior using the TPB model proposed by Ajzen (1991).

There is great interest in TPB research. Harland (2001), Montalvo (2002), and Wehn (2003) found hundreds of empirical studies based on this model and its predecessor, the Theory of Reasoned Action. Such popularity may be attributed to specificity with which instructions for applying these models were outlined by Ajzen and Fishbein in 1980, and also to the fact that these models are consistent (Harland, 2001). TPB has become the most influential attitude-behavior model in socio-psychology and in environmental psychology (Carabias, in press; Kaiser, Hübner, &

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[1] According Rokeach (1973), a belief is a simple proposition, conscious or not, which may be inferred from what a person says or does, and which may be preceded by the words "I believe that." Any belief consists of three parts: cognitive (knowledge); affective (feeling) and conative (action). The three main categories of belief are: descriptive or existential (I believe that the sun rises in the east); evaluative (I believe that trees are beautiful) and prescriptive or exhortative (I believe that trees must be respected). Beliefs are formed during childhood. The set of beliefs that an individual has regarding the surrounding socio-physical reality is called a belief system.

[2] An attitude is a smaller set of related beliefs. It is also a comprehensive, relatively enduring belief regarding an object or situation which predisposes the person to respond in a certain way to that object or situation (Caduto, 1995).

[3] Values are forged from sets of interrelated attitudes. Values are enduring beliefs about a certain behavior or ideal way of life which is personally or socially preferable to an alternative behavior or way of life (Caduto, 1995).

Bogner, 2005). In fact, with respect to the environment, health care, nutrition, sports, etc., many studies have found support in (aspects of) TPB.

Figure 2.1 Sustainable attitude model proposed by Ajzen (based on Montalvo, 2002)
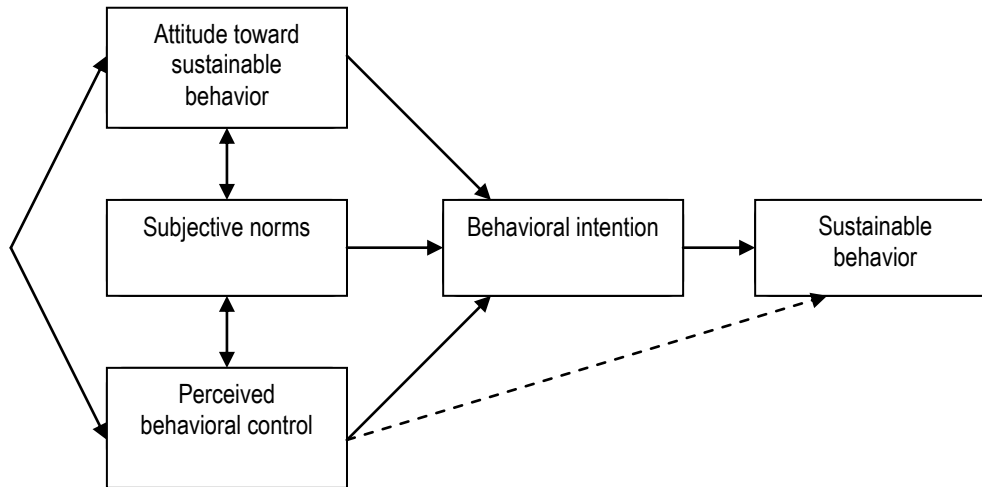
B. Norm Activation Theory

The NAT ascribes a significant role to personal norms. It postulates that personal norms are intrinsically motivated self-expectations with regard to morally appropriate behavior. Personal norms, if activated, are experienced among individuals as feelings of personal obligation, of either denying or not denying the consequences of their behavioral choices regarding the welfare of others. Behavioral expectations stem from personal norms which are grounded within and across individuals, and not from social norms, in a specific social group (Stern, Dietz, Abel, Guagnano and Kalof, 1999; Harland, 2001).

The NAT holds that activation of personal norms occurs under the influence of four situational activators and two personality trait activators. The four situational activators are (a) *awareness of need*, or the extent to which a person's attention is focused on the existence of another person or an abstract entity, such as environment, in need, (b) a person's sense of feeling *responsible* for the consequences of the behavior regarding that person's welfare (c) *efficacy*, which refers to the extent to which persons recognize actions which might alleviate need and (d) *ability*, or the extent to which one possesses the resources or capabilities needed to perform the action in question. Two personality traits refer to predispositional influences regarding norm-activation: *Awareness of consequences*, which refers to a person's receptivity for cues signaling situational needs, *denial of responsibility*, which refers to people's inclination to deny responsibility for the consequences of their behavioral choices directed toward the welfare of others. The four situational

activators and the two personality traits determine whether or not a behaviorally specific personal norm becomes activated (Harland, 2001; Stern, 2000).

The numerous applications of NAT in the environment domain have provided support for several of the relationships proposed in the model (Harland, 2001). However, Harland (2001) and Stern (2000) indicate that several authors have noted that in these models a decisive role has been assigned to personal norms. This view of personal norms raises the question whether the central role assigned to personal norms in NAT is justified in all cases, and suggests that personal norms could play a less striking role, as in other models.

C. Value-Belief-Norm Theory

The value-belief-norm (VBN) unites the value theory, the norm-activation theory, and the perspective of new ecological paradigm[4] (NEP) through a causal chain of five variables which guide an individual toward behavior: the first latent factor is Schwartz's (1977) set of personal values (altruism, selfishness), traditionalism and openness to change values); the second factor is the NEP (Dunlap, & van Liere, 1978); the third and fourth factors take into account the two elements of the NAT regarding moral norms, awareness of consequences (AC), and adscription of responsibility (AR) with respect to general conditions of the biophysical environment; and the fifth element includes personal norms for pro-environmental action. This model explains environmental activism, environmental citizenship, support for policies, and behavior in private sphere (Stern, Dietz, Abel, Guagnano, and Kalof, 1999; Stern, 2000). Previous authors' works support the rationale and empirical causal ordering of factors.

The causal chain starts with central elements, such as relatively stable personality, and belief structures and moves toward beliefs more focused on environment-human relationships, its consequences, and individual responsibility to take corrective actions. Stern (2000) hypothesizes that each variable in the chain directly affects nearby variables and can also directly affect variables which appear later in the chain. Personal norms leading to pro-environmental actions are activated by individuals' belief that environmental conditions threaten things which they value, and that they can act to reduce the threat. These norms create a general predisposition which affects many types of behaviors carried out with pro-environmental intention. Additionally, specific personal behavioral norms and social- psychological factors can affect individuals' pro-environmental behavior. Figure 2.2 shows the diagram proposed by Stern *et al.* (1999).

Stern (2000) recommends that studies which examine only attitudinal factors probably find effects in an inconsistent manner, because effects are contingent on abilities and contexts. Studies

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[4] NEP states that human beings are part of natural world and subject to the same rules which govern nature, such as the interdependence of species (Dunlap & van Liere, 1978).

which examine only contextual variables such as material incentives, social norms, or the introduction of new technologies may find effects which depend on people's attitudes or beliefs, although the model attributes these effects to other causes. Studies of simple variables demonstrate that a particular theoretical framework has explanatory strength, but they do not contribute much to the comprehensive understanding of individual behaviors which are environmentally significant which are needed to change people's actions.

Figure 2.2 Schematic model of variables in the Value-Belief-Norm theory
(Stern *et al.*, 1999)
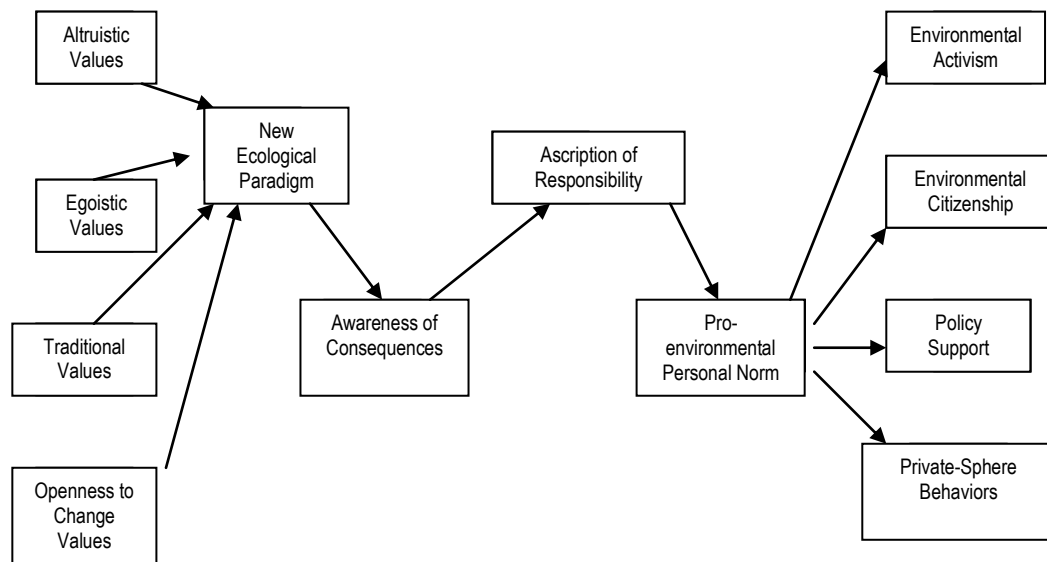
Harland (2001) and Stern (2000) consider that the NAT is an effective tool because they found the attitudinal component to be superior to the normative component in determining the willingness of behavior. This may have been caused by the fact that the normative component of the model is not moderate. On the other hand, Kaiser, Hübner, & Bogner (2005) compare TPB and VBN: TPB more fully explains proportion of explained variance. More importantly, the adjusted statistics reveal that only TPB appropriately represents the relationships among its concepts whereas the VBN model does not.

So, which social-psychology model is to be used to determine factors which foster sustainable behavior? Should we accept a model which focuses on rational choice and individual self-interest but which denies moral considerations, or a model based on values and moral norms through its generalization? What philosophical point of view should be considered in morally relevant situations in which social dilemmas are presented – that is, when one's self interest and the

interest of others are contradictory, when there is a tension between individual and collective rationality (social dilemmas; Kollock, 1998).

The undertakings of the Decade of Education for Sustainable Development (UNESCO 2004, 2005) involve social dilemmas: poverty reduction, gender equality, health promotion, environmental protection and conservation, rural transformation, human rights, intercultural understanding and peace, sustainable production and consumption, natural and cultural diversity, and communication and information technology. Several authors (Axelrod, 1984; Felkins, 1995; Kollock, 1998; Macy & Flach, 2002; Axelrod, 2004; Santos, Pacheco & Lenaerts, 2006) have analyzed the dynamics of social dilemmas. In general, they point out that agent-based models or models "from the bottom – up" assume the pre-existence of a very different world in which decision-making is equitably distributed on a global scale, where decision making is locally organized, stemming from multiple local interactions among autonomous interdependent actors. These authors recommend research on the expectations and effects of generalized reciprocity within groups, the transformation of incentive structures, and a greater focus on heterogeneous dynamic models in understanding social dilemmas.

The current study uses a model adapted from the VBN, because the TPB denies moral considerations, and the VBN is a generalization of the NAT. Additionally, Kaiser, Hübner & Bogner (2005) and Corral-Verdugo (2001) indicate that on average 40% of behavioral variances are predicted by psychological variables. In other words, 60% of behavioral variance still remains unpredictable. The field of behavioral change requires sinthetic theories or models which incorporate other variables, and which explain relationships among these new variables, which are used to explain one or more types of behavior.

The following section presents conceptual frameworks considered in this investigation to determine personal and situational variables which influence the behavior of key individuals in higher educational institutions which foster education for sustainability within their professional activities: teaching, research, outreach, and campus management. Secondly, the proposed model which illustrates relations among personality and contextual factors which explain such behavior is presented.

2.2   HOW TO IDENTIFY A MODEL FOR SUSTAINABLE BEHAVIOR

Prediction of sustainable behavior is not simple. It appears to involve a number of variables, none of which is likely to operate without interacting with others. Therefore, the development of a model is a difficult task. Several authors in social psychology (Hines, Hungerford & Tomera (1988/87); Blamey (1998), Stern (2000), Harland (2001), and Corral-Verdugo & Pinheiro (2004))

have used (one of several/ a set of) viable attitude-behavior models as a means to identify factors which lead to a change in sustainable behavior, or initially pro-environmental behavior.

Some of the models include familiar theories, such as TPB (Kaiser, 1998; Wehn, 2003; Montalvo, 2006 and 2002; Carabias, in press) and NAT (Arbuthnot, 1977; Hopper & Nielsen, 1991). Some models also consider organizational factors (Shriberg, 2002), personal abilities (Allen & Ferrand, 1999), context (Corraliza & Berenguer, 2000) and habits (Collins, 2001), which are other characteristics suitable for explaining behaviors which frequently have significant impacts through non attitudinal factors. Identification of advantages and disadvantages of behavior seems to be a straightforward way of detecting these determinats (Harland, 2001). However, the identification process is complicated because salient advantages and disadvantages of behavior seem to depend on the perspective from which they are evaluated.

For example, what brings a teacher to introduce in his/her course the values of sustainable development? What motivates students to dispose waste in proper containers? What guides a researcher to develop a project to solve local social problems? What makes staff buy more environmentally friendly goods in order to reduce environmental impact? What guides authorities of higher educational institutions to implement policies to improve the sustainability of their operations or educational context?

The above questions, it would seem then that efforts to explain advantages and disadvantages of behavior need to focus on various factors, such as beliefs, attitudes, motives, and abilities of individuals' to perform; social pressure exerted, moral values at election of acting, individuals' decisions on short or long-term, socio-demographic conditions, and contextual influences which foster or impede a particular behavior. As well as areas where we want to influence people's behavior and the conceptual framework where contemporary behavioral investigation is based on.

2.2.1 Factors explaining sustainable behavior

The appropriate question concerning sustainable behavior is: what factors are important and why? In order to prepare the proposed model, a number of conceptual frameworks were researched which provide important considerations in identifying psychological, situational, and contextual factors explaining behavior.

The first theoretical framework is the meta-analysis from Hines, Hungerford, & Tomera (1987) which addresses responsible environmental behavior. This study remains a benchmark for conclusions on behavioral variables.

The second model, the value-belief-norm (Stern, Dietz, Abel, Guagnano and Kalof, 1999) framework, states that, according to values, behavior may be predicted. This model offers an array of five causal factors which determine actions toward social movements.

Thirdly, the theory of multiple intelligences (TMI), developed by Howard Gardner in 1983 and updated in 1993, establishes seven skills (linguistic, logical-mathematical, musical, spatial, bodily-kinesthetic, and interpersonal and intrapersonal intelligence) which human beings perform in any culture in which they live and grow up. TMI is developed under a distributed vision, that is, inherent to individuals and artifacts that surround them.

The fourth and final theory consists of five psychological dimensions proposed by Corral-Verdugo & Pinheiro to achieve sustainable actions: effectiveness, deliberation, anticipation, solidarity, and austerity.

The author of this study considers that the elements drawn from the conceptual frameworks presented, the psychological and situational variables, causal arrangement of factors which determine an action in favor of the common good, personal skills applied in any culture, and the ideas behind sustainable actions, are all part of the notion of sustainability in human behavior.

A. <u>Hines, Hungerford & Tomera's Model</u>

The model proposed by Hines, Hungerford & Tomera (1988/87) identifies four factors which explain elements of willingness to perform an individual process: (1) recognition of the problem as a prerequisite for action, (2) knowledge of the courses of action which are available and most effective in a given situation, (3) the ability to implement strategies of action items, and (4) appropriate knowledge. These factors allow individuals to take action.

Abilities alone are not sufficient to lead to action. In addition, an individual must possess a desire to act. One's desire to act appears to be affected by a host of personality factors. These include locus of control[5], attitudes, and personal responsibility. Thus, an individual with an internal locus of control, positive attitudes toward the environment and toward taking action, and with a sense of obligation toward the environment will likely develop a desire to take action.

One remaining category exists which can interrupt this pathway to action: (5) situational factors. Situational factors such as economic constraints, social pressures, and opportunities to choose different actions may enter into the picture and serve either to counteract or to strengthen the variables in the model. For example, if an individual has the cognitive ability, desire, and

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[5] The locus of control represents an individual's perception of whether he/she has the skills to provoke changes through his/her own behavior. External locus of control refers to concepts based on the belief of some individuals do not intend to provoke change, because they attribute change to randomness or other powerful forces (God, government, and father). In the internal locus of control, on the other hand, individuals believe that their activities will likely have an impact.

opportunity to help stop pollution by contributing to a local toxic waste fund, but simply cannot afford to do so, that person will not engage in the environmental action and, in this instance, the model's main pathway will not be followed. Situational factors include age, income, education, and gender. Figure 2.3 presents the model's factors.

Figure 2.3 The proposed model of Responsible Environmental Behavior by Hines, Hungerford & Tomera (1988/87)
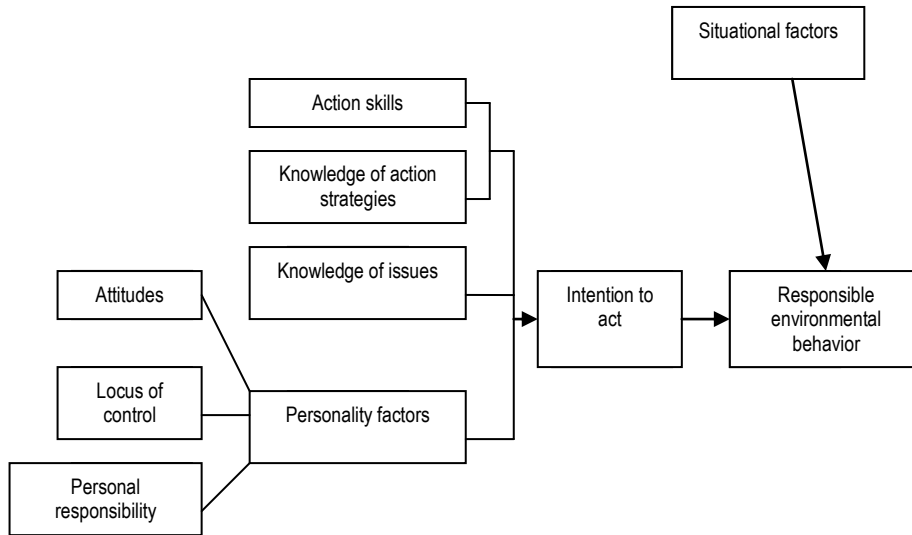
This model indicates several areas which are amenable to change by the efforts of environmental educators. The knowledge and skill components, and perhaps the personality components of the model, may be affected through the efforts of educators. Approaches which address both affective and cognitive experiences and which provide individuals with opportunities to develop and practice those skills necessary for environmental action must be developed and implemented in educational systems.

B. Theoretical framework by Stern *et al.*

The theoretical framework proposed by Stern *et al.* (1999), the so-called Value-Belief-Norm Theory, explains political activism which is essential to the success of social movements, which seek collective well-being. In some cases the benefit is distributed among a small and easily identifiable group, but in others collective benefits are often provided on a local, national and global scale. This suggest that although some individuals may expect enough personal gain to justify working toward the collective good on egotistical grounds, most are also motivated by a broader, altruistic concern, a willingness to take action even in the face of the "Free Rider Problem" as

explained in the "The Tragedy of the Commons" [6] (Hardin, 1968), "Voter's Paradox" [7] (Felkins, 1994), or "Prisoner's Dilemma" [8] (Poundstone, 1992; Axelrod, 1984, 2004).

Stern *et al.* (1999) find that in the United Sates many social movements, including the environmental movement, advocate the public good with reference to altruistic values. Such movements work to activate personal norms tied to those values. It is also possible, however, for a social movement to try to activate personal norms based on other types of values. For example, some conservative social movements, which see traditional values of duty, family loyalty, and the like as essential for providing public benefit such as social order, refer to these values in attempting to activate feelings of personal obligation to support the movement's objectives.

Stern *et al.* (1999) propose that norm-based action flow from three factors: (a) acceptance of particular personal values; the personal belief that everything important according to those values is under threat, (b) the belief that actions initiated by the individual can help alleviate the threat, and (c) the belief that these actions will restore the values under threat

Each of these three factors involves a generalization of Schwartz's theory (1977): (1) The original theory presumes altruistic values exist. The revised, broadened theory holds that personal norms may have roots in other values as well as in altruistic values and that levels of altruism and other relevant values may vary across individuals. (2) The original theory emphasizes awareness of adverse consequences of events for other people; the broadened theory emphasizes threats to whatever objects are the focus of the values that underlie the norm. (3) Norm activation depends on ascription of responsibility to oneself for the undesirable consequences to others; the broadened theory emphasizes beliefs regarding responsibility for causing undesirable effects or the ability to alleviate threats to any valued object.

In expanding the range of valued objects to be given theoretical consideration, Stern *et al.* (1999) adopt the typology of value developed by S. H. Schwartz (Schwartz & Blisky, 1987 y 1990; Schwartz, 1994; Schwartz & Huismans, 1995; Schwartz & Boehnke, 2004). It is worthy to stress some general considerations under value conceptual framework.

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[6] The Tragedy of the Commons describes conflicts between individual and group interest through an example of a common pasture shared by the local community with free access and no restrictions. Every individual realizes that his interest is best served by bringing as many cattle as possible to the pasture although the fodder is limited and it is obvious that if everyone does so the common goods will be completely exhausted.

[7] The Voter`s Paradox describes conflicts between individual and group interest in situations where, for instance, a person votes or volunteers in situations where collective action is involved, and people really cooperate, but they do (so) by self interest.

[8] The Prisoner`s Dilemma describes a model of cooperation between two or more individuals (or corporations, or countries) in ordinary life in which, in many cases, it would be personally worthwhile for each individual to not cooperate with the others (better to desert).

Universal aspects of human values

Values are forged from sets of interrelated attitudes. Values are enduring beliefs about a certain behavior or ideal way of life which is personally or socially preferable to an alternative behavior or way of life (Caduto, 1995). According to Caduto (1995), values associated with a particular behavior are called instrumental values (e.g. honesty, respect for the environment) and those involving ideal ways of life are called final values (e.g. peace in the world, environmental quality).

According to Pereira de Gómez (1997), values are classified into *physical* (e.g. health, physical ability and self-awareness), *intellectual* (e.g. attitude toward scientific knowledge, thought, and critical consciousness (criticism), *aesthetic* (e.g. sense of beauty, respect for different artistic expressions), *ethical* (e.g. honesty, kindness, truth, justice, tolerance), *socio-emotional* (e.g. sense of belonging, awareness of others, solidarity, democracy, brotherhood, service), *religious* (e.g. knowledge of one`s misión and living accordingly, recognition of one's limitations or deference to a higher power, and *liberty* (e.g. convictions, capacity to analyze, openness to pluralism, human rights).

According to Schwartz (1994), values have five conceptual aspects: A value is a (1) belief (2) pertaining to desirable end state or modes of conduct, that (3) transcends specific situations, (4) guides selection or evaluation of behavior, people, and events, and (5) is ordered according to importance relative to other values to form a system of value priorities.

Implicit in this definition of values as goals is that (1) they serve the interest of some social entity, (2) they can motivate action (giving it direction and emotional intensity), (3) they function as standards for judging and justifying action, and (4) they are acquired both through socialization to dominant group values and through the unique learning experiences of individuals.

In order to cope with reality in a social context, groups and individuals cognitively transform the necessities inherent in human existence and express them in the language of specific values about which they can then communicate. Specifically, values represent, in the form of conscious goals, responses to three universal requirements with which all individuals and societies must cope: (1) needs of individuals as biological organisms, (2) requisites of coordinated social interaction, and (3) requirements for the smooth functioning and survival of groups. Ten motivationally distinct types of values were derived, evaluated, and confirmed to be recognized within and across cultures: power, achievement, hedonism, stimulation, self-direction, universalism, benevolence, tradition, conformity, and security. The ten value types (see Annex A) are grouped in a semi-circular structure under four categories: Self-enhancement, Openness to change, Self-

transcendence, and Conservation. Figure 2.4 depicts the complete pattern of relations among values postulated by the theory.

The most important feature of Values Theory is the structure of dynamic relationships among 10 values. According to the theory, expressive actions of any value have practical, psychological, and social consequences which may create conflict or be compatible with the search for other values. For example, actions which express values of hedonism are likely to be in conflict with those which express values of tradition; or acting on values of self-direction is likely to conflict with values of conformity. On the other hand, values of hedonism are compatible with values of self-direction; values of tradition are compatible with values of conformity. Schwartz's 1994 study in 44 countries and his study conducted in 2004 in 27 countries, reveal systemic associations of many behaviors, attitudes, and personality variables with priorities for these values. The circular arrangement of values represents a continuous motivational. The closer two values are in any direction around the circle, the greater the similarity of their underlying motivations.

Figure 2.4 Theoretical model of relations among 10 motivational types of values
(adapted from Schwartz & Boehnke, 2004)
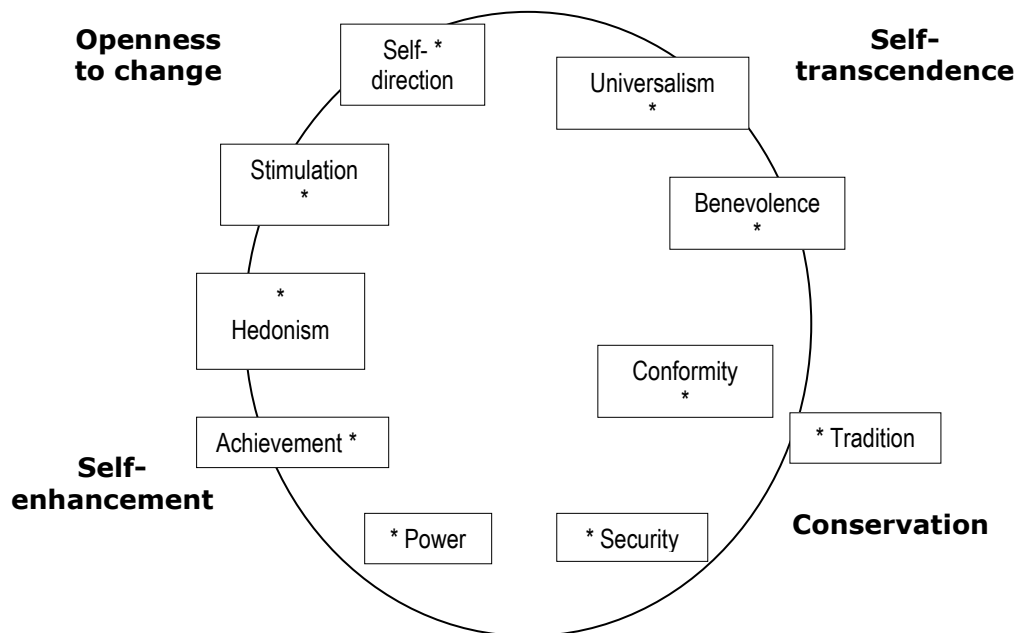
The ten types of values are listed in the first column of Table 2.2, each defined in terms of the central goal of that cateogory of values. The second column lists 45 specific values as primary examples representing each type.

Table 2.2 Motivational types of values
(Schwartz 1994 y Schwartz & Boehnke, 2004)

Definition	Example of values
Power	Social power, control over others, dominance. Health. Authority, the right to lead or command. Preserving public image.
Achievement	Ambitious, wealth, material possessions, money. Influential, having an impact on people or events. Capable. Successful.
Hedonism	Pleasure. Enjoying life. Self-indulgent.
Stimulation	An exciting life, stimulating experiences. A varied life, filled with challenge, novelty and change. Daring.
Self-direction	Freedom. Creativity. Independent. Choosing own goals. Curious, interested in everything, exploring.
Universalism	Equality, equal opportunities for all. A world of peace, free of war and conflict. Unity with nature, fitting into nature. Social justice, correcting injustice, care of the weak. Broad-minded. Preventing and protecting pollution, conserving natural resources. A world of beauty.
Benevolence	Responsible. Loyal, true friendship, faithful to friends. Honest, genuine, sincere. Amiable. Forgiving, willing to pardon others.
Tradition	Respecting the earth, harmony with other species. Moderate. Humble. Accepting portion in life. Devote.
Conformity	Politeness. Self-discipline, self-restrain, resistance to temptations. Honoring parents and elders, showing respect. Obedient, dutiful, meeting obligations.
Security	Social order. National security. Reciprocation of favors. Family security, safety for loved ones. Clean.

The theory sustains that there are 10 core values identifiable in all societies, and these values can be arranged to form a semi-circular structure based on inherent conflicts or compatibility between the motivational goals implicit to these values.

The conceptual framework proposed by Stern *et al.* (1999), states that behavior may be predicted according to one's values. This model offers an array of five causal factors which determine actions toward social movements. Also, it extends considerations of the activation of moral norms not only to environmental issues, but also to economic, social, and cultural issues implicit in the concept of sustainability.

C. <u>Howard Gardner's theoretical framework</u>

The Theory of Multiple Intelligences (TMI) points out the theoretical framework in relation to the range of skills deployed by human beings across all cultures. Gardner (2001) states that human cognition according to Piaget's concepts (Pansza, 1999; Salles, 1999) or actual cognitive science must include a repertoire of skills more universal and more comprehensive than they are now.

In order to formulate the TMI, Gardner (2001) reviewed the literature using eight criteria or 'signs' to define intelligence: 1) potential isolation from due to brain damage, 2) the existence of idiot savants, prodigies, and other exceptional individuals, 3) an identifiable core operation or set of mental operations, 4) an individual's distinctive development history, along with a definable set of 'end-state' performances, 5) an evolutionary history and evolutionary plausibility, 6) support from experimental psychological tasks, 7) support from psychometric findings, and 8) the individual's ability to decode a symbolic system. Howard Gardner views intelligence as the capacity to solve problems or fashion products which are valued in one or more cultural settings. This definition tells us nothing about the sources of such capabilities or the means of measuring them. Perhaps many of these skills do not lend themselves to measurement by verbal methods which largely depend on a combination of logic and language skills.

Based on this definition, and relying on a range of the above criteria and prerequisites. Gardner initially formulated a list of seven types of intelligence: (1) linguistic, (2) logical-mathematical, (3) musical, (4) spatial, (5) bodily-kinesthetic, (6) personal intelligence directed toward others (inter) and (7) personal intelligence directed toward oneself (intra).

The theory of multiple intelligences (TMI) (Gardner, 2001) establishes seven skills which human beings perform in any culture in which they live and grow up. TMI is developed under a distributed vision, that is, inherent to individuals and artifacts that surround them. In other words, intelligence does not end with the skin, but rather encompasses tools (paper, pencil, and computer), documentary memory (contained in files, notebooks, and diaries) and a network of acquaintances (coworkers, colleagues, and other persons to whom one communicates by telephone or electronically). In addition Gardner considers how skills may be put to use in a diverse range of educational settings (Gaxiola, 2005).

Gardner claims that the seven types of intelligence rarely operate independently. They are used simultaneously and tend to complement each other as people develop skills or solve problems. Human beings are organisms who possess a basic, uniquely blended set of intelligences. These intelligences are amoral - they may be put to constructive or destructive use. However, leaders, or people with skills which cross boundaries among intelligences, can affect other people emotionally, socially, and cognitively. They link individuals from different intellectual trends, scopes (disciplines, professions) and fields (people, institutions, award mechanisms, and everything which makes it possible to judge the quality of staff performance in a large enterprise.

Table 2.3 shows the relationships among seven types of intelligence identified by Gardner: linguistic, logical-mathematical, musical, spatial, body-kinesthetic, interpersonal, and intrapersonal. The table also presents their channel of access in humans and their neural representation (from a descriptive process), and examples of the most representative profile of what type of people exhibit for each type of intelligence.

Table 2.3 Relationships among types of intelligences and their neuronal representation
(Adapted from Gardner, 2001)

Kind of intelligence	Channel of access	Neuronal representation	Performance profile
Linguistic intelligence (involves sensitivity to spoken and written language, the ability to learn languages, and the capacity to use language to accomplish certain goals. This intelligence includes the ability to effectively use language to express oneself rhetorically or poetically; and language as a means to recall information)	Oral- auditory tract	Left temporal lobe	poets, writers, politicians, lawyers, speakers
Musical intelligence (involves skill in the composition, performance, and appreciation of musical patterns. It encompasses the capacity to recognize and compose musical pitches, tones, and rhythms)	Oral- auditory tract	Right hemisphere. Back portions of right-brain	musicians, composers
Logical-mathematical intelligence (consists of the capacity to analyze problems logically, carry out mathematical operations, and investigate issues scientifically, and entails the ability to detect patterns, reason deductively, and think logically)	Visual	Both hemispheres: left hemisphere has the ability to read and produce mathematical signs, while right hemisphere seems to understand relationships and numerical concepts	scientists, mathematicians
Spatial intelligence (involves the potential to recognize and maneuver in open spaces and confined areas)	Spatial visual	Back portions of right hemisphere.	sculptors, mathematicians topologists
Body-kinesthetic intelligence (entails the potential of using one's whole body or parts of the body to solve problems. It is the ability to use mental aptitudes to coordinate bodily movements)	Visual	Cerebral cortex, thalamus, basal ganglia	dancers, swimmers, gymnasts
Inter-personal intelligence (concerned with the capacity to understand the intentions, motivations, and desires of others. It allows people to work effectively with others)	Symbolization provided by culture as rituals and	Frontal cortex. Front lobes where networks of nerve representing internal environment of individuals	educators, salespeople, counselors, religious leaders,

Kind of intelligence	Channel of access	Neuronal representation	Performance profile
	religious and mythical systems	converge (feelings, motivations and subjective knowledge) with the system representing external environment: vision, sounds, tastes and customs transmitted through the senses	artists
Intra-personal intelligence (entails the capacity to understand oneself, to appreciate one's feelings, fears and motivations)			magicians, warriors, shamans, fortune-tellers

Applying this theory to educational contexts, several criticisms arise with respect to Howard Gardner's conceptualization of multiple intelligences. However, this theory holds that: 1) multiple intelligences act on a value system whereby students with a diversity of abilities can learn and succeed; 2) that learning is exciting, and that hard work by teachers is necessary; 3) that the exchange of constructive suggestions and formal and informal ideas embedded in the curriculum and the evaluation of educational activities are valid for the students, as well as for the broader culture, 4) that the arts may be employed in order to develop people's abilities and comprehension within and across disciplines, and 5) that multiple intelligences are means to fostering high quality student work. These features are highly pursued in education for sustainability.

D. Psychological dimensions by Corral-Verdugo & Pinheiro

With respect to psychological factors which affect or are affected by the interaction between the individual and the environment and the lack of clarity in dimensions behind the definition proposed for sustainable behavior (see section 1.3), and with the goal of complying with that idea, given that individual and group behaviors involve social, political, economic, and environmental impacts, the author of this study uses psychological dimensions reported by Corral-Verdugo & Pinheiro (2004).

According to Corral-Verdugo & Pinheiro (2004), sustainable behavior should meet at least five psychological features: (1) effectiveness, (2) deliberation, (3) anticipation (4) solidarity, and (5) austerity. Effectiveness implies swift reaction to requests or demands of the physical or social environment, while deliberation means that behavior must occur with the specific intent of caring and promoting the welfare of humans and other organisms in the environment. Anticipation means that even if one performs a behavior in the current moment, the individual temporarily separates him/ herself and projects the action to the future, which is the time to which the current behavior is directed. Solidarity is expressed as the sum of altruistic tendencies and actions deployed in response to concern for others. Finally, austerity raises the need to lead a lifestyle in which consumption of goods and natural resources is limited to that which is necessary, avoiding wastefulness.

The requirements for sustainability include challenges imposed by the environment (lack of resources, climatic adversity, environmental and social opportunities), and regulatory requirements of social groups (conventions, rules and laws for environmental protection, rules of solidarity, public policies). In addition, individual dispositions (attitudes, beliefs, perceptions, and values) generate conditions in individuals which lead them to act responsibly toward themselves, the environment, and fellow humans.

2.2.2 Proposed model to determine the construct of sustainable behavior

Figure 2.5 depicts the model proposed to explain sustainable behavior. Situational factors (demographics, in this study) which either counteract or strengthen actions in the model are taken into account. Two key elements of personal skills - inter and intra personal intelligences - which are concerned with the capacity to understand the intentions, motivations, and desires of others and oneself, are considered. These two personal skills were analyzed through the five psychological dimensions to predict sustainability actions of HE subjects. Two personality traits (ascription of responsibility and awareness of consequences) inform us as to people's desire to take action on environmental issues. In order to discern a personally or socially preferable way of life, the four core values based on inherent conflicts or compatibility among people's motivational goals are taken into account. The author of this study believes that both the psychological and the demographic variables elucidate people's sustainable behavior. That is, human sustainable behavior is based on core elements of personality which determine an action in favor of the common good, as well as causal factors joined to both the idea of sustainable actions and to social and individual responsibility in any culture.

As mentioned in previous section, the proposed model took into account Schwartz's Values Theory (1977) which includes four broad categories of values: self-enhancement, self-transcendence, conservation, and openness to change, as well as 10 types of values distributed along a semi-circular structure as shown in Fig. 2.4. Twenty one specific-values were arranged according to topics covered by the Decade of Education for Sustainable Development (see Table 2.4); while Stern *et al.'s* (1999) model arranged 23 values into four broader value categories: altruism, traditional, self-interest, and openness to change values. Table 2.4 shows each value type associated with 7 DESD themes: human rights, health promotion, sustainable production and consumption, gender equality, information and communication technology, rural transformation, and intercultural understanding and peace.

The proposed model changed two elements in Stern *et al.'s* (1999) model. Neither Drake's cultural items nor the New Ecological Paradigm issue were included. Kaiser, Hübner & Bogner

Figure 2.5

Proposed model for explaining sustainable behavior
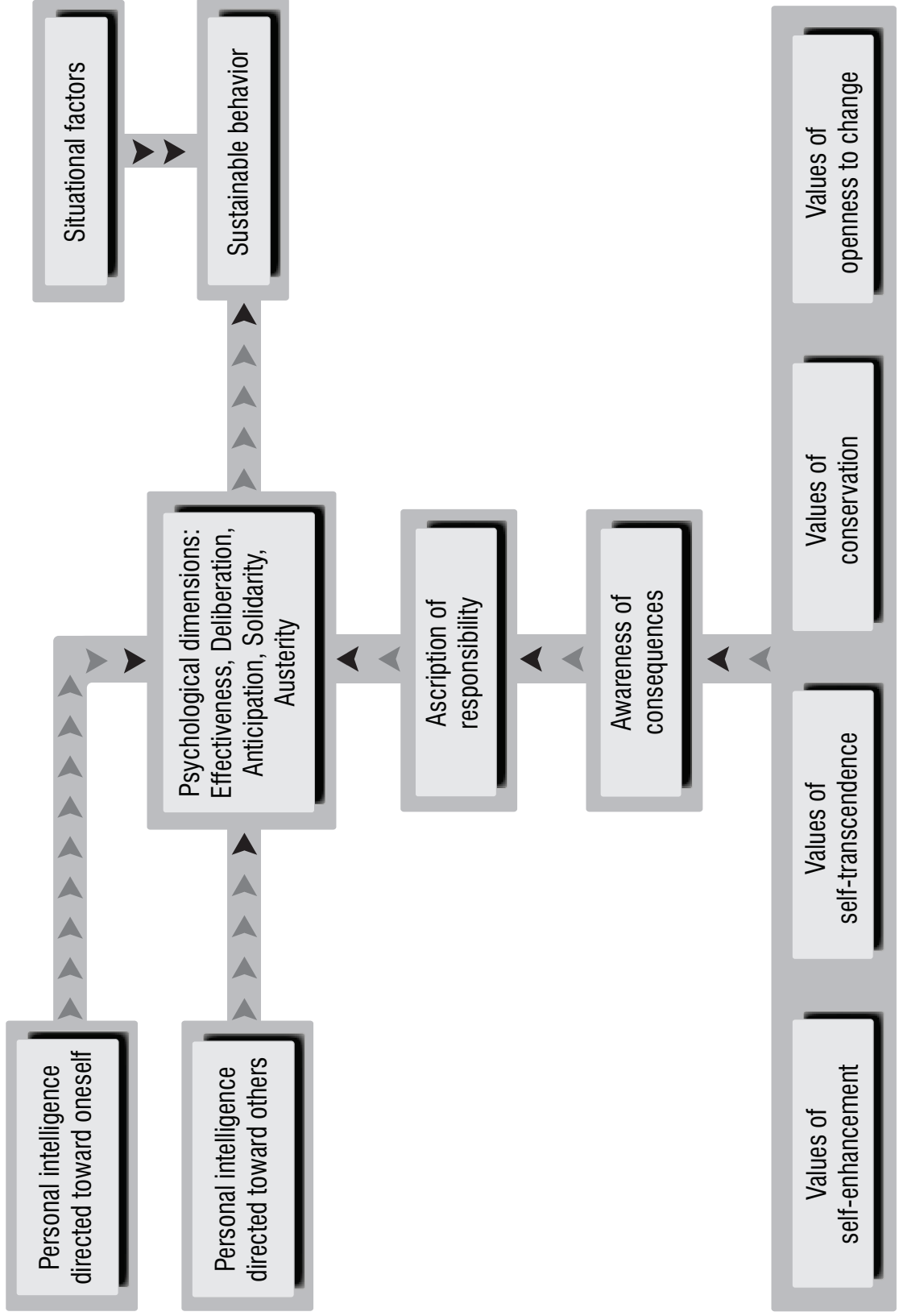
(2005), upon comparing VBN and TPB, found that VBN is imprecise with respect to the substantial residual values of NEP (Dunlap & van Liere, 1978). They view NEP as inadequately integrated into the model. Furthermore Stern *et al.* (1999) found low reproducibility in Drake's cultural items.

Stern *et al.'s* (1999) proposed model considers two personality traits: awareness of consequences and ascription of responsibility; both are part of Schwartz's Norm-Activation Theory (1977). Hines, Hungerford, and Tomera (1988/87) considered ascription of responsibility or locus of control to be iimportant factors in their model for determining behavior. These authors considered that the personality variables explain part of the responsible environmental behavior.

Table 2.4 Twenty-one values selected from the author's larger list (adapted from Schwartz 1994 and Schwartz & Boehnke, 2004) and the themes of the Decade of Education for Sustainability

Kind of values	Values of example	Themes of the Decade of ESD
Power	Social power, control over others, dominance. (I) Health. Authority, the right to lead or command. (I)	Human rights Health promotion Human rights
Achievement	Ambitious, wealth, material possessions, money. (I) Influential, having an impact on people and events. (I)	Sustainable production and consumption Human rights
Hedonism	Enjoying life. (I)	Human rights and sustainable production and consumption
Stimulation	Varied life, filled with challenge, novelty and change. (I)	Sustainable production and consumption
Self-direction	Creativity. Choosing own goals.	Technology of information and communication Sustainable production and consumption
Universalism	Equality, equal opportunities for all. A world of peace, free of war and conflict. Unity with nature, fitting into nature. Social justice, correcting injustice, care for the weak. Broadminded. Prevention and protection the environment, conservation of natural resources.	Gender equality Human rights Rural transformation Poverty alleviation Technology of information and communication Conservation and protection of environment
Benevolence	Responsible.	Human rights
Tradition	Respecting the earth, harmony with other species. Moderate. Accepting one's portion in life.	Rural transformation Sustainable production and consumption Intercultural understanding and peace
Conformity	Self-discipline, self-restraint, resistance to temptations.	Sustainable production and consumption
Security	Social order.	Human rights

(I) – Indicates a question regarding an attitude which was inverted upon creating the scales. That is, it is contrary to the underlying principles of ESD.

Table 2.5 presents both personality traits as they appear in the final questionnaire. In the first section, awareness of consequences appeared with respect to three main problems: climate change, tropical forest destruction, and toxic substances in the air, water, and soil. The questionnaire asked whether each problem was very serious, somewhat serious, or will not really be a problem for one-self and one's family, for the whole country, and for other plant animal species. In the second section, ascription of responsibility appeared in three questions related to an internal locus of control, and six to an external control (as explained in the footnote on page 10). The internal locus of control includes questions concerning oneself, and the external locus of control (includes) questions concerning the government and businesses as external supreme entities.

Table 2.5 Awareness of consequences and ascription of responsibilities
(Stern *et al.*, 1999)

Awareness of consequences
1a) In general, do you think that climate change, which is sometimes called the greenhouse effect, will be a very serious problem for you and your family, somewhat of a problem for you and your family or won't really be a problem for you and your family?
1b) Do you think that climate change will be a very serious problem for the country as a whole, somewhat of a problem or won't really be a problem for the country as a whole?
1c) Do you think that climate change will be a very serious problem for other species of plants and animals, somewhat of a problem or won't really be a problem for other species of plants and animals?
2a) Next, I'd like you to consider the problem of loss of tropical forest. Do you think this will be a very serious problem for you and your family, somewhat of a problem for you and your family or won't really be a problem for you and your family?
2b) Do you think that loss of tropical forest will be a very serious problem for the country as a whole, somewhat of a problem or won't really be a problem for the country as a whole?
2c) Do you think that loss of tropical forest will be a very serious problem for other species of plants and animals, somewhat of a problem or won't really be a problem for other species of plants and animals?
3a) Next, I'd like you to consider the problem of toxic substances in air, water and the soil. Do you think that this will be a very serious problem for you and your family, somewhat of a problem for you and your family or won't really be a problem for you and your family?
3b) Do you think that toxic substances in air, water and the soil will be a very serious problem for the country as a whole, somewhat of a problem or won't really be a problem for the country as a whole?
3c) Do you think that toxic substances in air, water and the soil will be a very serious problem for other species of plants and animals, somewhat of a problem or won't really be a problem for other species of plants and animals?
Ascription of Responsibility or Locus of Control
The government should take stronger action to clean up toxic substances in the environment.
I feel a personal obligation to do whatever I can to prevent climate change.
I feel a sense of personal obligation to take action to stop the disposal of toxic substances in the air, water, and soil.
Business and industry should reduce their emissions to help prevent climate change.
The government should exert pressure internationally to preserve the tropical forest.
The government should take strong action to reduce emissions and prevent global climate change.
Companies that import products from the tropics have a responsibility to prevent destruction on the forests in those countries.
People like me should do whatever we can to prevent the loss of tropical forests.
The chemical industry should clean up the toxic waste products it has emitted into the environment.

Table 2.6 grouped the intrapersonal intelligences under self-knowledge and self-management categories and the interpersonal intelligences under understanding of others and social

skills categories from the emotional competencies by Boyatzis, Goleman & Hay Acquisition Co. Inc. (2002). Twenty out of 72 items were selected among the 10 competency types: self-confidence, emotional self-control, integrity, adaptability, achievement orientation, initiative, empathy, leadership, catalyst for change and teamwork (See Appendix B for the complete list). The final 20 items were sifted under the underlying principles of the so-call five psychological dimensions which are the actions towards sustainable behavior; namely, effectiveness, austerity, solidarity, anticipation and deliberation; from each competence type two emotional competences for each psychological dimension were chosen.

Table 2.6 Emotional competencies selected by the author and psychological dimensions (Adapted from Boyatzis, Goleman & Hay Acquisition Co. Inc., 2002)

Category	Emotional competence	Associated psychological dimension
SELF KNOWLEDGE		
Confidence in oneself	Believes one-self to be capable for a job. Doubts his/her own ability.	Effectiveness 1
SELF MANAGEMENT		
Emotional self control	Acts impulsively. Stays composed and positive, even in stressful situations.	Anticipation 1
Integrity	Keeps his/her promises Acknowledges mistakes	Austerity 1
Adaptability	Adapts ideas based on new information. Changes overall strategy, goals, or projects to fit the situation.	Austerity 2
Orientation to achievement	Anticipates obstacles to a goal. Takes calculated risks to reach a goal.	Effectiveness 2
Initiative	Hesitates to act on opportunities. Cuts through red tape or bends rules when necessary.	Deliberation 1
UNDERSTANDING OF OTHER		
Empathy	Relates well to people of diverse backgrounds. Can see things from someone else's perspective?	Solidarity 1
SOCIAL SKILLS		
Leadership	Leads by example. Articulates a compelling vision.	Deliberation 2
Catalyst for Change	Personally leads change initiatives. Advocates change despite opposition.	Anticipation 2
Teamwork	Solicits others' input. Establishes and maintains close relationships at work.	Solidarity 2

Effectiveness is the tendency to respond swiftly to demands.

Deliberation is the act of directing actions towards a specified end.

Anticipation is the expectation of future actions or outcomes.

Solidarity is the tendency to be concerned about and to act in favor of others.

Austerity is prudent and conservative behavior in the face of an uncertain world.

Finally, eight demographical items were considered; some of which Hines, Hungerford, and Tomera (1988/87) and Carabias (in press) mentioned in their studies. These included income, gender, age, predominant activity related to education (student, faculty, or administrator), and educational level of respondent. Also religious denomination was included as a way to correlate attitudes in further studies according to motivational values promoted by each four major Western religions as suggested by Schwartz & Huismans (1995). Religious socialization is postulated by these authors influence those most strongly committed to accept priority values which express and support basic theological doctrines and institutional interests.

The general pattern found by Schwartz & Huismans (1995) in their study of the correlation of values with religiosity suggests that the values of certainty, self-restraint, and submission to external higher truths tend to be embraced by people who are more religious in general. By contrast, valuing openness to change and free self-expression tend to be values held by those who are less religious. They also found a negative correlation for religiosity among universal values and those of stimulation and self-direction, and between the promotion of tradition and rejection of hedonistic values.

2.2.3 How to implement the developed model

Once the conceptual model is constructed, the construct of behavior for sustainability must be operationalized. This is done by taking into account the five latent variables mentioned above: (1) universal values, (2) awareness of consequences, (3) ascription of responsibility, (4) inter- and intra-personal intelligences associated with psychological dimensions, and (5) demographical factors. Figure 2.5 depicts these.

The construct of behavior for sustainability and the factors mentioned, except for demographics, are entities which are impossible to directly observe and measure. The same is true for notions such as "quality of life", "general intelligence", "business sentiment," or "human nature" (Chomsky & Foucault, 2006), to name a few. In order to resolve this limitation, social psychologists and other social scientists have theorized and proposed latent variables (hypothetical terms). Latent variables are mental constructs which represent complex relationships; when subjects respond to a questionnaire containing a variety of indictors, these latent variables may be measured as real entities (Bartholomew, 1987).

Additionally, the reputation of a person with respect to a latent trait should be inferred from people's behavior on measurable tasks (Embretson, & Reise, 2000). The latent trait is applied to personal intelligences (see Section 4 of the questionnaire) which addresses the relation among

probabilities of the question and the level of annotation, and predicts the probability of the response pattern observed for each participant at each HEI, in order to test the extent and differences in levels of sustainable behaviors among students, faculty, and administrators.

The following section presents the methodology used for testing and validating the proposed model. Section A presents the basis for the construction of the questionnaire used, Section B the participants who tested the instrument, and Section C the statistical methods calculated to validate the model.

A. THE INSTRUMENT USED

A questionnaire was prepared which consisted of 67 items in five sections according to the latent variable model. The questionnaire is included in Appendix C. The first section of *universal values* includes 21 items of Schwartz's (1994, 2004) 10 value categories. At least one item was included from each value type. Fifteen of the items supported principles underlying the ESD (items 1.1, 1.4, 1.6, 1.8, 1.9, 1.11, 1.13 to 1.21) and six items were contrary to ESD (items 1.2, 1.3, 1.5, 1.7, 1.10 and 1.12). The order of latter variables was randomized to prevent participants from anticipated response and their scales were inverted for statistical treatment.

The variables for moral norm activation from the second and third sections of the questionnaire were measured through nine items regarding *awareness of consequences* (AC) and nine regarding *ascription of responsibility* (AR). Those questions related to AC included importance to oneself, country, and other species of three actual environmental problems (climate change, loss of forests, and chemicals). In the AR section, three items concerned personal obligations, three concerned government obligations, and three concerned business obligations (Stern *et al.*, 1999).

The fourth section on *intra-personal and inter-personal intelligences* contained 20 items (Boyatzis, Goleman & Hay Acquisition Co. Inc., 2002), sifted through five psychological dimensions of sustainability. The order of these variables was randomized to prevent participants from anticipated response. This section served as an example of exploratory measurement within the Item Response Theory raised by Van der Linden (2005) and Embretson & Reise (2000), because the questions form a system which shows variability in the properties of the questions and in the person's responses.

The final section contained eight questions related to *demographics* such as age, gender, religious denomination, general income level, and educational training (Hines, Hungerford and Tomera, 1988/87; Carabias, in press). These variables were dichotomous. Fifty-nine items were polytomous in four different Likert scale items: Thirty items corresponded to a multiple choice among fully agree, agree, undecided, disagree, and strongly disagree. Nine items were answered

with very serious, somewhat serious, or not serious. Twenty items were answered with never, rarely, sometimes, many times, and constantly (Converse & Presser, 1988; Kirakowski, 2000).

Polytomous models show the relationship of a variable of a latent trait variable in an ongoing way (Henerson, Morris, and Fitz-Gibbon, 1991; Shiken, 2000) and are used usually because they are more informative and reliable than items with dichotomous scores (Embretson, & Reise, 2000). However, Scheuthle *et al.* (2005) indicate that, contrary to common expectations, a broader set of questions causes more diverse, arbitrary participant responses.

Stern *et al.*'s (1999) questionnaire, as well as a/the personal intelligence competence list, was translated from English to Spanish. Subsequently a native speaking German translated the Spanish questionnaire to German and this was reviewed by LUL staff. Spanish and German questionnaires are not included in this manuscript but are available by request.

The questionnaire was prepared using the Pinpoint software version 3.10[th] (1995) which facilitates the task of capturing individual's responses. Thus, basic descriptive statistics were run and handled subsequently into SAV format by using SPSS software version 12, and then a principal component analysis was carried out. In order to determine item response probability calculations, Microsoft Excel format was used.

B. THE PARTICIPANTS

The questionnaire was applied to individuals from two universities in countries with vastly different cultures and economies. The first is the *Universidad Autonoma Metropolitana, Azcapotzalco* (UAMA), which is located north of Mexico City, and is one of four campuses of the UAM, a public university. In 2006, the UAM issued a general framework, the so-called *Plan Institucional hacia la Sustentabilidad.* This plan was part of a broader program developed by a three-part initiative of the Mexican Environmental Ministry, the National Association of Universities and Higher Education Institutions, and the Centro de Estudios sobre la Universidad. This initiative was published in 2000 and encourages a strategy to lead HEI toward improved environmental performance in light of the Decade of Education for Sustainable Development (Juarez-Najera *et al.*, 2006a).

The other university is the *Leuphana Universität Lüneburg, Institut für Umweltkommunication* (LULIfUK), a public university 30km from Hamburg in the Federal Republic of Germany, honored with the UNESCO Chair in Higher Education for Sustainable Development (see: http://portal.unesco.org/education/en/ev.php-URL_ID=42073&URL_DO=DO_TOPIC&URL_SECTION=201.html). The central aim of the UNESCO Chair is to investigate how academic teaching and learning can be reoriented toward sustainable development.

Two samples were obtained and their characteristics are shown in Table 2.7. The UAMA questionnaire was applied directly to participants who are key individuals; that is, they are or have been members of one of the three campus councils or have coordinated activities providing support and service for the entire campus community. At LULIfUK, the questionnaire was applied through the Internet via participants' e-mails. Each participant's decision-making activities are unknown.

Universidad Autónoma Metropolitana, Azcapotzalco (UAMA) in Mexico

The Mexican sample of 82 participants consisted of 15 (19%) students, 40 (49%) faculty members, and 27 (32%) administrators. The response rate was 65.6%. Average age was 43.7 years (range 20 to 78). Thirty five percent (29) of the sample were women with an average education level of 19.6 years and 65% (53) were men with an average educational level of 19.3 years. Eighty seven percent (71) of participants stated that they own their own home and 13% (10) are renters; 67% (55) live in family houses and 33% (27) in apartments. Sixty five participants were born under the Roman Catholic Church, 1 under the Calvinist church, 10 were born into non religious or atheist families, and 3 responded "other". Between July 18th and 27th 2007, 125 decision-makers were explained the research objectives and asked to participate anonymously. The questionnaire was answered in a single session of approximately 12 minutes, at council meetings or participants' offices. No credits or incentives were offered to questionnaire responders.

Leuphana Universität Lüneburg, Institut für UmweltKommunikation (LULIfUK) in Germany

The German sample of 40 participants consisted of 30 (75%) students, 7 (17.5%) faculty members, and 2 (5%) administrator (one participant did not identify their status). The response rate was 8%. Average age was 27.7 years (from 21 to 58). The sample was composed of 72.5% (29) women, 25% (10) men and one participant who do not identify gender. The majority of participants answered they are renting and live in an apartment. Five were born under Roman Catholic Church, 15 to the Lutheran Church, 2 to the Calvinist Church, 16 were born into non religious or atheist families, 1 responded "other", and 1 gave no answer. Between April 7th and 28th, 2008, 500 individuals were requested through a mailing list to participate anonymously by Internet. Participants received an email message explaining research objectives. The questionnaire was answered in a single session of approximately 12 minutes. No credits or incentives were offered to questionnaire responders.

Table 2.7 Characteristics of samples taken in Mexican and German universities

Samples	UAMA (Mexican HEI)	LULIfUK (German HEI)
Participants	82	40
Answer rate	65.6% (total 125)	8% (total 500)
Students	15 (19.0%)	30 (75.0%)
Faculty members	40 (49.0%)	7 (17.5%)
Administrators	27 (32.0%)	2 (5.0%)
Women	29 (35.0%)	29 (72.5%)
Men	53 (65.0%)	10 (25.0%)
Average age, years	43.7 (20-78)	27.7 (21-58)
Owners of their houses	Majority	Few
Renting their apartments	Few	Majority
Religious denomination	65 (80%) Catholic	15 (37%) Lutherans 16 (38%) non religious

C. STATISTICAL TECHNIQUES USED

In order to validate the proposed model, two analytical methods were applied in the following order: principal component analysis (Jolliffe, 1986) (for all data of both HEI), and the Rasch model (Scheuthle; Carabias-Hütter & Kaiser, 2005) based on Item Response Theory (Embretson & Reise, 2000) for personal intelligence data related to sustainable dimensions and participants). Annex D provides a brief historical description of statistical techniques and their scope, their mathematical expression, use, and further interpretation. The language used for the mathematical description for the two methods is less technical than it would be for statisticians or engineers.

Principal Component Analysis

Kaiser, Hübner & Bogner (2005) indicate that with respect to the Value-Belief-Norm, if there is a set of data which include a large number of interrelated variables, principal component analysis (PCA) is the most appropriate technique to use because it conserves as much of the actual variation in the entire set of data as possible. This reduction of variables is achieved by transforming the data into a new set of variables, *principal components*, which are not correlated and are ranked according to the first few variables which maintain the majority of the variation present in *all* original variables (Jolliffe, 1986). One use of principal component analysis is to establish one or more factors which underlie a large number of variables. As a result, the analysis identifies the number of factors and which variables make up which factor. Typically, (and in this study) unless otherwise specified, PCA is used interchangeably with "exploratory factor analysis" (Gardner, 2003; Brace, 2006).

Exploratory factor analysis does not test hypotheses by means of a formal test of significance. Instead, it explores the possibility of a factor structure underlying the variables. Therefore, exploratory factor analysis provides a large quantity of information, which the researcher can then use to specify factors in future studies. Specifically, PCA calculation reduces the solution of the eigenvalue (own values) problem to eigenvectors by using a symmetric, semi defined, positive matrix. Thus, PCA definition and calculations are direct, apparently simple, and have a wide variety of applications (Jolliffe, 1986).

Stern *et al.* (1999) tested and validated their VBN model using a national sample of 420 participants in the U.S.A. This study reinforced the validity of reducing dimensionality to one or more factors underlying a large number of variables. PCA has been used in very few studies of the Theory of Planned Behavior.

Rasch Model

The second procedure used to determine whether there is difference in sustainable behavior exists among decision-makers (students, faculty, and administrators) is a psychometric method. This is an exploratory exercise which applies the Item Response Theory (IRT), also known as the Latent Trait Theory (Embretson & Reise, 2000). This method was applied only to the fourth latent variable, inter-personal and intra-personal intelligence, associated with five selected psychological dimensions of effectiveness, austerity, solidarity, anticipation, and deliberation. The Rasch model describes a non-linear relationship between the independent variables such as a person's trait score and item difficulty, combined additively, and the dependant variable, the likelihood of person's response to a specific item.

CHAPTER 3

VALIDITY OF THE DEVELOPED MODEL

The previous chapter mentioned conceptual schemes used to model behavior, with emphasis on cognitive theory on the information processing approach. It also presented the most influential socio-psychological frameworks which take into account limiting or promoting factors of human behavior. Finally we proposed a model developed to describe sustainable behavior and how to operationalize it through a questionnaire at two HEI in two different countries.

This Chapter presents the outcomes by applying two statistical techniques: principal component analysis (for all data of both HEI), and the Rasch model based on Item Response Theory (only for personal intelligence data related to sustainable dimensions and participants).

This is a discussion of the results of the sustainable behavior construct. The results are exploratory because this study was limited to four aspects: (1) At each university, fewer than 100 individuals responded to the principal component analysis (PCA): sixty-nine at the Mexican university, and thirty-seven at the German university. (2) the emergent concept of sustainability is elucidated by constructing an instrument based on four current conceptual frameworks and DESD guides; (3) the results reveal a general pattern of the main latent variables which underlie behavior for sustainability across three categories: students, faculty, and administrators; and (4) five psychological dimensions toward action for sustainability show differences between two HEI in two different countries.

Data and outcomes are presented for each participating HEI, *Universidad Autónoma Metropolitana, Azcapotzalco* (UAM) in section 3.1 and *Leuphana Universitet Lüneburg, Institut für Umweltkommmunikation* (LULIfUK) in section 3.2. PCA results are depicted in section 3.1.1 and 3.1.2, and Rasch model outcomes in section 3.2.1 and 3.2.2, respectively.

PCA results appear according to the following topics and criteria (for more details on calculations, see Appendix D.1):

A. Descriptive statistics: These show means and standard deviations for 65 variables.

B. Matrix of correlation of coefficients: This describes bivariate relationships involving all variables. The criterion of 0.3 is normally considered the lower cut-off by which variables are factorable according Brace *el al.* (2006); however, in this research 0.445 was the cut-off in order to obtain higher values which provide more reliable conclusions. An annotated section of the original table is shown in this section, but the table is shown shrunk to fit the page in Appendix E1.1 and E1.2.

C. Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's Test of Sphericity: These tests provide some information regarding data factorability. KMO is a test of the

amount of variance within the data which could be explained by factors. A KMO value of 0.5 is poor; a value closer to 1 is better (Brace, 2006). Bartlett's test shows the data have a probability of factorability: if data have p>.05, the test recommends not to continue; but if data have p<.05, the test recommends to check other indicators of factorability before proceeding (Brace *el al.*, 2006).

D. Anti-image correlation from the anti-image matrices: The upper matrix contains negative partial covariances and the lower matrix contains negative partial correlations. The on-diagonal values in the anti-image correlation matrix are the KMO values. If any variable has a KMO value less than 0.5, one should consider dropping it from the analysis (Brace *el al.*, 2006). An annotated part of the table is shown in this section, but the entire table is shown shrunk to fit the page in Appendix E1.3.

E. Communalities: These indicate how much variance with in each variable is explained by the analysis. The initial communalities are calculated using all possible components, and these are always = 1. The extraction communalities are calculated using the extraction factors only; these are the useful values. If a particular variable has a low communality (less than 0.5), then one should consider dropping it from the analysis (Brace *el al.*, 2006).

F. Eigenvalues and explained variance: These explain a percentage of all the variance, and the cumulative percentage. Components are ranked in order of how much variance each accounts for. This is the first part of the output that gives a clear indication of the solution, in terms of how many factors explain how much variance. Previous tables and matrices are important, though, in indicating whether the solution is likely to be a good one.

G. Sedimentation graphic or scree plot: This is an alternative to eigenvalues > 1.0, to decide which component should be extracted. The eigenvalues are plotted in decreasing order. This is called a scree plot because the shape of the curve is reminiscent of the profile of scree which accumulates at the foot of steep hills (Gardner, 2003; Brace *et al.*, 2006).

H. Component matrix: This is a table of the factor loadings. Each column shows the loading of each variable for that component. Loading can be thought of as the correlation between the component and the variable: thus the larger the number, the more likely it is that the component underlies that variable. The extraction communalities are calculated using the formula $\square x^2$, where x is the loading factor in the table. The extent of communality indicates how much of that variable's variance is explained by the solution to the factor analysis.

I. Residual correlation from the reproduced matrix: This represents the difference of each value between the matrix of reproduced correlation (communalities) and the matrix of observed correlation. In this study, only the residual correlation matrix is shown because the reproduced correlation is shown in the entire correlation matrix (see section B above. The small size of most of

the residuals is another indication of factorability, and is also an indication of a good factor analysis solution (Brace *et al.*, 2006). An annotated part of the table is shown in this section, but the entire table is shown shrunk to fit the page in Appendix E1.4 and E.1.5.

J. Matrix of rotated factors: This represents the matrix of initial factors which has been rotated to produce a solution which is easier to interpret. It was not possible to obtain a rotation converged in 25 iterations for components and variables for both Mexican and German HEI.

K. PCA discussion: Data are analyzed by means of a principal component analysis, and outcomes of the underlying latent variables are presented In order to interpret PCA data, the following authors were used: Jollife (1986), Basilevsky (1994), Gardner (2003), and Brace, Kemp & Snelgar (2006).

The results of the Rasch model are calculated according to the following framework and formulas:

The psychometric measurement of 20 actions from the latent variable of personal intelligences was applied using the item response theory. The Rasch model predicts the probability of an item response from two independent variables, the person's trait level, and item difficulty, as follows (for more details on calculations, see Appendix D.2):

$P(X_{is}) = e^{(\theta s - \beta i)} / 1 + e^{(\theta s - \beta i)}$ (Equation 3.1)

The likelihood L of response *s* of person $\underline{X}$ is the product of response probability from each item, as follows:

$L(\underline{X}s) = P_{1s} P_{2s} P_{3s} \ldots P_{20s}$ (Equation 3.2) for item and participant category.

The product of probabilities in equation 3.2 yields the probability of observed pattern of participant's response. For the cluster of five psychological dimensions of 80 and 37 participants, sub-indexes change in equation 3.2.

$L(\underline{X}s) = P_{j1} P_{j2} P_{j3} \ldots P_{j80}$ or P_{j37} (Equation 3.3) calculated according Equation 3.2 for item and participants.

In order to interpret IRT data, the following authors were used: Embretson & Reise (2000) and Van der Linden (2005).

3.1   UAMA CASE - Mexico

3.1.1 Outcomes from principal component analysis

Principal component analysis of the UAMA case loaded 65 and not 67 variables because the level of studies and source of HEI were items used for data organizing purposes only; and the PCA loaded 69 participants who fully responded to the questionnaire. That is, 13 people for some reason

left one or more answers blank one, and as we do not have an algorithm to calculate missing data, we decided to work with that number.

A. Descriptive statistics of UAMA sample

Table 3.1 provides a description of minimum and maximum values, and mean and standard deviation of 65 observed variables. The first, third, and fourth sections of the questionnaire have minimum and maximum values which range from 1 to 5. The second section ranges from 1 to 3. The fifth section has dichotomous variables with yes or no responses. Mean values are above 1 and standard deviation data are up to 0.20 and 13.08. The reliability of the scale for the entire sample was a Cronbach's alpha of 0.643 and no squared multiple correlation values were observed.

Universal Values, the first section of the questionnaire, has a Cronbach's alpha for the scale in this sample of 0.670, and squared multiple correlation ranges from 0.370 to 0.770. The variable 16 Responsible has the highest value. Mean participant's responses for variable 10 (Variedlife), 12 (Enjoyinglife) and 2 (Influence) are up to four. This means that the majority of participants disagree with these values. It is important to mention that these three values were considered to represent the reverse of the goals of ESD (see table 2.4) and this seems to provide corroborative evidence for the idea proposed in Chapter 2 that values of achievement, hedonism, and stimulation go against the underlying principles of ESD. Variables 5 (Authority), 7 (Socialpower), 20 (Acceptinglife), 3 (Ambitious) and 11 (Socialjustice) have a mean score ranging from 2.24 to 3.10, which means is that the mean response is agree or not decided. Variables 3, 5, and 7 are also the reverse of ESD goals; that is, values of power and achievement go against underlying ESD principles. Variables 8 (Socialorder), 18 (Moderate) and 13 (Selfdiscipline) show scores of 1.55 to 1.97, that is, the mean response is agree. The remaining 10 variables: 1 (Worldatpeace), 4 (Broadminded) 6 (Creativity), 9 (Prevention), 14 (Unitywithnature), 15 (Wealth), 16 (Responsible), 17 (Respectful), 19 (Equality), and 21 (Choosinggoals) have scores ranging from 1.11 to 1.40, clearly representing the response totally agree.   Standard deviation indicates the extent in which individuals differ in scoring. Standard deviation ranges from 0.323 to 1.308. These values indicate a small standard deviation, considering the range of responses from 1 to 5.

The second section is Awareness of Consequences; Cronbach's alpha for this scale for the current sample was 0.667 and squared multiple correlation ranged from 0.164 to 0.573, while variable 22(aClimateyou) had the highest value. Mean participant's responses ranged from 1.04 to 1.27 and a very low standard deviation, that is, participants consider this to be a very serious problem. Variables 27 (cForestplants) and 25 (aForestyou) present the minimum and the maximum values, respectively.

The third section is Ascription of Responsibility; Cronbach's alpha of this scale for the current sample was 0.700 and squared multiple correlation ranged from 0.240 to 0.705, while variable 36 (Government3) had the highest value. Mean participant's responses ranged from 1.18 to 1.55 with a standard deviation slightly greater than that of the previous section: 0.43 to 0.70; which indicates that these participants totally agree, however some only agree. Variables 32 (Ifeelobligation), 33 (Ifeelasense), and 38 (Peoplelike) present higher mean values, that is, they are clearly closer to agree than is the case for other variables.

For the fourth section, Personal Intelligences, Cronbach's alpha for the current sample was 0.715 and the squared multiple correlation ranged from 0.127 to 0.728, while variable 47 (Advocateschange) had the highest value. Mean participant's responses ranged from 2.01 to 4.66, with a standard deviation lesser than or equal to 1. Variable 56 (Doubtsownability) is the lowest mean value; participants very rarely or never achieve them, and variable 54 (Believescapable) is the highest; participants very often or constantly achieve them. For the variables: 56 (Doubtsownability), 55 (Bendsrules), 58 (Hesitatestoact) and 48 (Actsimpulsively), very few achieve them; they show a mean value of 2.01 to 2.75. Variables 40 (Anticipatesobsta), 41 (Adaptsideas), 43 (Takesrisks), 45 (Stayscomposed), 49 (Personallyleads), 52 (Articulatesacompe), 53 (Can see things) and 59 (Changesstrategy) indicate mean values of 3.34 to 3.97, which means that some times or very often they are achieved. Variable 47 (Advocateschange), 46 (Leadsbyexam), 42 (Solicitsinput), 57 (Establishesclose), 51 (Acknowledgesmist), 44 (Relateswell), 50 (Keepspromi), 54 (Believescapable) present mean values of 4.00 to 4.66, which means that very often or constantly they are achieved.

The last section is Demographic Variables; Cronbach's alpha for this scale for the current sample was very low (0.001), and the squared multiple correlation ranged from 0.049 to 0.358; variable 64 (Age) had the highest value. Mean values varied according their type. Variables 60 (Whathousing), 61 (Own/rent) and 63 (Gender) are dichotomous variables. Variable 65 (Areyou) allowed for three kind of responses: student, faculty, or administrator. Variable 62 (Underwhatreligion) had 6 potential responses. However, for this sample the mean value was 1.60 with a standard deviation of 1.49, indicating that the majority belong to the Roman Catholic Church. The mean value of variable 64 (Age) is 43.43, with a standard deviation of 13 years. The sample age range is 22 to 78 years.

Table 3.1 Descriptive statistics of the UAMA sample with N=69

SCALE/ Item	Minimum	Maximum	Mean	Standard Deviation
I. UNIVERSAL VALUES				
1Worldatpeace	1	5	1.39	0.87
2Influential	1	5	4.05	0.83
3Ambitious	1	5	2.73	1.06
4Broadminded	1	5	1.34	0.72
5Authority	1	5	3.10	1.30
6Creativity	1	5	1.18	0.60
7Socialpower	1	5	2.84	1.20
8Socialorder	1	4	1.55	0.69
9Prevention	1	2	1.11	0.32
10Variedlife	3	5	4.71	0.51
11Socialjustice	1	4	2.24	0.93
12Enjoyinglife	3	5	4.73	0.56
13Selfdiscipline	1	4	1.97	0.90
14Unitywnature	1	3	1.43	0.58
15Wealth	1	4	1.17	0.48
16Responsible	1	5	1.27	0.68
17Respectful	1	3	1.17	0.41
18Moderate	1	4	1.79	0.91
19Equality	1	3	1.40	0.64
20Acceptinglife	1	5	2.81	1.44
21Choosingoals	1	4	1.27	0.59
II. AWARENESS OF CONSEQUENCES				
22aClimateyou	1	3	1.21	0.48
23bClimatecountry	1	3	1.20	0.44
24cClimateplants	1	3	1.15	0.40
25aForestyou	1	2	1.27	0.45
26bForestcountry	1	2	1.14	0.35
27cForestplants	1	2	1.04	0.20
28aToxicyou	1	2	1.08	0.28
29bToxicountry	1	2	1.08	0.28
30cToxicplants	1	2	1.05	0.23
III. ASCRIPTION OF RESPONSIBILITY				
31Government1	1	4	1.26	0.56
32Ifeelobligation	1	5	1.44	0.69
33Ifeelasense	1	3	1.55	0.67
34Business	1	5	1.24	0.60
35Government2	1	3	1.18	0.43
36Government3	1	5	1.31	0.65
37Companies	1	5	1.27	0.70
38Peoplelike	1	4	1.46	0.65
39Industry	1	3	1.27	0.48
IV. PERSONAL INTELLIGENCES				
40Anticipatesobsta	2	5	3.89	0.84
41Adaptsideas	2	5	3.97	0.76
42Solicitsinput	2	5	4.08	0.85
43Takesrisks	2	5	3.95	0.75
44Relateswell	2	5	4.37	0.84
45Stayscomposed	2	5	3.91	0.83
46Leadsbyexam	2	5	4.08	0.83
47Advocateschange	2	5	4.00	0.87
48Actsimpulsively	1	5	2.75	0.83
49Personallyleads	2	5	3.97	0.87
50Keepspromi	2	5	4.44	0.63
51Acknowledgesmist	3	5	4.14	0.69
52Articulatesacompe	2	5	3.98	0.73
53Canseethings	3	5	3.84	0.60
54Believescapable	2	5	4.66	0.58
55Bendsrules	1	4	2.15	0.90
56Doubtsownability	1	5	2.01	1.03
57Establishesclose	1	5	4.13	0.90
58Hesitatestoact	1	5	2.37	1.03
59Changesstrategy	1	5	3.34	1.04
V. DEMOGRÁPHICS				

SCALE/ Item	Minimum	Maximum	Mean	Standard Deviation
60Whathousing	1	2	1.37	0.48
61Own/rent	1	2	1.14	0.35
62Underwhatreligion	1	6	1.60	1.49
63Gender	1	2	1.30	0.46
64Age	20	78	43.43	13.08
65Areyou	1	3	2.13	0.70

B. Correlation matrix of the UAMA sample

Bold figures are annotated in part of the correlation matrix shown in Table 3.2. In Appendix E1.1, the original table is shrunk to fit the page. Eighteen variables are correlated and show factorability: variable 12 (Enjoyinglife) is moderately correlated (0.551) with variable 6 (Creativity). The same variable has a correlation of 0.446 with 10 (Varied life), and of 0.440 with variable 11 (Socialjustice). Variable 15 (Health) has a moderate correlation of 0.493 with variable 6 (Creativity) and a negative correlation of 0.427 with variable 12 (Enjoyinglife). Variable 16 (Responsible) has a high correlation of 0.654 with variable 15 (Health). Variable 17 (Respectful) has a moderate correlation of 0.498 with variable 16 (Responsible). Variable 18 (Moderation) has a high correlation of 0.677 with variable 16 (Responsible). Variable 23 (b Climate country) has a moderate correlation of 0.480 with variable 22 (aClimateyour). Variable 24 (cClimateplants) has a high correlation of 0.647 with variable 22 (aClimateyour). Variable 27 (cForestplants) has a moderate correlation of 0.490 with variable 4 (Broadminded). Variable 29 (bToxiccountry) has a high correlation of 0.603 with variable 26 (bForestcountry). Variable 34 (Business) has a moderate correlation of 0.501 with variable 32 (Ifeelobligation). Variable 36 (Government3) has a very high correlation of 0.730 with variable 34 (Business). Variable 38 (Peoplelike) has a moderate correlation of 0.542 with variable 21 (Choosinggoals). Variable 41 (Adaptsideas) has a moderate correlation of 0.542 with variable 40 (Anticipatesobsta). Variable 49 (Personallyleads) has a very high correlation of 0.731with variable 47 (Advocateschange). Finally, variable 50 (Keepspromi) has a moderate correlation of 0.594 with variable 46 (Leadsbyexam).

C. Kaiser-Meyer-Olkin measure and Bartlett's Test of Sphericity

The factorability for the entire UAMA sample is presented in table 3.3a. The values of the tables are very low. However, the KMO test for latent variables (universal values, awareness of consequences, ascription of responsibility, personal intelligences, and demographics) is poor, but still close to 0.6, and 0.7, except for the demographic variables which is 0.481. Tables 3.3b, c, d, e, and f show the amount of variance within data that could be explained by factors. Bartlett's test indicates in all cases that data are probably factorable because p<.05, but a further test using other indicators must be carried out.

Table 3.2 Correlation matrix of the UAMA sample

	1Mun	2In	3Am	4Broa	5Aut	6Cre	7Pow	8Ord	9Pre	10Var	11Just	12Enj	13Self
1Worldatpeace	1												
2Influential	-0.371	1											
3Ambitious	0.079	0.099	1										
4Broadminded	-0.055	0.063	-0.090	1									
5Authority	0.067	0.236	0.346	-0.100	1								
6Creativity	0.025	-0.139	-0.175	0.354	-0.212	1							
7Socialpower	0.212	0.096	0.355	0.132	0.308	-0.059	1						
8Socialorder	0.147	-0.081	0.038	0.285	0.018	0.135	0.123	1					
9Prevention	0.045	-0.080	-0.039	0.329	-0.203	0.265	-0.178	0.104	1				
10Variedlife	0.027	0.175	0.181	-0.198	0.261	-0.247	0.207	-0.162	-0.148	1			
11Socialjustice	-0.048	0.076	0.021	0.351	-0.275	0.258	-0.161	0.105	0.099	-0.277	1		
12Enjoyinglife	0.061	0.283	0.155	-0.136	0.238	**-0.551**	0.112	-0.079	-0.074	**0.446**	**-0.440**	1	
13Selfdiscipline	-0.022	0.002	0.007	0.172	-0.171	0.253	-0.085	0.374	0.012	-0.175	0.253	-0.160	1
14Unitywnature	0.065	0.129	0.091	0.055	-0.040	0.225	-0.026	0.308	0.198	-0.211	0.044	-0.098	0.248
15Wealth	0.149	-0.025	-0.025	0.245	-0.005	**0.493**	0.098	0.322	0.152	-0.089	0.230	**-0.427**	0.146
16Responsible	0.112	0.049	0.140	0.249	-0.048	0.373	0.161	0.263	-0.014	-0.104	0.169	-0.309	0.250
17Respectful	0.052	-0.029	0.136	0.186	0.021	0.219	0.056	0.120	0.284	-0.307	0.191	-0.180	0.091
18Moderate	0.173	-0.042	-0.010	0.241	-0.081	0.337	0.103	0.315	0.031	-0.250	0.146	-0.277	0.293
19Equality	0.079	0.037	0.219	0.321	-0.136	0.291	-0.010	0.116	0.264	-0.170	0.197	-0.231	0.295
20Acceptinglife	0.198	0.094	0.034	0.176	-0.223	0.126	0.075	0.308	0.142	-0.152	0.188	0.029	0.377
21Choosingoals	0.016	0.027	0.069	0.357	0.154	0.349	0.001	0.269	0.293	-0.264	0.062	-0.180	0.234
22aClimateyou	-0.170	0.041	-0.031	0.117	-0.106	-0.042	-0.268	0.120	0.404	-0.275	0.043	0.050	-0.120
23bClimatecountry	-0.056	0.008	0.115	0.191	0.219	0.020	-0.021	0.206	0.246	-0.125	0.056	0.039	-0.059
24cClimateplants	-0.136	0.016	-0.038	0.159	0.107	-0.065	-0.067	0.049	0.306	-0.057	0.050	0.056	-0.187
25aForestyou	-0.128	0.113	0.060	0.243	-0.073	0.077	-0.270	0.119	0.182	-0.347	0.327	-0.178	0.056

Table 3.3a KMO and Bartlett's Test for UAMA sample

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.066
Bartlett's Test of Sphericity	Approx. Chi-Square	3346.170
	df	2080
	Sig.	.000

Table 3.3b KMO and Bartlett's Test for Universal Values of UAMA sample

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.602
Bartlett's Test of Sphericity	Approx. Chi-Square	479.090
	df	210
	Sig.	.000

Table 3.3c KMO and Bartlett's Test for Awareness of Consequences of UAMA sample

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.536
Bartlett's Test of Sphericity	Approx. Chi-Square	168.871
	df	36
	Sig.	.000

Table 3.3d KMO and Bartlett's Test for Ascription of Responsibility of UAMA sample

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.539
Bartlett's Test of Sphericity	Approx. Chi-Square	170.533
	df	36
	Sig.	.000

Table 3.3e KMO and Bartlett's Test for Personal Intelligences of UAMA sample

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.738
Bartlett's Test of Sphericity	Approx. Chi-Square	457.925
	df	190
	Sig.	.000

Table 3.3f KMO and Bartlett's Test for Demographics of UAMA sample

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.481
Bartlett's Test of Sphericity	Approx. Chi-Square	46.888
	df	15
	Sig.	.000

D. Anti-image correlation of the UAMA sample

Bold on-diagonal values are annotated on a part of the anti-image correlation matrix for the UAMA sample and shown in Table 3.4. In Appendix E1.2, the original table is shrunk to fit the page. The on-diagonal values are same KMO values from the previous table; they are extremely low, and therefore must be eliminated from the analysis. However, high correlation values were obtained from each latent variable group.

Table 3.4 Anti-image correlation from the anti-image matrices for UAMA sample

	1	2	3	4	5	6	7	8	9	10	11	12	13
1Worldatpeace	**0.026**	0.950	0.938	0.950	-0.690	-0.340	0.667	-0.799	-0.903	-0.838	-0.817	0.267	0.883
2Influential	0.950	**0.022**	0.913	0.888	-0.668	-0.353	0.541	-0.708	-0.838	-0.789	-0.772	0.166	0.797
3Ambitious	0.938	0.913	**0.026**	0.962	-0.774	-0.260	0.703	-0.869	-0.928	-0.847	-0.857	0.305	0.909
4Broadminded	0.950	0.888	0.962	**0.055**	-0.711	-0.274	0.709	-0.871	-0.940	-0.833	-0.851	0.283	0.921
5Authority	-0.690	-0.668	-0.774	-0.711	**0.051**	-0.089	-0.716	0.773	0.784	0.545	0.900	-0.212	-0.809
6Creativity	-0.340	-0.353	-0.260	-0.274	-0.089	**0.353**	0.135	0.064	0.137	0.252	-0.051	0.192	-0.096
7Socialpower	0.667	0.541	0.703	0.709	-0.716	0.135	**0.041**	-0.829	-0.762	-0.677	-0.745	0.562	0.847
8Socialorder	-0.799	-0.708	-0.869	-0.871	0.773	0.064	-0.829	**0.061**	0.870	0.774	0.840	-0.385	-0.897
9Prevention	-0.903	-0.838	-0.928	-0.940	0.784	0.137	-0.762	0.870	**0.046**	0.812	0.878	-0.368	-0.927
10Variedlife	-0.838	-0.789	-0.847	-0.833	0.545	0.252	-0.677	0.774	0.812	**0.063**	0.674	-0.561	-0.810
11Socialjustice	-0.817	-0.772	-0.857	-0.851	0.900	-0.051	-0.745	0.840	0.878	0.674	**0.062**	-0.187	-0.898
12Enjoyinglife	0.267	0.166	0.305	0.283	-0.212	0.192	0.562	-0.385	-0.368	-0.561	-0.187	**0.202**	0.403
13Selfdiscipline	0.883	0.797	0.909	0.921	-0.809	-0.096	0.847	-0.897	-0.927	-0.810	-0.898	0.403	**0.060**
14Unitywnature	0.300	0.151	0.318	0.426	-0.208	0.100	0.519	-0.512	-0.491	-0.319	-0.316	0.244	0.398

E. Communalities of the UAMA sample

Communalities, or how much variance in each variable is explained by the analysis, are presented in Table 3.5. Communalities for variable 36 (Government3) have the highest value: 0.889. In other words, PCA explains 88.9% of its variance. Variable 36 (Government3) then has the highest communality, and variable 59 (Changesstrategy) the lowest (0.626). Variables 59 (Changesstrategy), 57 (Establishesclose) and 10 (Variedlife) have values of communality above 0.6. Twenty eight variables have communalities above 0.7, and 34 variables have communalities above 0.8. No variable had a value lower than 0.5. This implies that PCA explains much of the associated variance for all variables. In other words, variables have much in common with each other and are very closely related.

Table 3.5 Communalities of the UAMA sample

SCALE/ Item	Initial	Extraction
I. UNIVERSAL VALUES		
1Worldatpeace	1	0.838
2Influential	1	0.740
3Ambitious	1	0.754
4Broadminded	1	0.888
5Authority	1	0.750
6Creativity	1	0.785
7Socialpower	1	0.779
8Socialorder	1	0.788
9Prevention	1	0.876
10Variedlife	1	0.679
11Socialjustice	1	0.774
12Enjoyinglife	1	0.806
13Selfdiscipline	1	0.789
14Unitywnature	1	0.738
15Wealth	1	0.869
16Responsible	1	0.871

SCALE/ Item	Initial	Extraction
17Respectful	1	0.801
18Moderate	1	0.716
19Equality	1	0.842
20Acceptinglife	1	0.818
21Choosingoals	1	0.856
II. AWARENESS OF CONSEQUENCES		
22aClimateyou	1	0.854
23bClimatecountry	1	0.843
24cClimateplants	1	0.855
25aForestyou	1	0.799
26bForestcountry	1	0.805
27cForestplants	1	0.834
28aToxicyou	1	0.773
29bToxicountry	1	0.842
30cToxicplants	1	0.757
III. ASCRIPTION OF RESPONSIBILITY		
31Government1	1	0.733
32Ifeelobligation	1	0.849
33Ifeelasense	1	0.756
34Business	1	0.835
35Government2	1	0.852
36Government3	1	0.889
37Companies	1	0.863
38Peoplelike	1	0.842
39Industry	1	0.865
IV. PERSONAL INTELLIGENCES		
40Anticipatesobsta	1	0.719
41Adaptsideas	1	0.757
42Solicitsinput	1	0.801
43Takesrisks	1	0.772
44Relateswell	1	0.816
45Stayscomposed	1	0.754
46Leadsbyexam	1	0.792
47Advocateschange	1	0.797
48Actsimpulsively	1	0.862
49Personallyleads	1	0.812
50Keepspromi	1	0.776
51Acknowledgesmist	1	0.777
52Articulatesacompe	1	0.798
53Canseethings	1	0.762
54Believescapable	1	0.871
55Bendsrules	1	0.742
56Doubtsownability	1	0.712
57Establishesclose	1	0.697
58Hesitatestoact	1	0.793
59Changesstrategy	1	0.626
V. DEMOGRAPHICS		
60Whathousing	1	0.805
61Own/rent	1	0.811
62Underwhatreligion	1	0.829
63Gender	1	0.799
64Age	1	0.814
65Areyou	1	0.761

Extraction Method: Principal Component Analysis

F. Eigenvalues and explained variance of the UAMA sample

Table 3.6 presents eigenvalues for the entire analysis, as well as estimations of explained variance for a final solution of the PCA calculation. This table contains two sets of results. The section entitled "Initial Eigenvalues" presents own values, percentage of variance, and cumulative

percentage of variance for each factor ranked in the magnitude of eigenvalues. In this case, the first eigenvalue is 8.96, and this explains 13.78% of variance. Eigenvalues are greater than zero and their sum is 65. The section entitled "Extraction Sums of Squared Loadings" reproduces the number of extracted factors in the PCA (21 in this case). Sums of squared saturations are identical to eigenvalues and 21 factors explain 79.78% of variance.

Table 3.6 Total Variance Explained in the UAMA sample

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %
1	8.96	13.7803	13.78	8.96	13.7803	13.78
2	4.44	6.8294	20.61	4.44	6.8294	20.61
3	3.92	6.0294	26.64	3.92	6.0294	26.64
4	3.56	5.4699	32.11	3.56	5.4699	32.11
5	3.14	4.8376	36.95	3.14	4.8376	36.95
6	2.83	4.3609	41.31	2.83	4.3609	41.31
7	2.57	3.9481	45.26	2.57	3.9481	45.26
8	2.38	3.6626	48.92	2.38	3.6626	48.92
9	2.15	3.3105	52.23	2.15	3.3105	52.23
10	1.99	3.0620	55.29	1.99	3.0620	55.29
11	1.90	2.9220	58.21	1.90	2.9220	58.21
12	1.86	2.8571	61.07	1.86	2.8571	61.07
13	1.72	2.6406	63.71	1.72	2.6406	63.71
14	1.57	2.4228	66.13	1.57	2.4228	66.13
15	1.56	2.3935	68.53	1.56	2.3935	68.53
16	1.44	2.2215	70.75	1.44	2.2215	70.75
17	1.36	2.0923	72.84	1.36	2.0923	72.84
18	1.27	1.9486	74.79	1.27	1.9486	74.79
19	1.16	1.7829	76.57	1.16	1.7829	76.57
20	1.06	1.6257	78.20	1.06	1.6257	78.20
21	1.03	1.5809	79.78	1.03	1.5809	79.78
22	0.96	1.4768	81.26			
23	0.92	1.4175	82.67			
24	0.84	1.2925	83.97			
25	0.82	1.2583	85.22			
26	0.77	1.1785	86.40			
27	0.69	1.0552	87.46			
28	0.66	1.0158	88.47			
29	0.63	0.9727	89.45			
30	0.56	0.8626	90.31			
31	0.55	0.8424	91.15			
32	0.50	0.7738	91.92			
33	0.50	0.7675	92.69			
34	0.44	0.6786	93.37			
35	0.42	0.6413	94.01			
36	0.38	0.5839	94.60			
37	0.35	0.5413	95.14			
38	0.32	0.4896	95.63			
39	0.30	0.4590	96.09			
40	0.28	0.4264	96.51			
41	0.26	0.4042	96.92			
42	0.25	0.3822	97.30			
43	0.21	0.3228	97.62			
44	0.20	0.3086	97.93			
45	0.18	0.2740	98.20			
46	0.16	0.2490	98.45			
47	0.15	0.2292	98.68			
48	0.14	0.2106	98.89			
49	0.11	0.1670	99.06			
50	0.11	0.1659	99.23			

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %
51	0.09	0.1407	99.37			
52	0.07	0.1142	99.48			
53	0.07	0.1040	99.58			
54	0.05	0.0722	99.66			
55	0.04	0.0659	99.72			
56	0.04	0.0592	99.78			
57	0.03	0.0538	99.84			
58	0.03	0.0433	99.88			
59	0.02	0.0312	99.91			
60	0.02	0.0262	99.94			
61	0.02	0.0242	99.96			
62	0.01	0.0181	99.98			
63	0.01	0.0124	99.99			
64	0.01	0.0086	100.00			
65	0.00	0.0002	100.00			

Extraction Method: Principal Component Analysis

G. Scree plot of the UAMA sample

This section presents eigenvalues for factors in figure 3.1. This graph allows for determining the number of factors that best represent any significant variance described by the correlation matrix. Inspection of graph 3.1 suggests that 20 factors explain the main significant variance of the correlation matrix. This decision is based on the position of the "elbow" in the graph. In this case, it is at factor twenty, suggesting that the amount of variance explained by 21 factors and subsequent factors is low and virtually equivalent to that determined by the eigenvalue method. We are trying to distinguish the "mountain" (i.e., principal components based on true covariance) from "rocks" (i.e., principal components based on random error) (Gardner, 2003).

H. Component matrix of the UAMA sample

The matrix of initial factors is the matrix for principal component factors. It is a structural matrix because it involves correlations of each variable with each principal component. The component matrix is shown in Table 3.7 and consists of 21 factors. The decision concerning the number of factors is based on the eigenvalue rule of 1, not on results of previous scree plots, although in this case both methods give the same results. In other words, 21 factors have eigenvalues greater than 1.0.

Figure 3.1 Scree Plot of UAMA Sample
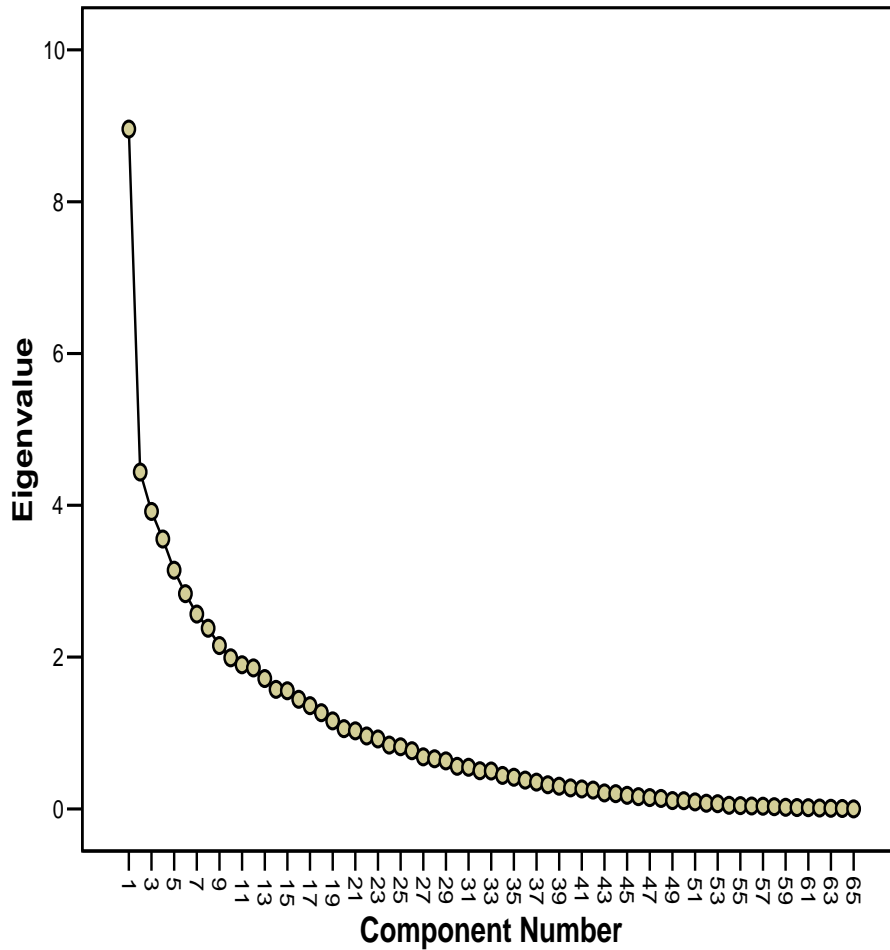
An inspection of the component matrix reveals that factors have positive and negative values across all variables. In other words, factors are a combination of positive and negative saturation in the component matrix. In table 3.7, loadings are ranked by component. The variable 47 (Advocateschange) has a strong loading (0.653) on the first component; a low loading (0.347) on the second component, and a very low loading (-0.116) on the fifth component. These loadings may be useful for seeing the pattern of which variables load most strongly with which factors. In particular, the negative loadings found here may be an artifact of the calculation method. Blanks are very low loadings.

I. Matrix of residual correlation for the UAMA sample

Usually when the matrix of residual correlation is generated, the matrix of reproduced correlations is obtained. However, this matrix is identical to communalities presented in Table 3.5 and therefore they will not be presented in this section. The matrix of reproduced correlations was calculated by the equation from the fundamental theorem (see Equation 3.1) submitted to factorial saturation in the correlation matrix.

In determining how well PCA explains the observed matrix of correlations, the matrix of residual correlation was calculated by subtracting each value from reproduced correlations to the corresponding value in the matrix of correlations. This produces the matrix of residual correlation. Part of table 3.8 is presented below. In Appendix E1.3, the table is shrunk to fit the page. These residual values are close to zero. To give a rough idea of how to fit the adjustment, statistical software counts the number of non redundant residuals whose absolute value is greater than 0.05. The footnote *a* for Table-3.8 indicates that 250 (12%) exceed 0.05.

J. Matrix of rotated factors of the UAMA sample

Twenty five iterations were carried out with a varimax rotation using SPSS12 statistical software, but this was insufficient to obtain loading values for UAMA sample. The purpose of the rotation is to produce an easier solution for interpreting data. The rationale of rotation criteria is based on continuing the rotation until the squared sum of factorial saturation variances for each factor is as large as possible (Gardner, 2003). Failure to obtain a rotated matrix does not alter initial results, the only difference is the frame of reference used to describe the location of points in space.

Table 3.7 Component matrix of the UAMA sample

Component	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
47Advocateschange	-.653	.347		-.116	.155	.269					.227	.168									
38Peoplelike	.600	-.133	.277	.109	.255	.285	.195	.143					-.189	-.114			-.127		.124	.238	
21Choosingoals	.599	.216	-.139	.220	.142	-.148		-.307		-.121	.112	.215	.143						.119	-.117	
49Personallyleads	-.583	.332		-.201		.204	.309		.256	.215			-.314	.207			-.101		.175	-.163	
16Responsible	.571	.505				.329		.169								.102					
33Ifeelasense	.567	.190	-.187		-.176		.120	.147			.185		.325		-.169		-.132		-.198		-.176
17Respectful	.538	.298	.147				.267		.149	.114		-.170									
14Unitywnature	.535	.270	-.145	-.172			.179		.257	.257									.389	-.150	
46Leadsbyexam	-.516	.220	-.330		.227			.254	-.158	.109		-.167	-.119		-.126		-.108	-.245	-.150	-.124	
52Articulatesacompe	-.503	.455		.282		.149	.111							-.162		.358					
50Keepspromi	-.483	-.104	.314	-.338	.271	.144		.275	.162		-.193		-.160			-.144					
42Solicitsinput	-.474	-.224	.165	.138	-.132	-.104	-.104	-.291	-.112	.240	.294	-.205	-.138		.143			-.154	-.172		
4Broadminded	.470	.149	-.124		.133	-.342		.257	-.254	.202	.257	.148	.340			.153	-.342	-.165	-.124		
6Creativity	.465	.215	-.377	-.113	.187	-.196	-.165	-.117	-.210	-.158	.242	.145		.162	.163	.113	.169				
35Government2	.450			-.373	.206		.244	.242	.358	-.244	-.210	-.244	.142	-.235	-.185	-.171	-.131	.131			
10Variedlife	-.450		-.130	.354	.206			.133	.109	.153	.172	.216			.257						
57Establishesclose	-.445		-.212	.152					.400	-.237			.387								
45Stayscomposed	-.444	.238	.106	-.182	-.413			-.112	.186			-.186	-.275				-.113	.168			
53Canseethings	-.402	.218	.359	-.144			.374			.114	-.174			-.275					.163		
58Hesitatestoact	.394	-.192	.355	.390				-.184			.306	-.161	-.155	-.171	.131	.237		.169			
11Socialjustice	.379	.283		.103			.373	-.164	-.213		-.228	-.142	-.130	-.241		-.174				-.142	
18Moderate	.449	.554		-.179		.150		.242	.177		.115	.275	-.130		.113		-.145				
44Relateswell	-.432	.511	.257	-.115	-.107	-.174		.162	.115	.177	.275			.108	-.234	.177		.108			
20Acceptinglife	.305	.506	-.157		-.229	.128	.223	-.202	.235	.129	.324	-.234			-.164						
51Acknowledgesmist	-.265	.485		.160			.152		-.398	-.197	-.311	-.170	.241	-.109							
15Wealth	.407	.483	-.151		.302		-.314	.191	-.175		-.135	.155			.152	-.176	-.151	.250			
41Adaptsideas	-.395	.466	.356	.117		-.293		-.128	-.118				-.168	.139	.173	-.176	.195	-.131			
43Takesrisks	-.368	.466	.102		-.124		-.130	-.248	-.221		-.191	.296			.162	.162	.195	-.131			
22aClimateyou	.300	-.348	.629	.119	-.154	-.124	.332	.102		.159	.107					-.112					
36Government3	.307		.515	-.179	.444	-.291	-.195	.140	-.147	.162	-.226			.131			-.155				
30cToxicplants	.262	-.321	.455	.354	.257	.111	.308	.264	.174	.137		.125			-.161						
48Actsimpulsively			-.453	-.323	-.195	.335		-.273	-.156	.348	-.191	.297	.125	-.234	-.103	.202	.195				
9Prevention	.334	.452	.452	-.195		-.117	-.251	-.157	-.221	-.101	.238	-.157		.399		-.234	.214	.113			

Table 3.7 Component matrix of the UAMA sample

Component	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
31Government1	.304		.445	-.144		-.291		.239	.196	-.104	.159	.202	-.227					.177	.144	.112	.156
40Anticipatesobsta	-.379	.339	.427		.118	.202		-.336		-.173						-.209					
19Equality	.377	.301	.390	-.168	.244	.114	-.126	.131				.129		-.143	.284	.193	.364		.125		
5Authority			-.154	.577	.290	.231		-.103			-.155	.153		-.142		-.144		.185		-.296	
13Selfdiscipline	.421	.121	-.164	-.471	.296	-.151				-.138	.225	.288	.210								.201
65Areyou	-.236	-.358	-.115	-.452	.183	.302				.169	.221	-.109	.210	-.139		.153		.170			
12Enjoyinglife	-.336	-.138		.437	.241	-.193		.130	.198		.215	.253	.278	.130	.246		-.192				-.101
59Changesstrategy		.284	.303	.380			-.177	-.164	-.167	-.155		-.221	.182		-.165			.315		.126	.207
29bToxicountry	.328	-.338	.319	.358			-.104	-.157		.254	.169	.209	-.261	-.169						-.102	.137
32feelobligation	.485	.202			.565					-.170		.147	.107		-.103	-.157			.149		-.307
34Business	.363		.383	-.151	.494		-.228	-.106	.148	-.142		-.155	.187	.121		.133	.152			-.179	-.128
3Ambitious				.324	.479		.118	.348					-.288	-.174	.254	.213		-.132			
64Age	-.229	-.468	.282	-.104	-.230	.556	-.100					.131						.104	.146		.113
27cForestplants				.118	-.123	.531	.136	-.376	.297		.174		-.222		-.201		.119		.107	.234	
54Believescapable	-.258		.345	.205	.134	.181	.527					-.285			.146	.168	-.177	.249			-.101
28aToxicyou	.422		.275		-.218		.479	.425		-.202	-.200	.164	-.112		.141		.128	.159	.126	.213	-.109
24cClimateplants	.308	.105	.230	-.203	-.104	.319	.461	-.183		.238		.184		.207			-.150	-.276	-.125		-.101
26bForestcountry				.330	-.198	-.369	.380	-.462	.329	.232	.429		-.101	-.123		-.193	.161		.137		
60Whathousing			-.346			-.225		.434		.122	-.134			.237			.344		.147		
37Companies	.254	.149	-.210		.138		-.166	.425	.178	.370			-.221	-.221		-.342	.234			.290	
56Doubtsownability	.298	-.120	-.132	.152	.386	.138			-.465	.133	.271			.192	.119						
25aForestyou	.225		.130		-.297		.100	-.271	.329	-.195		-.182	.155	.262	.312	-.207	.263	-.118	.140		
7Socialpower		.242	-.342	.252	.328			-.132	.219	.421					.121		.183	-.122	-.196	-.244	
36Government3	.336	-.193	.116	.349	-.118		-.116	.133	.209	-.366	.325			-.221			.294	-.106	-.240	.182	
63Gender		-.186	-.119	-.262	.331	-.271	.369	-.149			.446					.152			-.169	.182	.205
23bClimatecountry	.122		.185	.287	-.265	-.325	.141	-.209		.274	.404		-.193		-.233	.181	-.293	-.259			-.233
8Socialorder	.463	.141					-.161	-.162	.175			.508	-.212	.127		-.166		.185			.154
1Worldatpeace		.399					-.326	.168	.106	.153	.143		-.430	.117	.341	-.260	-.149				-.103
2Influential			.238				.370			-.333	-.123		.391	-.102		-.130	.149			-.165	.264
62Underwhatreligion			.142	.207			-.278	.323		-.121		-.182	-.122	.424		.417		-.259			.140
61Own/rent	.112	.189	-.323			-.250	.322	.142	-.115	.289	-.193		.260			.375	-.225	.302	-.222		
55Bendsrules	-.105	.132	-.121	.291		.268	-.237		.348			-.181	.121	.137				.354	-.125	.304	

Extraction Method: Principal Component Analysis

a.   21 components extracted

Table 3.8 Matrix of residual correlation of UAMA sample

	1	2	3	4	5	6	7	8	9	10	11	12	13
1Worldatpeace													
2Influential	0.009												
3Ambitious	-0.014	-0.107											
4Broadminded	-0.048	0.033	-0.040										
5Authority	0.020	-0.065	0.023	-0.010									
6Creativity	0.003	0.015	0.036	0.002	0.042								
7Socialpower	0.002	0.018	-0.010	-0.007	-0.045	-0.027							
8Socialorder	-0.036	0.009	0.026	0.010	-0.021	-0.003	0.054						
9Prevention	-0.006	0.030	0.032	-0.009	-0.011	-0.028	0.008	-0.041					
10Variedlife	0.005	-0.049	-0.014	0.003	-0.022	0.007	-0.085	-0.080	0.016				
11Socialjustice	0.033	-0.033	0.063	-0.046	0.007	-0.044	0.049	0.010	-0.001	0.057			
12Enjoyinglife	0.031	0.009	-0.048	0.026	-0.035	0.024	-0.066	-0.009	-0.018	0.014	-0.005		
13Selfdiscipline	0.046	-0.021	0.010	-0.017	0.073	-0.029	-0.020	-0.051	0.047	-0.012	0.015	0.009	
14Unitywnature	0.016	0.046	0.072	0.030	-0.075	0.000	0.002	-0.014	0.023	-0.039	-0.006	-0.037	-0.006
15Wealth	-0.005	-0.018	-0.050	0.014	-0.017	-0.034	-0.053	-0.054	0.004	0.011	-0.048	0.060	0.001
16Responsible	-0.018	0.016	-0.018	-0.002	-0.056	0.010	-0.059	-0.025	0.033	0.069	-0.053	0.040	0.003
17Respectful	0.003	0.042	0.028	-0.010	0.079	0.047	-0.022	0.001	0.004	-0.102	-0.011	0.026	0.000
18Moderate	-0.038	0.029	-0.033	0.013	-0.020	-0.039	-0.030	-0.031	0.047	0.020	-0.032	0.035	-0.008
19Equality	0.000	0.032	-0.049	0.011	-0.018	-0.019	-0.028	-0.039	-0.026	0.024	-0.020	0.016	-0.028
20Acceptinglife	0.006	-0.063	0.020	-0.034	-0.010	0.044	0.054	-0.013	-0.038	-0.002	0.019	-0.041	-0.045
21Choosingoals	-0.021	0.039	-0.084	0.010	0.022	-0.005	-0.012	0.050	-0.042	0.009	0.019	0.016	-0.021
22aClimateyou	0.009	0.027	0.022	-0.027	-0.029	0.041	0.009	0.029	-0.014	-0.039	-0.024	-0.031	-0.009
23bClimatecountry	-0.022	0.003	-0.026	0.000	-0.093	0.000	-0.032	-0.008	-0.032	0.026	-0.003	0.053	-0.028

Extraction Method: Principal Component Analysis.
a. Residuals are computed between observed and reproduced correlation. There are 250 (12.0%) nonredundant residuals with absolute values greater than 0.05.

K. Pattern of component and latent variables for the UAMA-case

The data were analyzed by means of a principal component analysis with a varimax rotation which did not converge after 25 iterations at UAMA. Three of six of the various indicators of factorability were poor: the matrix of correlation coefficients, Kaiser-Meyer-Olkin measures of sampling, and the on-diagonal values of the anti-image correlation matrix. However, the last three indicators load a good factorability level; the Bartlett test shows the data have a probability of factorability and high values in communalities, and the very low residual values from the matrix of reproduced correlations indicate optimum outcomes.

Within the data, 21 components were found with an eigenvalue of greater than 1.0; they explain 79.78%, of associated variance as opposed to 40 to 60% from previously mentioned models; therefore this is a very promising model. Scree plots indicate 21 components, very close to the eigenvalue. The communalities values were an average of 0.7; this means that the variables had much in common with each other even though fewer than one hundred subjects participated.

Table 3.9 shows the pattern found as a representative relation of latent variables, which were the leading factors underlying behavior for sustainability at UAMA. In the left-most column, saturation values from the component matrix extracted using the PCA method are presented. The second column is composed of the first four components of the initial matrix for Mexican HEI. There are no data for this high saturation value at UAMA sample. For middle saturation values (0.6) related to the first component, UAMA loads variable 47 under the personal-intelligences latent variable and variable 38 under the latent variable "ascription-of-responsibility". The lower saturation values (0.4 to 0.5) for the first component at UAMA associate universal values and personal intelligences mainly. But, ascription of responsibility, universal values and personal intelligences appear more frequently than the other two latent variables "awareness of consequences" and "demographics".

Table 3.9 Pattern of the first four components found by the PCA and the representative relations of the latent variables in the UAMA sample (PCA value above 0.400)

	Component			
	1	2	3	4
PCA Values	Variables			
Higher 0.7 – 0.8				
Middle 0.6	$V47^{III}$ $V38^{I}$		$V22^{IV}$	
Lower 0.4 – 0.5	$V21^{II}$ $V49^{III}$ $V16^{II}$ $V33^{II}$ $V17^{II}$ $V14^{III}$ $V46^{I}$ $V52^{III}$ $V50^{I}$ $V42^{III}$ $V4^{II}$ $V6^{II}$ $V8^{II}$ $V35^{I}$ $V32^{I}$ $V10^{II}$ $V57^{I}$ $V46^{III}$ $V44^{III}$ $V53^{III}$ $V18^{II}$ $V28^{IV}$ $V15^{II}$ $V13^{II}$	$V18^{II}$ $V44^{III}$ $V20^{II}$ $V15^{II}$ $V51^{III}$ $V41^{III}$ $V43^{III}$ $V64^{V}$	$V36^{I}$ $V30^{IV}$ $V48^{III}$ $V9^{II}$ $V31^{I}$ $V40^{III}$	$V5^{II}$ $V13^{II}$ $V65^{V}$ $V12^{II}$

Note: Latent variables are: I – Ascription of responsibility, II – Universal values, III – Personal Intelligences, IV – Awareness of consequences, V – Demographics. Variables names are in above tables. PCA values = saturation values extracted by principal component analysis method

3.1.2 Outcomes from psychometric measurement applying the Item Response Theory for the UAMA sample

The Rasch model loads 20 variables, grouped in subsets of five dimensions (see explanation in Table 2.6: Effectiveness, Deliberation, Anticipation, Solidarity, and Austerity) and loads 80 participants at UAMA. In other words, the number of participants who fully responded to the questionnaire is 80, but two people for some reason left blank some responses. Additionally, one respondent forgot to identify to which participant they belong and was not considered in the calculations. There is no algorithm to calculate missing data, and therefore the author of this study worked with this number.

Table 3.8 shows the probability of the observed response pattern for each category: student, faculty, and staff, and for the entire UAMA sample, as well as the set of four items in each psychological dimension and their respective trait level. Appendix E2 shows extensive calculations of probability for each participant and each dimension of sustainability.

A 4-trait level item, that is, a behavior which is very unlikely to be carried out, has a probability value close to zero across all participants; however, when the trait level is 1, a behavior which is more likely to be performed, participants show higher probability values. Observations show that students almost always show the highest probability values in the five dimensions, and faculty members the lowest. "Effectiveness" is the most likely behavior performed by the three types of subjects, as shown by the probability value of 0.09. "Solidarity" and "Anticipation" were the least likely to be shown, however "Anticipation" is the most unlikely behavior, obtaining the lowest probability among the three groups of participants. "Austerity" and "Deliberation" offer intermediate probability values of 0.05 and 0.01 respectively.

Table 3.10 Probability of observed item and participant pattern for UAMA case

Dimension	TL	Item	Students	Faculty	Administrators	
			Probability[a]			Prob[b]
Effectiveness	1	1. Believes one-self to be capable for a job.	**0.695**	0.275	0.480	**0.0920**
	2	2. Doubts his/her own ability.	0.0000278	0.00000000002	0.00000000123	0.0000000000000000000000000000939
	3	3. Anticipates obstacles to a goal.	**0.00733**	0.0000529	0.0000145	0.00000000000000000566
	4	4. Takes calculated risks to reach a goal.	0.000589	0.00000000001	0.00000000113	0.000000000000000000000000920
Austerity	1	5. Keeps his/her promises	0.387	0.308	**0.400**	0.0477
	3	6. Acknowledges mistakes	0.0107	0.0000541	0.00279	0.000000000162
	1	7. Adapts ideas based on new information.	**0.373**	0.154	0.131	0.00751
	4	8. Changes overall strategy, goals, or projects to fit the situation.	0.00000453	0.000000078	0.0000000000000121	0.0000000000000000000000000000000000000431

Dimension	TL	Item	Students	Faculty	Administrators	
				Probability[a]		Prob[b]
Solidarity	3	9. Relates well to people of diverse backgrounds.	**0.019**	0.000502	0.00205	0.00000000195
	4	10. Can see things from someone else's perspective.	0.0000293	0.000000000000868	0.000000000237	0.000000000000000000000000000605
	2	11. Solicits others' input.	**0.086**	0.036	0.081	0.0000251
	4	12. Establishes and maintains close relationships at work.	0.00000191	0.00000000000594	0.00000143	0.0000000000000000000000000163
Anticipation	2	13. Acts impulsively.	0.00388	0.000000991	0.000102	0.00000000000000393
	4	14. Stays composed and positive, even in stressful situations.	0.000300	0.00000000000120	0.000000000225	0.000000000000000000000000000814
	3	15. Personally leads change initiatives.	0.00413	0.0000133	0.000215	0.000000000000118
	4	16. Advocates change despite opposition.	0.0000517	0.000000000021	0.00000000966	0.000000000000000000000000000109
Deliberation	1	17. Hesitates to act on opportunities.	**0.0175**	0.000154	0.00152	0.000000000412
	3	18. Cuts through red tape or bends rules when necessary.	0.000000315	0.000000000000000000000101	0.0000000000000413	0.0000000000000000000000000000000000000000000000000000000131
	1	19. Leads by example.	0.235	0.151	**0.247**	0.00875
	4	20. Articulates a compelling vision.	0.0000449	0.000000000012	0.0000000262	0.000000000000000000000000000148

a. $L(\underline{X}s) = P_{1s}\,P_{2s}\,P_{3s}\ldots P_{20s}$ calculated according Equation 3.2 for item and participant category which was calculated according Equation 3.1: $P(X_{is}) = e^{(\theta s - \beta i)} / 1 + e^{(\theta s - \beta i)}$

b. $L(\underline{X}s) = P_{j1}\,P_{j2}\,P_{j3}\ldots P_{j80}$ calculated according Equation 3.3 for each question for 80 participants.

TL = Trait Level, 1 means a likely behavior…4 means an unlikely behavior.

Outcomes from the Rasch model show that a simple behavior was relatively easier to demonstrate when participants showed high probability values (0.09 as compared to values closer to zero), in a context amongst students, faculty, and administrators. Also it is possible to anticipate that, given a level of motivation of a particular population motivated toward a specific goal, this goal will inevitably fail, unless something is done to provide for structural changes.

3.2   LULIfUK CASE - Germany

Principal component analysis of LULIfUK loaded 65 and not 67 variables because level of studies and source of HEI were items for data organizing purposes only; and loaded 37 participants who fully responded the questionnaire. That is, there are 3 people who for some reason left blank one or more answers, and because we do not have an algorithm to calculate missing data it was decided to work with that number.

3.2.1 Outcomes from principal component analysis
A. Descriptive statistics of LULIFUK sample

Table 3.11 provides a description of minimum and maximum values, and mean and standard deviation of 65 observed variables. The first, third and fourth sections of the questionnaire have

minimum and maximum values which range from 1 to 5. The second section ranges from 1 to 3. the fifth section has dichotomous variables with yes or no responses. Mean values are above 1 and standard deviation data are up to 0.277 and 27.84. The reliability of the scale for the entire sample was a Cronbach's alpha of 0.779 and no squared multiple correlation values were observed.

Universal Values, the first section of the questionnaire, has a Cronbach's alpha for the scale in this sample of 0.732 and squared multiple correlation range from 0.464 to 0.891. The variable 17(Respectful) has the highest value. Mean participant's responses for variable 12 (Enjoyinglife) and 10 (Variedlife) are up to four. This means the majority of participants disagree with these values. It is important to mention that these two values were considered to represent the reverse of the goals of ESD (see table 2.4) and this seems to provide corroborative evidence for the idea proposed in Chapter 2 that values of hedonism and stimulation go against underlying principles of ESD. Variable 20 (Acceptinglife) and variable 2 (Influential) have a mean score ranging from 3.56 and 3.49, which means is that the mean response is disagree. Variables 13 (Selfdiscipline), 18 (Moderate), 3 (Ambitious), 8 (Socialorder), 5 (Authority) and 14 (Unitywnature) have a mean score ranging from 2.00 to 2.64, which means is that the mean response is agree. Variable 7 (Socialpower), 16 (Responsible), 6 (Creativity) and 21 (Choosingoals) have a mean score ranging from 1.54 a 1.64, which means is that the mean response is agree. Variables 9 (Prevention), 15 (Wealth), 4 (Broadminded), 1 (Worldatpeace), 11 (Socialjustice), 19 (Equality) and 17 (Respectful) have a mean score ranging from 1.21 to 1.49; clearly representing the response agrees. Similarly standard deviation indicates the extent in which individuals differ in scoring. Standard deviation ranges from 0.47 to 1.07. These values indicate a small standard deviation, considering the range of responses from 1 to 5.

The second section is Awareness of Consequences; Cronbach's alpha of this scale for the current sample was 0.590 and squared multiple correlation ranged from 0.220 to 0.736, while variable 25(aForestyou) had the highest value. Mean participant's responses ranged from 1.02 to 1.75 and a very low standard deviation (0.16 – 0.64), that is, participants consider this to be a very serious to serious problems. Variables 27 (cForestplants) and 22 (aClimateyou) present the minimum and the maximum values, respectively.

The third section is Ascription of Responsibility; Cronbach's alpha of this scale for the current sample was 0.744 and squared multiple correlation ranged from 0.180 to 0.665, while variable 35 (Government2) had the highest value. Mean participant's responses ranged from 1.25 to 2.02 with a standard deviation slightly greater than that of the previous section: 0.51 to 1.03; which indicates that these participants totally agree, however some only agree. Variables 31 (Government1), 33 (Ifeelasense), 37 (Companies), and 38 (Peoplelike) present higher mean values: 1.80 to 2.02, that is, they are closer to agree than is the case for other variables.

For the fourth section, Personal Intelligences, Cronbach's alpha for the current sample was 0.541 and the squared multiple correlation ranged from 0.364 to 0.725, while variable 52 (Articulatesacompe) had the highest value. Mean participant's responses ranged from 2.65 to 4.17, with a standard deviation lesser than or equal to 0.55 to 0.98. Variable 49 (Personallyleads) is the lowest mean value; participants very rarely or never achieve them, and variable 50 (Keepspromi) is the highest; participants very often achieve them. For variables: 49 (Personallyleads) and 55 (Bendsrules), very few achieve them; they show a mean value of 2.65 to 2.80. Variables 56 (Doubtsownability), 58 (Hesitatestoact), 48 (Actsimpulsively), 52 (Articulatesacompe), 46 (Leadsbyexam), 47 (Advocateschange), 42 (Solicitsinput), 45 (Stayscomposed), 59 (Changesstrategy), 51 (Acknowledgesmist), 40 (Anticipatesobsta), 57 (Establishesclose) and 54 (Believescapable) indicate mean values of 3.00 to 3.95, which means that some times and very often they are achieved.

The last section is Demographic Variables; Cronbach's alpha of this scale for the current sample was -0.173; this value is negative and the code among items or number of respondents must be checked and enlarged. No squared multiple correlations were obtained. Mean values varied according their type. Variables 60 (Whathousing), 61 (Own/rent) and 63 (Gender) are dichotomous variables, they show respectively that the majority of participants live in an apartment (mean of 1.87), rent housing (mean of 1.92) and are females (mean of 1.74). Variable 65 (Areyou) allowed for three kind of responses: student, faculty, or administrator. Variable 62 (Underwhatreligion) had 6 potential responses. However for this sample the mean value was 3.26 with a standard deviation of 1.67, indicting that the majority belong to none Church / atheist (16 people) and protestant Lutherans (15 people). The mean value of variable 64 (Age) is 27.74 with a standard deviation of 7.54 years. The sample age range is 21 to 58 years.

Table 3.11 Descriptive statistics of the LULIfUK sample with N= 37

SCALE/ Item	Minimum	Maximum	Mean	Standard Deviation
I. UNIVERSAL VALUES				
1Worldatpeace	1	4	1.41	.725
2Influential	2	5	3.43	.765
3Ambitious	1	4	2.43	.801
4Broadminded	1	3	1.51	.651
5Authority	1	4	2.03	.897
6Creativity	1	4	1.59	.725
7Socialpower	1	3	1.62	.681
8Socialorder	1	4	2.27	.732
9Prevention	1	4	1.22	.584
10Variedlife	2	5	4.16	.764
11Socialjustice	1	3	1.46	.650
12Enjoyinglife	3	5	4.41	.599
13Selfdiscipline	1	5	2.65	.857
14Unitywnature	1	4	2.03	.833
15Wealth	1	2	1.32	.475
16Responsible	1	4	1.65	.753
17Respectful	1	4	1.51	.731
18Moderate	1	5	2.57	.929
19Equality	1	3	1.46	.605
20Acceptinglife	1	5	3.54	1.070

SCALE/ Item	Minimum	Maximum	Mean	Standard Deviation
21Choosingoals	1	4	1.54	.691
II. AWARENESS OF CONSEQUENCES				
22aClimateyou	1	3	1.21	.630
23bClimatecountry	1	2	1.20	.498
24cClimateplants	1	3	1.15	.419
25aForestyou	1	3	1.27	.626
26bForestcountry	1	3	1.14	.651
27cForestplants	1	2	1.04	.164
28aToxicyou	1	3	1.08	.495
29bToxicountry	1	2	1.08	.435
30cToxicplants	1	2	1.05	.315
III. ASCRIPTION OF RESPONSIBILITY				
31Government1	1	4	1.86	1.004
32Ifeelobligation	1	4	1.76	.723
33Ifeelasense	1	5	1.95	.941
34Business	1	5	1.27	.769
35Government2	1	4	1.51	.731
36Government3	1	3	1.31	.525
37Companies	1	4	1.97	1.013
38Peoplelike	1	5	2.05	1.053
39Industry	1	3	1.30	.618
IV. PERSONAL INTELLIGENCES				
40Anticipatesobsta	1	5	3.49	.692
41Adaptsideas	3	5	3.59	.551
42Solicitsinput	1	5	3.41	.832
43Takesrisks	2	4	3.05	.705
44Relateswell	3	5	4.05	.664
45Stayscomposed	2	5	3.46	.931
46Leadsbyexam	2	4	3.11	.699
47Advocateschange	2	5	3.38	.794
48Actsimpulsively	1	4	3.05	.705
49Personallyleads	1	4	2.62	.982
50Keepspromi	3	5	4.19	.616
51Acknowledgesmist	2	5	3.92	.547
52Articulatesacompe	1	5	3.08	.894
53Canseethings	3	5	4.03	.645
54Believescapable	3	5	3.89	.658
55Bendsrules	1	5	2.73	.838
56Doubtsownability	2	5	3.03	.799
57Establishesclose	2	5	3.89	.809
58Hesitatestoact	2	5	3.03	.687
59Changesstrategy	2	5	3.51	.731
V. DEMOGRAPHICS				
60Whathousing	1	2	1.86	.347
61Own/rent	1	2	1.92	.277
62Underwhatreligion	1	6	3.35	1.654
63Gender	1	2	1.76	.435
64Age	21	58	27.84	7.730
65Areyou	1	3	1.30	.571

B. Correlation matrix of the LULIFUK sample

Bold figures are annotated in part of the correlation matrix shown in Table 3.12. In Appendix E1.4, the original table is shrunk to fit the page. Sixty-four variables are correlated from the 0.445 limit and show factorability: variable 1 (Worldatpeace) is moderately correlated (0.452) with variable 24 (cClimateplants). The same variable has a correlation of 0.440 with 41 (Adaptsideas). Variable 2 (Influential) has a moderate correlation of 0.489 with variable 3 (Ambitious), a correlation of 0.482 with variable 7 (Socialpower) and a negative correlation of 0.455 with variable 56 (Doubtsownability). Variable 3 (Ambitious) has a moderate correlation of 0.503 with variable 5 (Authority), 0.512 with variable 7 (Socialpower), 0.533 with variable 12 (Enjoyinglife), 0.521 with variable 22 (aClimateyou),

0.494 with variable 25 (aForestyou), and 0.452 with variable 26 (bForestcountry). Variable 5 (Authority) has a moderate correlation of 0.522 with variable 7 (Socialpower) and 0.474 with variable 12 (Enjoyinglife). Variable 7 (Socialpower) has a moderate correlation of 0.484 with variable 22 (aClimateyou). Variable 9 (Prevention) has a moderate correlation of 0.501 with variable 14 (Unitywnature), 0.576 with variable 17 (Respectful) and 0.528 with variable 32 (Ifeelobligation). Variable 11 (Socialjustice) has a moderate correlation of 0.479 with variable 14 (Unitywnature), 0.581 with variable 16 (Responsible), 0.503 with variable 25 (aForestyou), 0.572 with variable 26 (bForestcountry), 0.552 with variable 32 (Ifeelobligation), and 0.533 with variable 33 (Ifeelasense). Variable 12 (Enjoyinglife) has a moderate correlation of 0.497 with variable 57 (Establishesclose). Variable 14 (Unitywnature) has a moderate correlation of 0.458 with variable 15 (Health), and has a high correlation of 0.623 with variable 16 (Responsible), 0.608 with variable 17 (Respectful). The same variable has a moderate correlation of 0.522 with variable 31 (Government), high correlation of 0.638 with variable 32 (Ifeelobligation), and moderate correlation of 0.426 with variable 41 (Adaptsideas). Variable 15 (Health) has a high correlation of 0.703 with variable 17 (Respectful), moderate correlation of 0.472 with variable 29 (bToxicountry), moderate correlation of 0.500 with variable 30 (cToxicplants), and moderate correlation of 0.472 with variable 50 (Keepspromi). Variable 16 (Respectful) has a moderate correlation of 0.542 with variable 25 (aForestyou), 0.440 with variable 26 (bForestcountry), 0.616 with variable 31 (Government), 0.551 with variable 32 (Ifeelobligation), 0.552 with variable 38 (Peoplelike), and 0.446 with variable 41(Adaptsideas). Variable 17 (Respectful) has a moderate correlation of 0.472 with variable 21 (Choosingoals), 0.485 with variable 28 (aToxicyou), 0.532 with variable 29 (bToxicountry), and negative correlation of 0.467 with variable 45 (Stayscomposed). Variable 18 (Moderate) has a moderate correlation of 0.517 with variable 24 (cClimateplants). Variable 20 (Acceptinglife) has a moderate correlation of 0.532 with variable 32 (Ifeelobligation), and a negative correlation of 0.585 with variable 53 (Canseethings). Variable 21 has a moderate correlation of 0.472 with variable 35 (Government1). Variable 22 (aClimateyou) has a moderate correlation of 0.530 with variable 23 (bClimatecountry), 0.501 with variable 45 (Stayscomposed), 0.508 with variable 50 (keeppromi), and 0.465 with variable 65 (Areyou). Variable 23 (bClimatecountry) has a moderate correlation of 0.512 with variable 26 (bForestcountry). Variable 25 (bClimatecountry) has a high correlation of 0.766 with variable 26 (bForestcountry) and a moderate correlation of 0.516 with variable 32 (Ifeelobligation). Variable 26 (bClimatecountry) has a moderate correlation of 0.529 with variable 32 (Ifeelobligation). Variable 27 (cForestplants) has a moderate correlation of 0.478 with variable 30 (cToxicplants). Variable 28 (aToxicyou) has a moderate correlation of 0.678 with variable 29 (bToxicountry) and a moderate correlation of 0.538 with variable 30 (cToxicplants). Variable 28 (aToxicyou) has a moderate correlation of 0.449 with variable 30 (cToxicplants). Variable 31 (Government) has a moderate correlation of 0.543 with variable 35

(Government1). Variable 32 (Ifeelobligation) has a high correlation of 0.695 with variable 33 (Ifeelsense), a negative correlation of 0.523 with variable 51 (Acknowledgesmist), and 0.441 with variable 52 (Articulatesacompe). Variable 33 (Ifeelsense) has a high correlation of 0.680 with variable 38 (Peoplelike) and a negative moderate correlation 0.466 with variable 52 (Articulatesacompe). Variable 35 (Government1) has a moderate correlation of 0.532 with variable 36 (Government2). Variable 36 (Government2) has a moderate correlation of 0.440 with variable 51 (Acknowledgesmist). Variable 38 (Peoplelike) has a negative moderate correlation of 0.501 with variable 51 (Acknowledgesmist), and a negative moderate correlation of 0.507 with variable 52 (Articulatesacompe). Variable 40 (Anticipatesobsta) has a negative moderate correlation of 0.485 with variable 58 (Hesitatestoact). Variable 44 (Relateswell) has a negative moderate correlation of 0.445 with variable 59 (Changesstrategy). Variable 46 (Leadsbyexam) has a moderate correlation of 0.581 with variable 52 (Articulatesacompe), 0.488 with variable 57 (Establishesclose), and 0.452 with variable 64 (Age). Variable 47 (Advocateschange) has a moderate correlation of 0.506 with variable 49 (Personallyleads) and a high correlation of 0.629 with variable 52 (Articulatesacompe). Variable 49 (Personallyleads) has a moderate correlation of 0.513 with variable 52 (Articulatesacompe). Variable 52 (Articulatesacompe) has a negative moderate correlation of 0.509 with variable 56 (Doubtsownability). Variable 54 (Believescapable) has a moderate correlation of 0.513 with variable 64 (Age). Variable 56 (Doubtsownability) has a moderate correlation of 0.574 with variable 58 (Hesitatestoact). Variable 60 (Whathousing) has a high correlation of 0.751 with variable 61 (Own/rent). The same variable has a negative high correlation of 0.775 with variable 64 (Age), and a moderate correlation of 0.490 with variable 65 (Areyou). Variable 61 (Own/rent) has a negative high correlation of 0.877 with variable 64 (Age). Variable 64 (Age) has a moderate correlation of 0.574 with variable 65 (Areyou).

C. Kaiser-Meyer-Olkin measure and Bartlett's Test of Sphericity

The factorability for the entire LULIfUK sample was not obtained. However, the KMO test for latent variable (universal values, awareness of consequences, ascription of responsibility, personal intelligences, and demographics) is poor, but still close to 0.6. Tables 3.13b, c, d, e, f show the amount of variance within data that could be explained by factors. Bartlett's test indicates in all cases that data are probably factorable because $p<.05$, but a further test using other indicators must be carried out.

Table 3.12 Correlation matrix of the LULIfUK sample

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1Worldatpeace	1													
2Influential	0.116	1												
3Ambitious	-0.093	**0.489**	1											
4Broadminded	0.124	-0.143	-0.193	1										
5Authority	-0.258	0.39	**0.503**	-0.283	1									
6Creativity	-0.17	0.186	0.176	0.203	-0.018	1								
7Socialpower	-0.009	**0.482**	**0.512**	-0.039	**0.522**	-0.025	1							
8Socialorder	0.149	-0.047	-0.045	0.043	-0.17	-0.059	-0.287	1						
9Prevention	0.308	0.391	0.435	0.279	0.013	0.007	0.219	0.051	1					
10Variedlife	0.149	0.209	0.199	-0.61	0.139	-0.26	0.052	-0.02	-0.134	1				
11Socialjustice	0.114	0.023	0.364	0.202	-0.027	0.217	0.229	0.37	0.386	-0.078	1			
12Enjoyinglife	-0.25	0.233	**0.533**	-0.32	**0.474**	-0.036	0.17	0.007	0.233	0.254	0.247	1		
13Selfdiscipline	-0.296	-0.36	0.045	-0.209	-0.014	-0.138	-0.098	0.25	-0.229	0.035	0.209	0.333	1	
14Unitywnature	0.197	0.296	0.371	0.261	-0.039	0.037	0.24	0.254	**0.501**	-0.103	**0.479**	0.128	0.188	1
15Wealth	0.408	0.274	0.104	0.244	-0.047	-0.027	-0.029	0.134	0.438	0.026	0.03	-0.166	-0.184	**0.458**
16Responsible	0.073	-0.049	0.394	0.221	0.028	0.1	0.27	0.233	0.247	-0.108	**0.581**	0.129	0.316	**0.623**
17Respectful	0.163	0.246	0.183	0.414	-0.068	0.074	-0.091	0.247	**0.576**	-0.338	0.18	0.04	-0.051	**0.608**
18Moderate	0.152	0.26	0.326	-0.212	0.092	-0.093	0.167	0.141	0.183	0.328	0.351	0.214	0.113	0.29
19Equality	0.187	0.025	0.208	0.433	-0.14	-0.025	0.042	0.271	0.415	-0.269	0.5	0.03	0.008	0.344
20Acceptinglife	0.039	-0.014	0.159	-0.082	-0.109	0.05	-0.062	0.133	**0.437**	0.013	0.203	0.336	0.118	0.382
21Choosingoals	0.206	-0.044	-0.149	0.468	-0.119	-0.239	-0.073	0.025	0.247	-0.366	0.035	-0.259	-0.132	0.194
22aClimateyou	-0.068	0.171	**0.521**	-0.021	0.152	0.143	**0.484**	-0.127	0.043	-0.002	0.231	-0.098	-0.028	0.188
23bClimatecountry	0.092	0.282	0.419	-0.123	-0.042	0.035	0.373	-0.069	0.38	0.08	0.299	0.15	0.004	0.155
24cClimateplants	**0.452**	0.005	0.005	-0.169	-0.069	-0.098	0.19	0.056	0.101	0.292	0.272	0.006	-0.17	0.059

Table 3.13a KMO and Bartlett's Test for Universal Values of LULIfUK sample

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.561
Bartlett's Test of Sphericity	Approx. Chi-Square	366.457
	df	210
	Sig.	.000

Table 3.13b KMO and Bartlett's Test for Awareness of Consequences of LULIfUK sample

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.511
Bartlett's Test of Sphericity	Approx. Chi-Square	128.242
	df	36
	Sig.	.000

Table 3.13c KMO and Bartlett's Test for Ascription of Responsibility of LULIfUK sample

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.623
Bartlett's Test of Sphericity	Approx. Chi-Square	105.230
	df	36
	Sig.	.000

Table 3.13d KMO and Bartlett's Test for Personal Intelligences of LULIfUK sample

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.524
Bartlett's Test of Sphericity	Approx. Chi-Square	256.268
	df	190
	Sig.	.001

Table 3.13e KMO and Bartlett's Test for Demographics of LULIfUK sample

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.645
Bartlett's Test of Sphericity	Approx. Chi-Square	109.737
	df	15
	Sig.	.000

D. Anti-image correlation of the LULIfUK sample

No bold on-diagonal values are annotated on a part of the anti-image correlation matrix for the LULIfUK sample. There is no table. A reason for that might be the number of participants which did not allow calculating the anti-image matrices.

E. Communalities of the LULIFUK sample

Communalities, or how much variance in each variable is explained by the analysis, are presented in Table 3.14. Communality for variable 3 (Ambitious) have the highest value: 0.954. In other words, PCA explains 95.4% of its variance. Variable 3 (Ambitious) then has the highest communality, and variable 42 (Solicitsinput) the lowest (0.740). Nine variables have communalities above 0.7, 39 variables have communalities above 0.8, and seventeen variables had communalities above 0.9. No variable had a value lower than 0.5. This implies that PCA explains much of the associated variance for all variables. In other words, variables have much in common with each other and are very closely related.

Table 3.14 Communalities of the LULIfUK sample

SCALE/ Item	Initial	Extraction
I. UNIVERSAL VALUES		
1Worldatpeace	1	0.865
2Influential	1	0.906
3Ambitious	1	0.954
4Broadminded	1	0.836
5Authority	1	0.859
6Creativity	1	0.876
7Socialpower	1	0.887
8Socialorder	1	0.824
9Prevention	1	0.926
10Variedlife	1	0.758
11Socialjustice	1	0.860
12Enjoyinglife	1	0.898
13Selfdiscipline	1	0.747
14Unitywnature	1	0.903
15Wealth	1	0.879
16Responsible	1	0.874
17Respectful	1	0.951
18Moderate	1	0.775
19Equality	1	0.792
20Acceptinglife	1	0.930
21Choosingoals	1	0.882
II. AWARENESS OF CONSEQUENCES		
22aClimateyou	1	0.939
23bClimatecountry	1	0.841
24cClimateplants	1	0.908
25aForestyou	1	0.912
26bForestcountry	1	0.849
27cForestplants	1	0.884
28aToxicyou	1	0.886
29bToxicountry	1	0.925
30cToxicplants	1	0.917
III. ASCRIPTION OF RESPONSIBILITY		
31Government1	1	0.870
32Ifeelobligation	1	0.898
33Ifeelasense	1	0.798
34Business	1	0.871
35Government2	1	0.878
36Government3	1	0.864
37Companies	1	0.808
38Peoplelike	1	0.878
39Industry	1	0.871
IV. PERSONAL INTELLIGENCES		
40Anticipatesobsta	1	0.909
41Adaptsideas	1	0.882
42Solicitsinput	1	0.740
43Takesrisks	1	0.863
44Relateswell	1	0.751
45Stayscomposed	1	0.810
46Leadsbyexam	1	0.848
47Advocateschange	1	0.788
48Actsimpulsively	1	0.888
49Personallyleads	1	0.891
50Keepspromi	1	0.762
51Acknowledgesmist	1	0.908
52Articulatesacompe	1	0.853
53Canseethings	1	0.928
54Believescapable	1	0.899
55Bendsrules	1	0.865
56Doubtsownability	1	0.888

SCALE/ Item	Initial	Extraction
57Establishesclose	1	0.819
58Hesitatestoact	1	0.912
59Changesstrategy	1	0.871
V. DEMOGRAPHICS		
60Whathousing	1	0.868
61Own/rent	1	0.934
62Underwhatreligion	1	0.840
63Gender	1	0.898
64Age	1	0.817
65Areyou	1	0.868

Extraction Method: Principal Component Analysis

F. Eigenvalues and explained variance of the LULIFUK sample

Table 3.15 presents eigenvalues for the entire analysis, as well as estimations of explained variance for a final solution of the PCA calculation. This table contains two sets of results. The section entitled "Initial Eigenvalues" presents own values, percentage of variance, and cumulative percentage of variance for each factor ranking in the magnitude of eigenvalues. In this case, first eigenvalue is 8.64, and this explains 13.29% of variance. Eigenvalues are greater than zero and their sum is 65. The section entitled "Extraction Sums of Squared Loadings" reproduces the number of extracted factors in PCA (18 in this case). Sums of squared saturations are identical to eigenvalues and 18 factors explain 86.68% of variance.

Table 3.15 Total variance explained of the LULIfUK sample

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	**% of variance**	**Cumulative %**	**Total**	**% of variance**	**Cumulative %**
1	8.64	13.2967	13.30	8.64	13.2967	13.30
2	6.30	9.6870	22.98	6.30	9.6870	22.98
3	5.67	8.7280	31.71	5.67	8.7280	31.71
4	5.02	7.7264	39.44	5.02	7.7264	39.44
5	4.02	6.1902	45.63	4.02	6.1902	45.63
6	3.45	5.3052	50.93	3.45	5.3052	50.93
7	3.11	4.7866	55.72	3.11	4.7866	55.72
8	2.95	4.5440	60.26	2.95	4.5440	60.26
9	2.54	3.9133	64.18	2.54	3.9133	64.18
10	2.34	3.6011	67.78	2.34	3.6011	67.78
11	2.03	3.1209	70.90	2.03	3.1209	70.90
12	1.96	3.0147	73.91	1.96	3.0147	73.91
13	1.71	2.6233	76.54	1.71	2.6233	76.54
14	1.66	2.5591	79.10	1.66	2.5591	79.10
15	1.47	2.2639	81.36	1.47	2.2639	81.36
16	1.32	2.0291	83.39	1.32	2.0291	83.39
17	1.10	1.6902	85.08	1.10	1.6902	85.08
18	1.04	1.5984	86.68	1.04	1.5984	86.68
19	0.99	1.5192	88.20			
20	0.88	1.3544	89.55			
21	0.83	1.2778	90.83			
22	0.77	1.1920	92.02			
23	0.73	1.1233	93.14			
24	0.65	1.0032	94.15			
25	0.61	0.9318	95.08			
26	0.56	0.8543	95.93			
27	0.51	0.7795	96.71			
28	0.45	0.6885	97.40			

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %
29	0.38	0.5892	97.99			
30	0.32	0.4886	98.48			
31	0.30	0.4562	98.94			
32	0.24	0.3768	99.31			
33	0.20	0.3108	99.62			
34	0.16	0.2386	99.86			
35	0.09	0.1373	100.00			
36	0.00	0.0000	100.00			
37	0.00	0.0000	100.00			
38	0.00	0.0000	100.00			
39	0.00	0.0000	100.00			
40	0.00	0.0000	100.00			
41	0.00	0.0000	100.00			
42	0.00	0.0000	100.00			
43	0.00	0.0000	100.00			
44	0.00	0.0000	100.00			
45	0.00	0.0000	100.00			
46	0.00	0.0000	100.00			
47	0.00	0.0000	100.00			
48	0.00	0.0000	100.00			
49	0.00	0.0000	100.00			
50	0.00	0.0000	100.00			
51	0.00	0.0000	100.00			
52	0.00	0.0000	100.00			
53	0.00	0.0000	100.00			
54	0.00	0.0000	100.00			
55	0.00	0.0000	100.00			
56	0.00	0.0000	100.00			
57	0.00	0.0000	100.00			
58	0.00	0.0000	100.00			
59	0.00	0.0000	100.00			
60	0.00	0.0000	100.00			
61	0.00	0.0000	100.00			
62	0.00	0.0000	100.00			
63	0.00	0.0000	100.00			
64	0.00	0.0000	100.00			
65	0.00	0.0000	100.00			

Extraction Method: Principal Component Analysis

G. Scree plot of the LULIFUK sample

This section presents eigenvalues to factors in figure 3.2. This graph allows determining the number of factors that best represent any significant variance described by the correlation matrix. Inspection of graph 3.2 suggests that 17 factors explain the main significant variance of the correlation matrix. This decision is based on the position of the "elbow" in the graph. In this case, it is at factor seventen, suggesting that the amount of variance explained by 17 factors and subsequent factors is low and virtually equivalent to that determined by the eigenvalue method. We are trying to distinguish the "mountain" (i.e., principal components based on true covariance) from "rocks" (i.e., principal components based on random error) (Gardner, 2003).

H. Component matrix of the LULIFUK sample

The matrix of initial factors is the matrix for principal component factors. It is a structural matrix because it involves correlations of each variable with each principal component. The component

matrix is shown in Table 3.16 and consists of 18 factors. This decision concerning the number of factors is based on the eigenvalue rule of 1, not on results of previous scree plot, although in this case both methods give the same results. In other words, 18 factors have eigenvalues greater than 1.0.

An inspection of the component matrix reveals that factors have positive and negative values across all variables. In other words, factors are a combination of positive and negative saturation in the component matrix. . In table 3.16, loadings are ranked by component. The variable 32 (Ifeelobligation) has a strong loading (0.832) on the first component; a low loadings (-0.218) on the fourth component, and a low loading (-0.233) on the seventh component, and a very low loading (0.130) on the eighth component. These loadings may be useful for seeing the pattern of which variables load most strongly with which factors. In particular, the negative loadings here may be an artifact of the calculation method. Blanks are very low loadings.

I. Matrix of residual correlation of the LULIFUK sample

Usually when the matrix of residual correlation is generated, the matrix of reproduced correlations is obtained. However, this matrix is identical to communalities presented in Table 3.14 and therefore they will not be presented in this section. The matrix of reproduced correlations was calculated by the equation from fundamental theorem (see Equation 3.1) submitted to factorial saturation in the correlation matrix.

In determining how well PCA explains the observed matrix of correlations, the matrix of residual correlation was calculated by subtracting each value from reproduced correlations to corresponding value in the matrix of correlations. This produces the matrix of residual correlation. Part of table 3.17 is presented below. In Appendix E1.4, the table is shrunk to fit the page. These residual values are close to zero. To give a rough idea of how to fit the adjustment, statistical software counts the number of non redundant residuals whose absolute value is greater than 0.05. The footnote *a.* at Table-3.17 indicates that 238 (11%) exceed 0.05.

Figure 3.2   Scree Plot of LULIFUK Sample
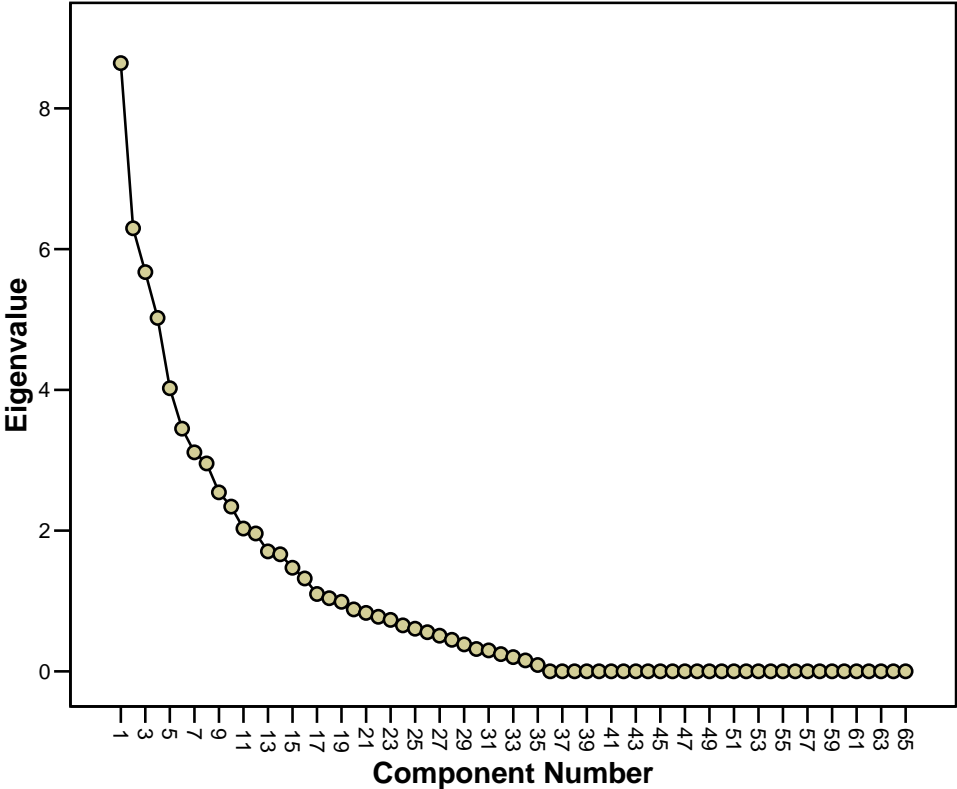
J. Matrix of rotated factors of the UAMA sample

  Twenty five iterations were carried out with a varimax rotation using SPSS12 statistical software, but this was insufficient to obtain loading values for LULIfUK sample. The purpose of the rotation is to produce an easier solution for interpreting data. The rationale of rotation criteria is based on continuing the rotation until the squared sum of factorial saturation variances for each factor is as large as possible (Gardner, 2003). Failure to obtain a rotated matrix does not alter initial results, the only difference is the frame of reference used to describe the location of points in space.

Table 3.16 Matrix of initial factors of the LULIfUK sample

Component	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
32Ifeelobligation	0.832			-0.218			-0.233	0.130				-0.169			-0.141			
38Peoplelike	0.754	-0.178		-0.146	0.157		-0.138											
14Unitywnature	0.752		0.351			-0.160	0.398				0.110	0.122						
16Responsible	0.725		0.171	-0.262					0.167							0.164		
11Socialjustice	0.701	0.180		-0.143		0.135	0.128			0.174	-0.304	0.190		0.275				0.188
33Ifeelasense	0.684	-0.105		-0.164	-0.280	-0.270	-0.122	0.145	-0.150	-0.152		-0.224			-0.120	-0.133		
28aToxicyou	0.646	0.302			-0.189	-0.189		-0.281		-0.125		0.313	0.105		-0.228	0.255		
23bClimatecountry	0.607		0.396	-0.232		-0.183	-0.157		-0.165		-0.208	0.201		0.122	0.162	0.189		
31Government1	0.563			0.133	0.117	-0.154	0.414	-0.137	0.233		0.281	-0.312			0.180	0.147		
52Articulatesacompe	-0.557	0.263	0.527	-0.110		0.148	-0.157		0.206		0.101			-0.226		0.150		-0.160
9Prevention	0.547	-0.174	0.412	0.122	-0.277	0.206	-0.265	0.131	-0.150	0.296	-0.277	-0.120	0.249	0.337				
19Equality	0.454	-0.243		0.114	-0.153	0.342		0.178	0.163			0.137	0.120	0.120			0.216	
42Solicitsinput	-0.372		0.297	0.369	-0.206		0.171	0.178	-0.299	-0.190	0.127	0.230	0.213	-0.140	-0.175			
45Stayscomposed	-0.166	0.638	0.132		-0.168	-0.154	0.313	-0.335	-0.101		-0.272	-0.272		-0.112				
4Broadminded	0.357	-0.632	0.104	-0.177	-0.177		-0.119	-0.176	-0.161	0.166	0.348	0.101	0.102	0.199	0.199			
17Respectful	0.431	-0.594	0.559	-0.102	-0.277	-0.188	-0.119						-0.110		-0.110			
10Variedlife	-0.258	0.581	0.234	-0.102	0.184	0.212				-0.120	0.230		-0.222	-0.222			0.162	
40Anticipatesobsta	-0.182	-0.562	0.169	0.180	-0.210	0.269	0.246		0.446	-0.190	-0.174	0.230	0.153	0.112	-0.109	0.181		
21Choosinggoals	0.249	-0.528	0.184			0.118		-0.236	-0.282	0.518	-0.102	-0.272		-0.144	-0.109		0.142	
44Relateswell	-0.152	0.512	0.104	0.294	0.456	-0.206	0.168	-0.405	-0.143	0.157	-0.153	-0.153	0.109	-0.113	0.309			0.104
22aClimateyou	0.367	0.508	-0.163	0.294	-0.374	0.308	0.168	-0.405	-0.100	-0.143	0.114		0.109	-0.197	-0.110	-0.158	0.212	-0.123
18Moderate	0.386	0.484	0.232		-0.355	0.308	-0.144	-0.150			0.114		-0.284	0.171	0.283	-0.250	0.155	
3Ambitious	0.410	0.437	0.431	0.324	-0.338		0.165	-0.144	0.125	0.156	0.135	0.133	0.145	0.145	-0.183	-0.203		
50Keepspromi	0.446	0.446	-0.213		-0.355		0.191	-0.144	0.242	0.156	0.135	0.153	0.171	0.171	0.283	-0.250	0.155	
29bToxicountry	0.394	0.407	0.113	0.127	-0.280	0.259	-0.146		-0.185	-0.207		-0.166	0.295	-0.128	0.301	0.163	0.131	-0.103
55Bendsrules	0.208	0.404	0.113	-0.301	0.351	0.170	-0.185		-0.242	-0.154	-0.140		0.289	0.147	-0.322		0.140	
2Influential		0.206	0.729	0.305	-0.247				-0.154	-0.192	-0.109						-0.191	0.223
49Personallyleads	-0.277	-0.113	0.641	0.183	0.100	0.207	-0.193	0.138	-0.194	-0.140	-0.222	0.298	0.192	-0.151			-0.103	0.140
47Advocateschange	-0.227	0.273	0.610	0.149	0.139	0.181		-0.129		0.265	-0.156			-0.140			0.149	
46Leadsbyexam	-0.357	0.172	0.575	-0.199	-0.177	-0.213	-0.101			0.348				-0.239		0.139		-0.120
15Wealth	0.272	-0.441	0.563	0.111	0.217	0.191				-0.245	0.215		-0.199		-0.101	0.256		-0.107
56Doubtsownability	0.302	-0.166	-0.495	-0.186	0.452	0.186	0.182		-0.353	0.126	0.126	0.141				0.256		
25aForestyou	0.175	-0.166	0.424	0.111	0.180	-0.394		-0.164	0.230	-0.415	0.281			0.207		0.101	0.161	0.139

Table 3.16 Matrix of initial factors of the LULIfUK sample

Component	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
64Age	-0.218	-0.129	0.346	-0.701	-0.365		0.155		-0.188	0.101	0.111							
60Whathousing	0.279	0.111	-0.293	0.628	0.355				0.208		-0.258						-0.164	0.158
35Government2	0.207		0.343	0.613				0.106	-0.123	0.373	0.267	0.209	0.138	0.104		-0.161		-0.168
61Own/rent	0.281		-0.210	0.582	0.482		-0.143		0.260					0.212	0.130	-0.179		0.157
51Acknowledgesmist	-0.448	-0.190	0.123	0.569	0.131	-0.311	0.163	0.162		0.333		0.154	-0.233	0.103		0.177	0.259	-0.116
5Authority		0.346	0.243	0.548						0.225							-0.245	
65Areyou	-0.240	-0.289	0.168	-0.499			0.298	0.197	-0.217	0.175		0.316	0.106		0.175	-0.175		0.102
36Government3	0.438	-0.441		0.465		-0.225	0.201	-0.230	-0.102	0.243	0.152	-0.157		-0.125	0.146			-0.188
41Adaptsideas	0.314		0.360	-0.434	0.274	0.129	0.235	0.251		0.120	0.185		0.200		0.201	-0.123	-0.266	
13Selfdiscipline	0.218	0.240	-0.143	-0.325	0.286	-0.324		0.172	0.280	0.188			0.298	-0.118	-0.168			
6Creativity	0.104	-0.110			-0.507		0.231	-0.114	0.104	-0.368	-0.285	0.285	-0.230		0.132	-0.315	-0.170	
27cForestplants		-0.238	0.411	-0.123	0.494	-0.262	0.238	-0.232		-0.465	-0.117	0.174					0.112	
59Changesstrategy	0.187	0.182	0.296		0.479	-0.237	0.178		-0.227	0.116	-0.402	-0.227				-0.371		
58Hesitatestoact	0.227	0.376	-0.340		0.456		0.284		-0.333		0.149	0.206	-0.166	0.186	-0.180	-0.180	-0.124	
30cToxicplants	0.104	0.256			0.362	0.632	0.264			-0.123		-0.119	-0.329				0.156	
1Worldatpeace		-0.194	0.249		0.254	0.555		-0.309			0.121	-0.209		0.367	0.243			
53Canseethings	-0.307	-0.103	-0.240	-0.240		-0.529	0.231	-0.270	-0.331			-0.165	0.265	0.329		0.152		
26bForestcountry	0.267	-0.304	0.312		0.282	-0.421	-0.371			-0.239	0.232				0.266		0.252	
39Industry		-0.118		0.291		-0.197	0.511		0.138	-0.191		-0.231	0.166	-0.333	-0.379		0.188	0.162
54Believescapable		0.242	0.243	-0.439	-0.242	-0.244	0.509	0.109	0.211	0.203		-0.110	-0.130	0.143		0.181		0.134
62Underwhatreligion	-0.183	0.340			0.307	-0.125	-0.476	-0.144	0.169		0.288	0.271	0.163			0.214	-0.267	
24cClimateplants		-0.256	0.155		0.348	0.211	0.449	0.139	0.108	-0.103	-0.385	0.200		-0.171		0.352		-0.229
12Enjoyinglife	0.191	0.455	0.279	0.184		-0.212	-0.135	0.612	0.118	0.141				0.224				
37Companies	0.104	-0.282		0.410	0.201		0.114	0.572	-0.287				0.127		0.132			-0.168
20Acceptinglife	0.460					0.294	-0.189	0.504	0.166			-0.354	-0.234	-0.232	0.133	0.144		-0.107
63Gender	-0.187		-0.246	0.245		0.111	0.346	0.474	0.285	-0.294	0.135	-0.191	0.111	0.323	0.121	-0.128		
48Actsimpulsively	0.265		-0.290	-0.191	0.139	0.116		0.471			0.185	0.412		-0.199	0.131			0.423
57Establishesclose	0.189	0.317	0.405	-0.285		-0.344	-0.200	0.441	0.608	0.235	-0.237	0.189	-0.135			-0.180	0.128	-0.259
8Socialorder			0.176	-0.311	0.174	0.104		-0.131	-0.402		-0.126				0.163		-0.125	
7Socialpower	0.261	0.392	0.189				0.369				0.572	0.181	0.176			0.161	-0.265	0.110
34Business	-0.187		0.162	0.401		0.432	0.191	0.118	0.175	0.126	-0.126	-0.234	0.312		-0.179	-0.192		-0.158
43Takesrisks		0.244	0.216	-0.239	0.164	0.198		0.210					0.534		0.382	-0.169		0.187

Extraction method: Principal Component Analysis

a   18 extracted components

Table 3.17 Matrix of residual correlation of the LULIfUK sample

	1	2	3	4	5	6	7	8	9	10	11	12	13
1Worldatpeace													
2Influential	-0.006												
3Ambitious	0.002	-0.012											
4Broadminded	0.031	-0.018	-0.039										
5Authority	-0.014	-0.002	0.020	-0.047									
6Creativity	0.013	0.007	-0.007	-0.012	-0.043								
7Socialpower	-0.033	-0.010	-0.007	0.026	0.031	-0.066							
8Socialorder	-0.038	0.025	-0.004	-0.060	-0.009	-0.047	0.025						
9Prevention	0.005	0.015	-0.016	0.034	-0.045	-0.023	0.012	-0.003					
10Variedlife	0.078	-0.024	0.024	0.013	-0.016	-0.055	-0.036	-0.018	0.045				
11Socialjustice	-0.008	-0.023	-0.002	-0.036	-0.036	0.057	-0.073	0.042	-0.010	0.003			
12Enjoyinglife	-0.008	0.015	0.010	0.038	-0.002	0.035	-0.032	-0.040	-0.018	0.007	-0.026		
13Selfdiscipline	0.000	0.001	-0.020	-0.016	0.003	0.067	-0.007	-0.015	-0.012	-0.012	0.033	-0.003	
14Unitywnature	-0.019	0.002	-0.025	0.056	0.003	-0.017	0.015	-0.026	-0.004	-0.037	-0.036	0.014	0.016
15Wealth	-0.024	-0.026	0.010	-0.014	0.056	-0.027	0.021	0.017	-0.009	0.020	0.021	-0.033	0.030
16Responsible	0.046	-0.045	0.022	-0.009	0.020	-0.010	0.024	-0.010	-0.002	-0.011	-0.020	-0.022	-0.016
17Respectful	-0.031	-0.012	0.017	0.003	0.011	-0.021	0.045	-0.011	-0.002	-0.026	-0.026	-0.013	-0.028
18Moderate	-0.026	0.021	-0.025	-0.036	0.036	0.027	-0.008	0.067	-0.049	-0.082	0.028	0.009	0.160
19Equality	-0.008	0.077	-0.011	-0.007	0.024	-0.034	-0.033	-0.006	0.018	0.039	-0.033	0.013	0.029
20Acceptinglife	0.003	-0.023	0.004	0.035	0.011	-0.002	0.041	-0.044	-0.002	-0.025	-0.042	0.015	-0.005
21Choosingoals	-0.004	0.034	0.030	-0.055	-0.002	0.034	0.001	-0.008	-0.013	-0.002	-0.038	0.034	0.010
22aClimateyou	0.018	-0.006	-0.009	0.005	0.012	-0.013	0.024	-0.009	0.009	-0.030	0.001	-0.042	0.012
23bClimatecountry	0.012	0.022	0.041	-0.071	-0.010	0.028	-0.047	0.040	-0.011	0.081	0.061	0.000	0.056
24cClimateplants	-0.018	0.021	-0.021	0.028	0.011	0.006	0.025	0.004	0.001	-0.061	-0.004	0.012	-0.046

Extraction Method: Principal Component Analysis.
a Residuals are computed between observed and reproduced correlations. There are 238 (11.0%) nonredundant residuals with absolute values greater than 0.05.

K. Pattern of component and latent variables for the LULIfUK-case

The data were analyzed by means of a principal component analysis with a varimax rotation which did not converge after 25 iterations at LULIfUK. Three of six of the various indicators of factorability were poor: the matrix of correlation coefficients, Kaiser-Meyer-Olkin measures of sampling, and the on-diagonal values of the anti-image correlation matrix. However, the last three indicators load a good factorability level; the Bartlett test shows the data have a probability of factorability and high values in communalities, and the very low residual values from the matrix of reproduced correlations indicate optimum outcomes.

Within the data, 18 components were found with an eigenvalue of greater than 1.0; they explain 86.68%, of associated variance as opposed to 40 to 60% from previously mentioned models; therefore this is a very promising model. Scree plots indicate 17 components, very close to the eigenvalue. The communalities values were above an average of 0.7; this means that the variables had much in common with each other even though fewer than one hundred subjects participated.

Table 3.18 shows the pattern found as a representative relation of latent variables, which were the leading factors underlying behavior for sustainability at LULIfUK. In the left-most column, saturation values from the component matrix extracted using the PCA method are presented. The second column is composed of the first four components of the initial matrix for German HEI. For high saturation value (0.7 to 0.8) at LULIfUK; variables 32 and 38, pertaining to the latent variable "ascription of responsibility", appear. The same is true for variables 14, 16 and 11 for the latent variable of universal values. For middle saturation values (0.6) related to the first component, LULIfUK loads variable 33 under "ascription-of-responsibility", and 28 and 23 awareness-of-consequences latent variable. The lower saturation values (0.4 – 0.5) for the first component at LULIfUK associate AR, PI and UV latent variables. Ascription of responsibility, universal values and personal intelligences appear more frequently than the other two latent variables "awareness of consequences" and "demographics".

Table 3.18 Pattern of the first four components found by the PCA and the representative relations of the latent variables in the LULIfUK sample (PCA value above 0.400)

PCA Values	Component			
	1	2	3	4
PCA Values	Variables			
Higher 0.7 - 0.8	V32^I V38^I V14^{II} V16^{II} V11^{II}		V2^{II}	V64^V
Middle 0.6	V33^I V28^{IV} V23^{IV}	V45^{III} V4^{II}	V49^{III} V47^{III}	V35^I V60^V
Lower 0.4 – 0.5	V31^I V52^{III} V9^{II} V19^{II} V17^{II} V51^{III} V36^I V32^I	V17^{II} V10^{II} V40^{III} V21^{II} V18^{II} V44^{III} V22^{IV} V18^{II} V50^{III} V3^{II} V29^I V55^{III}	V46^{III} V15^{II} V17^{II} V3^{II} V56^{III} V57^{III} V27^{IV}	V61^V V5^{II} V65^V V38^I V51^{III} V41^{III} V37^I V7^{II}

Note: Latent variables are: I – Ascription of responsibility, II – Universal values, III – Personal Intelligences, IV – Awareness of consequences, V – Demographics. Variables names are in above tables. PCA values = saturation values extracted by principal component analysis method

3.2.2 Outcomes from psychometric measurement applying the Item Response Theory for the LULIFUK sample

The Rasch model loads 20 variables, grouped in subsets of five dimensions (see explanation in Table 2.6: Effectiveness, Deliberation, Anticipation, Solidarity and Austerity) and loads 37 participants

at LULIFUK. In other words, the number of participants who fully responded to the questionnaire is 37, but three people for some reason left blank any responses. There is no algorithm to calculate missing data, and therefore the author of this study worked with this number.

Table 3.16 shows the probability of the observed response pattern for each category: student, faculty, and staff, and for the entire LULIFUK sample, as well as the set of four items in each psychological dimension and their respective trait level. In Appendix E2 shows extensive calculations of probability for each participant and each dimension of sustainability.

A 4-trail level item, that is, a behavior which is very unlikely to be carried out, has a probability value closely to zero across all participants; however, when the trait level is 1, a behavior which is more likely to be performed, participants show higher probability values. Observations show that administrators consistently offered the highest probability in all five dimensions, although a bias exists as the category only consists of two administrators and probability calculations are very sensitive to the number of participants. "Austerity" is the most likely behavior to be performed by the three categories of participants, as shown by the probability value of 0.17. "Solidarity" and "Anticipation" were the behaviors least likely to be shown among all questions; "Anticipation" was the least likely behavior, obtaining the lowest probability across the three types of subjects. "Effectiveness" and "Deliberation" offer intermediate probability values of 0.09 and 0.01, respectively.

Table 3.19 Probability of observed item and participant pattern for LULIFUK case

Dimension	TL	Item	Student	Faculty	Administrators	
				Probability[a]		Prob[b]
Effectiveness	1	1. Believes one-self to be capable for a job.	0.132	0.733	**0.935**	**0.090**
	2	2. Doubts his/her own ability.	0.0000296	0.0757	**0.643**	0.00000144
	3	3. Anticipates obstacles to a goal.	0.000000265	0.0294	**0.365**	0.00000000284
	4	4. Takes calculated risks to reach a goal.	0.0000000000000000228	0.000189	**0.134**	0.0000000000000000000000580
Austerity	1	5. Keeps his/her promises	0.267	0.678	**0.935**	**0.169**
	3	6. Acknowledges mistakes	0.0000387	0.0629	**0.534**	0.00000132
	1	7. Adapts ideas based on new information.	0.0816	0.658	**0.907**	**0.0487**
	4	8. Changes overall strategy, goals, or projects to fit the situation.	0.000000000000307	0.000787	**0.134**	0.00000000000000000325
Solidarity	3	9. Relates well to people of diverse backgrounds.	0.000103	0.0628	**0.534**	0.00000346
	4	10. Can see things from someone else's perspective?	0.000000000474	0.0114	**0.365**	0.0000000000197
	2	11. Solicits others' input.	0.000152	0.341	**0.643**	0.0000334
	4	12. Establishes and maintains close relationships at work.	0.0000000000103	0.0244	**0.250**	0.0000000000000634
Anticipation	2	13. Acts impulsively.	0.0000381	0.110	**0.644**	0.00000272
	4	14. Stays composed and positive, even in stressful situations.	0.000000000000385	0.0000838	**0.0871**	0.00000000000000000281
	3	15. Personally leads change initiatives.	0.0000000000000568	0.00898	**0.134**	0.00000000000000000687

Dimension	TL	Item	Student	Faculty	Administrators	
				Probability[a]		Prob[b]
	4	16. Advocates change despite opposition.	0.0000000000000000221	0.000352	**0.134**	0.00000000000000000104
	1	17. Hesitates to act on opportunities.	0.0154	0.369	**0.776**	0.00442
Deliberation	3	18. Cuts through red tape or bends rules when necessary.	0.00000000000362	0.00420	**0.135**	0.0000000000000205
	1	19. Leads by example.	0.0134	0.520	**0.839**	**0.00586**
	4	20. Articulates a compelling vision.	0.0000000000000000360	0.000189	**0.0596**	0.000000000000000000407

a. $L(\underline{X}s) = P_{1s}\, P_{2s}\, P_{3s} \ldots P_{20s}$ calculated according Equation 3.2 for item and participant category which were calculated according Equation 3.1: $P(X_{is}) = e^{(\theta s - \beta i)} / 1 + e^{(\theta s - \beta i)}$

b. $L(\underline{X}s) = P_{j1}\, P_{j2}\, P_{j3} \ldots P_{j80}$ calculated according Equation 3.3 for item for 37 participants

TL = Trait Level, 1 means a likely behavior…4 means an unlikely behavior.

Outcomes from the Rasch model show that a simple behavior was relatively easier to demonstrate when participants showed high probability values (0.17 as compared to values closer to zero), in a context amongst students, faculty, and administrators. Also it is possible to anticipate that, given a level of motivation of a particular population motivated toward a specific goal, this goal will inevitably fail, unless something is done to provide for structural changes.

3.3 SUMMARY OF TWO-CASE STUDIES AND SOME COMPARISONS BETWEEN HEI

Table 3.20 presents a summary of outcomes from UAMA and LULIFUK cases. Every aspect considered throughout the entire chapter is described: A. Descriptive statistics, B. Matrix of correlation, C. Kaiser-Meyer-Olkin measure and Bartlett's Test of Sphericity, D. Anti-images matrices, E. Communalities, F. Eigenvalues and explained variance, G. Sedimentation graphic, H. Component matrix, I. Matrix of residual correlation, J. Matrix of rotated factors, and K. Pattern of components and latent variables. Also section L was added to explain the probability of the dimensions observed and the pattern of the participants.

The data for each HEI were analyzed by means of a principal component analysis with a varimax rotation which did not converge after 25 iterations at both HEI. Three of six of the various indicators of factorability were poor: the matrix of correlation coefficients, Kaiser-Meyer-Olkin measures of sampling, and the on-diagonal values of the anti-image correlation matrix. However, the last three indicators load a good factorability level; the Bartlett test shows the data have a probability of factorability and high values in communalities, and the very low residual values from the matrix of reproduced correlations indicate optimum outcomes.

Within the data, 21 and 18 components were found for UAMA and LULIfUK respectively, with an eigenvalue of greater than 1.0; they explain 79.78% and 86.68%, respectively, of associated variance as opposed to 40 to 60% from previously mentioned models; therefore this is a very promising

model. Scree plots indicate 21 and 17 components, very close to the eigenvalue. The communalities values were above an average of 0.7; this means that the variables had much in common with each other even though fewer than one hundred subjects participated.

Cronbach's alpha for the entire UAMA sample was 0.643 and 0.779 for the LULIfUK sample, though both are considered fairly unreliable questionnaire scales, due to possible chance error caused by the measuring instrument.

In relation to results obtained from the Rasch model at UAMA, observations show that students almost always show the highest probability values in the five dimensions, and faculty members the lowest. "Effectiveness" is the most likely behavior performed by the three types of subjects, as shown by the probability value of 0.09. "Solidarity" and "Anticipation" were the least likely to be shown, however "Anticipation" is the most unlikely behavior, obtaining the lowest probability among the three groups of participants. "Austerity" and "Deliberation" offer intermediate probability values of 0.05 and 0.01 respectively.

At LULIfUK, administrators consistently offered the highest probability in all five dimensions, although a bias exists as the category only consists of two administrators and probability calculations are very sensitive to the number of participants. One of the recommendations of this study is to keep the same number of participants in each category. "Austerity" was the most likely behavior to be performed by the three categories of participants, as shown by the probability value of 0.17. "Solidarity" and "Anticipation" were the behaviors least likely to be shown among all questions; "Anticipation" was the least likely behavior, obtaining the lowest probability across the three types of subjects. "Effectiveness" and "Deliberation" offer intermediate probability values of 0.09 and 0.01, respectively. Outcomes from the Rasch model show that a simple behavior was relatively easier to demonstrate when participants showed high probability values (0.17 as compared to values closer to zero).

On a policy basis, in order to encourage higher education for sustainability, ascription of responsibility, values, personal skills, and simple behavioral traits must be fostered as principal determinants for all three types of subjects at an HEI regardless of the socio-economic structure of the nation in which the HEI is located. Future research should consider additional HEI and a greater number of participants. Furthermore, an iterative process (test, correct, and retest) is necessary in order to obtain a more precise measuring instrument.

In order to test statistically significant differences among 2 or more HEI, a comparison should be carried out to reveal variance distribution across HEI. One possible step is to prepare histograms of the first four components to show (ab)normality distribution. Then the HEI pair should be compared in a xy-graphic by component in order to see how they correlate. Finally, a t-test of means should be run

if components show a normal distribution, or a U Man-Whitney, nonparametric, test should be run if they do not pass an equality of variance test.

Table 3.20 Summary of outcomes for the two HEI observed

	UAMA CASE	**LULIFUK CASE**
	Cronbach's alpha for the entire UAMA sample was 0.643, but no squared multiple correlations were found.	Cronbach's alpha for the entire UAMA sample was 0.779, but no squared multiple correlations were found.
A. Descriptive statistics	**In relation to universal values:** Cronbach's alpha was 0.670, R2 range was 0.370 to 0.770. Two categories of variables had values in disagreement: variable 12 (Enjoying life) within the hedonism values, variable 10 (Varied life) within the stimulation values, both in the openness to change section; and variable 2 (Influential) within the achievement values in the self-enhancement section. But the three variables are close to each other. Nine variables had values on "totally agree" score; but the variable with the highest value was variable 9 (Prevention) within the universalism values in the self-transcendence section.	**In relation to universal values:** Cronbach's alpha was 0.732, R2 was 0.464 to 0.891. Two variables had values "disagree" score, variable 12 (Enjoying life) within the hedonism values and variable 10 (Varied life) within the stimulation values. Both were in the openness change section. Six variables had values within the "totally agree" score; but variable with the highest value was variable 9 (Prevention) within the universalism values in the self-transcendence section.
	With respect to awareness of consequences: Cronbach's alpha was 0.667, R2 range was 0.164 to 0.573. All variables had scores of "very serious". Variable 27 (c Forest plants) had the highest score with the initial factors.	**With respect to awareness of consequences:** Cronbach's alpha was 0.590, R2 range was 0.220 to 0.736. All variables had scores as very serious problem, but variable 27 (cForestplants) had the highest score with the initial factors.
	With respect to ascription of responsibility: Cronbach's alpha was 0.700, R2 range was 0.240 to 0.705. All variables scored "totally agree", but the variable most agreed with was 35 (Government 1) within the external locus of control.	**With respect to ascription of responsibility:** Cronbach's alpha was 0.744, R2 range was 0.189 to 0.665. All variables scored "totally agree", but the variable most agreed with was 39 (Industry) within the external locus of control.
	With respect to personal intelligence: Cronbach's alpha was 0.715, R2 range was 0.127 to 0.728. Variable 54 (Believes capable) is very often achieved and variable 56 (Doubts own ability) is less frequent, both in the effectiveness dimension.	**With respect to personal intelligence:** Cronbach's alpha was 0.541, R2 range was 0.364 to 0.725. Variable 50 (Keeps promi), in the austerity dimention, was very often achieved,; and variable 49 (Personaly leads), in the anticipation dimension, was less frequent
	With respect to demographics: Cronbach's alpha was 0.001, R2 range was 0.049 to 0.358.	**With respect to demographics:** Cronbach's alpha was -0.173. The value is negative due a negative average covariance among items.
B. Matrix of correlation	18 correlations were above the 0.445 cut-off.	64 correlations were above the 0.445 cut-off.
C. Kaiser-Meyer-Olkin measure and Bartlett's Test of Sphericity	KMO measure for the entire UAMA sample was 0.066. KMO for universal values was 0.602. KMO for awareness of consequences was 0.536. KMO for ascription of responsibility was 0.539. KMO for personal intelligences was 0.738. KMO for demographics was 0.481 Bartlett's test was p<0.05 in all cases.	No KMO for the entire LULIfUK sample. KMO for universal values was 0.561. KMO for awareness of consequences was 0.511. KMO for ascription of responsibility was 0.623. KMO for personal intelligences was 0.524. KMO for demographics was 0.645. Bartlett's test was p<0.05 in all cases.
D. Anti-images matrices	On–diagonal values for the anti-image correlation were very low.	No anti-image matrices. Number of participants was under 40.
E. Communalities	Three variables had values above 0.600, 28 above 0.700, and 34 above 0.800. Variable 36 (Government 2) had the highest communalities (0.889) and variable 59 (Changes strategy) the lowest (0.626).	Nine variables had values above 0.700, 39 above 0.800, and 17 above 0.900. Variable 22 (a Climate you) had the highest communalities (0.939) and variable 42 (Solicits input) the lowest (0.740).
F. Total explained variance	Explained variance was 79.78% and 21 factors were extracted.	Explained variance was 86.68% and 18 factors were extracted.
G. Scree plot	21 factors were detected in the graph.	17 factors were detected in the graph.
H. Component matrix	46 correlations (either positive or negative) were above 0.445.	64 correlations (either positive or negative) were above 0.445.
I. Matrix of residual correlation	The matrix presents 250 values (12%) which exceeded 0.05.	The matrix presents 238 values (11%) which exceeded 0.05.
J. Matrix of rotated factors	No matrix of rotated factors was obtained after 25 iterations.	No matrix of rotated factors was obtained after 25 iterations.
K. Pattern of components and latent variables	**Component 1:** middle values were shown for ascription of responsibility (AR) and personal intelligences (PI); lower values were shown for a mix of four latent variables: universal values (UV) and PI, AR and awareness of consequences (AC).	**Component 1:** higher values were shown for values ascription of responsibility (AR) and universal values (UV), middle values for awareness of consequences (AC) and AR, lower values for PI and UV.
	Component 2: UV and PI were mainly related to this component.	**Component 2:** – higher values were shown for PI and UV, middle values for AC and UV, lower values for a mix of 4 main latent variables.
	Component 3: higher value was shown for awareness of consequences (AC), PI and UV: middle values for the same combination, and lower values for PI and demographics (D).	**Component 3:** UV and PI were mainly related to this component
	Component 4: higher values were shown for UV, D, middle values for awareness of consequences (AC), and lower values for PI and UV.	**Component 4:** higher values were shown for demographics (D), AR, middle values for PI, UV, D and AR, lower values for PI and AR.
L. Probability of observed item and actor pattern	"Solidarity" and "Anticipation" dimensions had the least common trait levels, and are the least likely behaviors. "Anticipation" was the least common among the three types of participants considered. The "Austerity" and "Deliberation" dimension had intermediate probability values and "Effectiveness" dimension was the most likely sustainable behavior achieved by students (10 individuals).	"Solidarity" and "Anticipation" had the least common trait levels, and this are the least likely behavior. "Anticipation" was the least likely among the three types of participants considered. "Effectiveness" and "Deliberation" had intermediate probability values and "Austerity" was the most likely sustainable behavior achieved by staff (2 individuals).

PART B

AREAS FOR CHANGING PEOPLES' BELIEFS IN HEI

CHAPTER 4

WHAT TO PROMOTE FOR ACHIEVING EDUCATION FOR SUSTAINABILITY

The previous Chapter assessed, in an exploratory manner, the sustainable-behavior construct at two different HEI. PCA outcomes showed significant relationships between psychological and demographic variables explain greater than 75% of the associated variance, and the Rasch model results showed that people act in favor of simpler actions. Similarities and differences between the two HEI however could be explained by their status, the permeability of group borders, or group size or power (Sanchez, 2002), the method in which a questionnaire is administered should be determined by item content or theoretical approaches (Van de Vijver & Tanzer, 1998).

Regardless of similarities and differences found between countries, the world situation requires educating critical, responsible, and fair citizens, and thus the DESD objectives may be achieved. In order to achieve such a citizenry, basic necessities must be adequately met: physiological needs, security, love, and belonging. Only when these needs are met may people realize themselves and attain a high level of self esteem (Maslow, 2005).

In order to explain the goal of education for sustainability, the first section of this chapter reviews the distinction between human needs and desires as a prerequisite for developing an ethical proposal which promotes such education among HEI. The second section presents some areas of human intervention where beliefs and attitudes may be changed to some extent in a long-term manner without coercion. These areas are education and the community-based area.

This study shows that, in the educational field, alternative learning methods such as game playing and art exploration may be integrated into the four main activities developed by higher education institutions – teaching, research, outreach, and physical campus operations. In the area of community management, group psychotherapy and labor management may modify individuals` potential for creativity, compassion, ethics, love, and spirituality. The goal is for individuals to find profound significance in their work relations in order to attain self-actualization. Table 4.1 summarizes a schema of principal HEI activities, the two areas of intervention mentioned, and four alternative learning methods.

Table 4.1 Four relevant learning methods in two human intervention areas among four university activities

Human intervention area HEI Activities	Education	Community Management
Teaching Research Outreach Campus management	GAMING (Vigotsky) ART (Heidegger)	GROUP PSYCHOTHERAPY LABOR MANAGEMENT (Maslow)

4.1   HOW TO SATISFY HUMAN NECESSITIES OR HUMAN DESIRES

Human needs are dynamic notions. People can achieve them depending on prevailing conditions (Maslow, 2005), or as Neuhouser (2008) suggests, by accidental conditions such as material dependence, inequality of wealth, division of labor, improved methods of production, and individual differences with respect to character circumstances and possessions related to luck, effort, and natural endowment.

Figure 4.2 shows Maslow's hierarchy of human needs divided into two main aspects according to Neuhouser (2008): self-preservation needs and recognition needs. Self-preservation needs include physiological needs, safety needs, and belongingness and love needs. Recognition needs include esteem needs and recognition needs in and of themselves.

At the base of the pyramid are physiological needs; that is, basic needs such as hunger, thirst, sex, gut, and rest. It is quite true that "man lives by bread", but what happens to "man's" desires when there is plenty of bread and the belly is chronically full? Other (higher) needs emerge, and these, rather than physiological hungers, dominate the organism. The next most important class of motives includes safety needs (Maslow, quoted by Lowry, 1974, p. 18). The need for safety is seen as an active and dominant mobilizer of the person's resources in emergencies such as war, disease, natural catastrophies, crime waves, societal disorganization, neurosis, brain injury, or chronically bad situations.

Once safety needs have been well satisfied, yet other needs emerge: the needs for belongingness and love, and the whole cycle will then repeat itself with a new motivation center (Lowry, 1974). Now the person will keenly feel, as never before, the absence of friends, a sweetheart, spouse, or children. He or she will hunger for affectionate relations with people in general, for a place in the group, and will strive with great intensity to achieve this goal. The person will want to attain this

more than anything in the world and may even forget that once, when hungry, he/she sneered at love as unreal, unnecessary, or unimportant.

Physiological needs and safety needs are normally fairly well satisfied in industrialized societies, the needs of belonging and love, on the other hand, are not. This is so because love and affection, as well as their possible expressions in sexuality, are generally looked upon with ambivalence and we customarily follow many restrictions and inhibitions. Thus, in our society, the thwarting of these needs is the most commonly found core in cases of maladjustment and more severe psychopathology (Maslow, quoted by Lowry, 1974, p. 26).

As the needs of belonging and love are satisfied, however, still another class of basic needs, the esteem needs, will emerge. This consists of the need for a stable, firmly based, high evaluation of oneself and therefore this need may be classified into two subsets. First is the desire for strength, achievement, adequacy, mastery and competence, confidence in the face of the world, and independence and freedom. Second, is what we may call the desire for reputation or prestige, status, dominance, recognition, attention, importance, or appreciation (Maslow, quoted by Lowry, 1974, p. 27).

Even after all other more basic needs (physiological, safety, belonging-love, esteem) have been satisfied, we may still often (if not always) expect that a new restlessness will develop. An individual finds inner peace only when doing that for which he/she is fit. One must be what one can be. This need we may call self-actualization. It refers to a person's desire for self-fulfillment, namely, the tendency for him or her to actualize their potentiality. This tendency might be phrased as the desire to become more and more of what one is, to become everything that one is capable of becoming (Maslow, quoted by Lowry, 1974, p. 26). However, when one is highly regarded by others, it can be in a benign form, such as being recognized for merit and honor, or in negative forms for pride, vanity, and egoism (Neuhouser, 2008).

According to this theory people are all good (self-actualizing), and decent inside, if only their basic needs are adequately fulfilled: their wishes for security, love, and esteem, not to mention the most basic, physiological needs (Maslow, quoted by Lowry, 1974, p. 17).

Nussbaum, in conjunction with the Nobel Prize winner in economics Amartya Sen, has proposed a reasonable and well-argued list of basic needs (Martinez, 2002). Doyal and Gough (2003) have also published a list of basic needs which is having a great influence on reports prepared by the United Nations Development Program (UNDP). Both basic-needs lists are shown in Table 4.2.

The latter authors have thoroughly studied the possibility of a theory of human needs based on the firm conviction that such requirements are essentially the same for everyone, despite obvious biological and cultural differences that exist between people around the world. But it is clear that if one

pursues progress toward an education for sustainable development or toward sustainable human development, generally speaking, it is necessary to distinguish needs from desires.

Table 4.3 provides a comparison between needs and desires. Necessities can be met because they are existential and physical, finite, few, classifiable, universal, and objective. On the other hand, wishes can not be satisfied because they belong to future and are projections of the mind (Osho, 2006a). However, core values and needs are relative and local, while economic resources and policies are global and universal. That is, needs are place- and time-specific across cultures (Gough, 2004). The relationship between satisfying factors and needs is that of means to ends. But postmodern society is characterized, among other traits, by a deliberate and incessant confusion between ends and means (Martinez, 2000). This implies that what may be satisfied is being neglected, and what can not be fulfilled, is fed (Osho, 2006b). Humans are at a crossroads, and environmental and ethical implications are obvious.

One is regarded
Benign form:
desire for superior standing
Negative form:
vanity, egotism, and pride

Self-preservation

from evil:
enslavement, conflict, vice, misery, alienation

Self-Actualization needs
(worthy, full of approval)

Esteem needs
(beloved, respect)

Belonging and love needs
(isolated or belonging to a group)

Safety needs (anguish, fear)

Physiological needs (hunger, thirst, sphincter, gut, sex, sleep)

Figure 4.1 Hierarchy of human needs (based on Maslow, 2005, but extended on Neuhouser, 2008)

Table 4.2 List of necessities (Martínez, 2002; Gough, 2003)

Proposed by Nussbaum and Amartya Sen	Proposed by Doyal and Gough, used by UNDP
1. Life. Capable of living a human life of normal length: not dying prematurely, or until one's life is so reduced as to not be worth living.	PHYSICAL HEALTH
	1. Nutritious food and clean water
	2. Protective housing
2. Bodily health. Capable of good health, including reproductive health; to be adequately nourished, to have adequate shelter.	3. A non-hazardous work environment
	4. A non-hazardous physical environment
3. Bodily integrity. The ability to move freely from place to place, having one's bodily boundaries treated as sovereign, i.e. being able to protect oneself against assault, including sexual assault, child sexual abuse, and domestic violence; having opportunities for sexual satisfaction and for choice in matters of reproduction.	5. Safe child bearing and birth control
	6. Appropriate healthcare
	AUTONOMY
	7. A secure childhood
4. Senses, imagination, and thought. The ability to use the senses, to imagine, think, and reason in an informed manner cultivated by an adequate education, being able to use imagination and thought in connection with experiencing and producing self-expressive works and events of one's own choice: religious, literary, musical, and so forth. The ability to use one's mind in such a manner which is protected by guarantee of freedom of expression with respect to both political and artistic speech, and freedom of religious exercise. The ability to search for the ultimate meaning of life in one's own way. The ability to have pleasurable experiences, and to avoid unnecessary pain.	8. Significant primary relationships
	9. Physical security
	10. Economic security
	11. Appropriate education
5. Emotions. The ability to have attachments to things and people outside ourselves; to love those who love and care for us; to grieve at their absence, in general: to love, grieve, experience longing and gratitude, and justify anger.	
6. Practical reasoning. The ability to form a conception of the good and to engage in critical reflection about the planning of one's life.	
7. Affiliation. The ability to live with and reach out to others, to recognize and show concern for other human beings, to engage in various forms of social interaction, to have the capability for both justice and friendship. The ability to be treated as a dignified being whose worth is equal to that of others.	
8. Other species. The ability to live with concern for, and in relation to, animals, plants, and the natural world.	
9. Play. The ability to laugh, play, and enjoy recreational activities.	
10. Control over one's environment. The ability to participate effectively in political choices which govern one's life. The ability to demand property rights and seek employment on an equal basis with others.	

Table 4.3 Comparison between needs and desires (Osho, 2006a)

Necessities	Desires
They can be satisfied.	They cannot be satisfied.
They are simple (hunger, thirst, sleep).	They are complex (to wish the symbolic value of an object or service).
They come from nature.	They do not come from nature; they are creations of the mind.
They come from the moment, creations of own life, existential, physical.	They do not come from the moment, cannot be satisfied because their nature is a projection of the ego into the future. They are psychological.
They are finite, few, classifiable, universal and objective.	They are infinite, diverse, unclassifiable, non-universal and subjective.

Necessities, roughly speaking, are not needs as such, but rather are instrumental satisfying factors dependent on local contexts. Tasks may be carried out in small groups, including formal education and social mobilization, in order to ethically intervene in current conflicts (Martinez, 2000). But first and foremost, people's basic needs must be satisfied to promote responsible citizenship.

The next section discusses two areas of human intervention. The educational field and the community management area are spheres within which it is plausible to change human behavior in the long run without coercion. Four methods grounded in EFS principles – games, art, group psychotherapy, and labor management - are proposed for inclusion in HEI activities in order to transform people's personal and work relationships and find a deep significance in people's needs for self-actualization.

4.2   SPACES WHERE BELIEFS AND HUMAN BEHAVIORS MAY BE MODIFIED

Political scientists believe that coordinating individual behavior for the common good is an eternal problem (Gardner & Stern, 2002) and point out four basic areas (Stern, 2000; Gardner & Stern, 2002) in which behavior may be changed in a coordinated manner. The four areas identified are:

(a) Religious and moral approaches which appeal to values and aim to change broad worldviews and beliefs;

(b) Education to change attitudes and provide information;

(c) Efforts to change the material incentive structure of behavior by providing monetary and other types of rewards or penalties; and

(d) Community management, involving the establishment of shared rules and expectations.

Actions involving combinations of these four areas of intervention could modify individual behavior in favor of the common good. However, moral and incentive-based approaches both have generally disappointing track records and are coercive. Meanwhile, the community-based approach, which acts upon people's need for belonging, combined with education, may have potential to modify people's beliefs and attitudes to some extent without coercion in the long run (Stern, 2000; Gardner & Stern, 2002).

This section considers two of four areas identified above: that related to education including games and art, and the community management area including group psychotherapy and life experience as mechanisms which can modify human beliefs and attitudes to some extent.

4.2.1 Educational area of intervention

Behavioral achievements among individuals in HEI who have previously overcome internal barriers are quite specific, such as increasing their knowledge or degree of commitment. Education can make a difference in people's behavior, but there are serious limits to what may be accomplished. In the short term, education is only successful when principal barriers to action (for example, individual attitudes), are successfully modified. When such barriers are eliminated, individual actions, such as depositing cans in the recycling bin or adjusting the thermostat on the air conditioner, or even buying high-efficiency appliances, may be accomplished. Reducing external barriers requires greater effort – for example, community organizing or even changing national legislation. Education may have important indirect long term effects, such as when education affects people's political preferences; this in turn influences government policy to reduce external barriers to sustainable behavior. Education is only likely to induce behavior which is already compatible with people's deeper values (Gardner & Stern, 2002). Table 4.4 summarizes short and long term accomplishments, as well as some characteristics to overcome principal internal barriers to individual action.

Educational programs, according Gardner & Stern (2002), are more effective when they are designed according to psychological principles of communication and also directly address the links between attitudes and behavior. That is, making information available is not the same as to taking special effort to get people's attention, using sources of information which the audience trusts, involving the recipients of the information in efforts, reminding people that their pro-environmental attitudes apply to the situation at hand, and explaining how to manifest their attitudes.

Table 4.4 Accomplishments of education (Gardner & Stern, 2002)

Factors	Accomplishments of education
Time	*Short term educational strategies* These strategies are important source of information. They are effective, relatively simple, and involve little risk *Long term educational strategies* These strategies can build public support for policies. *Long term indirect effects* Education can change people's political behavior; which in turn can change government policy.
Characteristics	*Values* Education induces behavior compatible with people's deeper beliefs and values. *Efficiency* Educational programs can be efficient when designed according to psychological principles of communication and when they directly address the links between attitudes and behavior. *Quality of information and level of public concern* Changing relevant behavior depends mainly on the quality of the information and on the level of public concern.

Education works best when combined with other intervention strategies. For example, when an energy conservation program provided water-flow restrictors along with information on how to use them and how much water they could save behavioral success was achieved (Gardner & Stern, 2002). Changing environmentally relevant behavior sometimes depends critically on the quality of the information provided and on the level of public concern and willingness to support the incentives or interventions.

The aim of education toward sustainability is to develop a way of life which includes all behavioral facets, where humans interact responsibly in their physical and social environments. Art and games, in the context of teaching, research, outreach, and campus management activities are two ways of approaching this.

A) Play

The explosion of knowledge, combined with bureaucratization and increased division of labor have produced highly trained, specialized experts. Frequently, specialists must process and absorb vast amounts of information in order to keep their jobs. They are simultaneously urged, as citizens, to develop a general understanding of world aspects. If a mission of HEI is to generate and transmit knowledge and technological advances, they must find methods of learning which combat narrow perspectives born of specialization, and integrate learning which leads to a competent, ethical judgment

in order to to understand what may be read within the structure of human experiences, and what describes and transmits complexity of our minds to others.

Some educators (Greenblat & Duke, 1975) have identified critical elements to achieve such learning to include: (1) finding ways to instill motivation prior to transmission of information; (2) the learner being an active participant in the learning process, rather than a passive recipient of transmitted information; (3) individualized instruction which allows for each learner to proceed at their own pace; (4) constructive feedback regarding success and error should be encouraged because there is a need for an awareness and understanding of elements and relations in a systematic manner.

Greenblat & Duke (1975) mention four heuristic principles for designing learning environments: First, the learner must have the opportunity to operate from several perspectives. Second, activities must include their own goals and sources of motivation, not only represent a means to end. Third, the learner must be encouraged not to depend on authority and allowed to reason for her/himself; this will allow for a more productive in the learning process. And finally, the environment must be structured so as to respond positively to the learning activity, helping him/ her to reflect and assess his/ her own progress.

The importance of playing games lies in counteracting narrow perspectives derived from specialization, and provides ways to develop a holistic understanding and the ability to retain details. Play is a tool for communication and learning (Greenblat & Duke, 1975), and allow for simulating social situations based on certain explicit or implicit behavioral suppositions.

Figure 4.2 provides an outline of important principles of the Theory of Historical and Cultural Activity (THCA) developed by Vigotsky. THCA holds that each psychological function has a history of development which determines the level achieved in a higher psychological process (Morenza, 2004). The theory furthermore explains how games develop the learning process. In the human psyche, each higher psychological function exists at least twice, first in the social area as an interpsychological function, and later in the individual area as an intra-psychological function. That is, the higher psychological function originates from interactions in the social communication process. (Talyzina, 1988).

Galperin and collaborators, or the so called School of Vigotsky poses a hypothetical mechanism explaining this process. The mechanism is called "internalization" (Morenza, 2004). When activities are internalized with external objects which act as socially defined symbols, not only is this symbol`s image internalized, but also the entire structure of relations and transformations within the symbolic world are constructed. Tools - words, symbols, rituals - are used as aids in this process, but in "phase two", one learns to do this without the external tool. For example, we tour a new city; we initially need to use a map. But this later becomes unnecessary because an image of the city remains in our head (Vigotsky, 1967).

Play is closer to recalling than to imagining; that is, it is memory in action rather than a new imaginary situation. As play develops, a movement occurs towards conscious awareness of its purpose. Play becomes an internal process, then internal speech, logical memory, and abstract thinking. A game is a source of development. According to Vigotsky (1985; Talyzina, 1988), development is created in the "zone of proximal development" (ZPD). ZPD is the distance between the social and individual realm, namely between what individual is capable of doing without being prompted and what he or she is capable of if encouraged.

Vigotsky here identifies a measurement of development which the subject can achieve by collaborating with others. Vigotsky (1967) argues that *learning leads to development*; that is, if someone is being presented with challenges, and also assisted in overcoming these challenges, they are induced to develop new skills. By contrast, Piaget argues that *development leads to learning*, that is, children can learn only what is possible given for his stage of development, which originates from an innate process of stages of development*.*

Play permeates attitudes towards reality. It has its own internal continuation at school and at work (compulsive activity based on rules). In play, action is subordinated to meaning, but in real life, of course, action is subordinated by meaning. All examinations of the essence of play have shown that play create a new relationship between semantics and that which is visible - that is, between imagined situations and real situations.

Figure 4.2 Diagram of how human psyche functions according the Theory of Cultural-historical psychology, School of Vigotsky (Juárez *et al.*, 2006b)
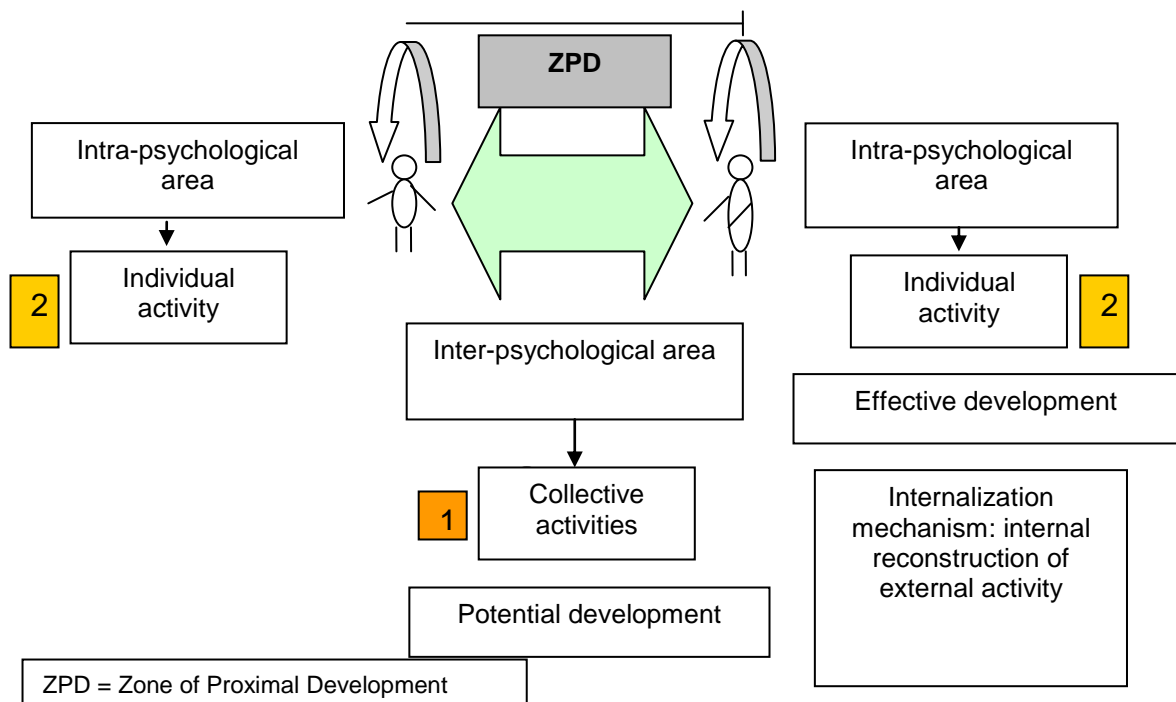
Play can be seen as tools which can mediate between that which students do without any assistance, to that which they do through their relationship with others. Or, as Vigotsky proposes, it consists of concrete marks which initially act as an external aid and then are converted into structures in our mind, which can mediate between what students do without any kind of help and what they do through their relationship with others. Using play thus helps students to search for new ways to work together in an unsustainable world where ecological borders and complex ecosystemic processes are not currently respected. This requires the development of very inventive abilities, and a sustainable world requires collaboration, but also consideration in awaking the interest to develop: inquisitive attitudes, inductive reasoning, the generation of ideas, new perspectives, and the use of analogies (Juarez-Najera, 2006b).

Play is a source of development. Dieleman & Huisingh (2006a) state, in their article on the potential of play in learning and teaching about sustainable development, that:

- Play generates <u>learning experiences and communication</u>. You can 'learn by doing' without creating real consequences for the outside world.

- Playing games offers the possibility to <u>create shared experiences and form inter-psychological relationships</u>. This is extremely important to arriving at shared definitions of problems and (visions) of solutions, which is crucial to in sustainable development. Sustainable development is a complex phenomenon which by its very nature involves a multitude of actors with a variety of backgrounds and positions regarding reality, and a key challenge is to develop a shared vision among such a heterogeneous group.

- Play contributes to <u>teambuilding</u> because it creates shared experiences. However, shared experience and teambuilding are related but different issues. Not every shared experience leads to a more positive experience of the other. Play which facilitate communication and collaboration usually result in better team performance and sense of group belonging. Here again the advantage of play is the 'experimental' nature. Since it is 'not for real' you may be able to induce individuals who prefer to be alone into collaboration.

- Play contributes to <u>knowledge of oneself or the formation of intra-psychological relationships</u>. Participants gain insight to their own thought processes. Play helps an individual discover one`s implicit assumptions in life, which are not necessarily shared by others. Play helps an individual perceive people's limitations and possibilities as part of a system. Participants learn that their freedom is bounded but that there is nevertheless room to move and influence the system. This can be very helpful in real life when we want to realize change.

- Play helps to <u>test alternative solutions</u>. As mentioned before, the real beauty of Play is that we can 'learn by doing' without negative consequences for the real world. We can simulate certain realities, play the games, manipulate reality and experience consequences. While we test alternative solution we learn things about ourselves and create shared experiences. With respect to sustainable development such testing is essential, due to the systems-nature of sustainable development, it is very difficult to predict the outcome of interventions in the real world

- Last but not least, Play is <u>fun and entertaining; it is an idea that becomes an affect</u>. Fun and entertainment is important because this generates energies and gives the participants the energy to engage in the complex challenge that sustainable development confronts us with. It may also contribute to a change in the image that the concept of sustainable development still has. Many people associate the issue with words such as 'heavy', 'serious', negative' or 'depressing'. But in fact, even though there is some truth that some of the qualifications, sustainable development is at the same time a space for creativity and adventure. Play may help to make people see this part of sustainable development.

Play helps students, faculty, administrators, and educational authorities alike to see that education for sustainability demands other lifestyles, forms of production, institutional organization, research methods, and these can be simulated in the classroom, the laboratory, or within normal campus activities with no environmental impact, in a joyous, fun manner.

B) <u>Art</u>

Art, like science, is a diverse set of activities which allows one to explore, conform, construct, test, and challenge reality. Often, one considers only in terms of paintings and sculptures, poems and novels, music and dance, and plays to be art. Nevertheless, these lie within the process of self-questioning to understand the essence of reality and reflect that reality (Dieleman, 2007a). Artists can make a real contribution to redefining reality, transcending boundaries of established institutional frameworks, and thinking in a lateral way (Dieleman, 2006b), as the artistic process requires the concept of sustainability (a concept which redefines industrial development and material growth , incorporating bottom-up processes of decision-making and change.

In this study, the author uses Heiddeger's (2006) explanation on esthetics in order to relate the concepts of art and sustainability in a different, as demanded by both themes. Why consider Heidegger? Because he, along with Wittgenstein, who come from different backgrounds, use different vocabularies, and have different concerns, coincide in denying the legitimacy of an ultimate fundamental philosophical searching (Bengoa, 2002). This aspect seems important to the author of this study as forming part of a new paradigm applied to the study of art.

What is ultimate fundamental searching? Throughout history, philosophy has tried to elaborate a universal discourse on reality, from our knowledge of it, toward our actions with respect to it, that is,

regarding principles - not only ontologicals, but also epistemological and ethical. This demand has been common to all philosophies which envision themselves as systems. These philosophies have always tried to justify their own exclusive access this universal knowledge.

However, in the decade of the 1930`s, Kurt Gödel mathematically demonstrated that logical systems always contain wordings which are true, but that those systems cannot be derived from a fix set of axioms. That is, there is always missing information. During the third century before Christ, Aristotle expressed something similar when he stated that the sign of a well educated mind is to be happy with the level of precision which the nature of the matter permits, and not seek accuracy when only an approximation is possible. At the beginning of the Twentieth Century, quantum mechanics discovered the uncertainty principle, complementarity, and wave-particle duality, thus showing limits to what we can observe with respect to microscopic events. At this level, quantum mechanics speculated that at this level exists an uninterrupted wholeness which cannot be separated into parts or events, which is basically statistical and undetermined, not exact (Briggs & Peat, 1989). So, art according to Heidegger's philosophical position along with Gödel's thinking and the principals of quantum mechanics can be useful to explain how reality is perceived.

Heidegger (2006) holds that a work of art is an entity, which exists in a natural way, like an object. Works of art have thingly elements and for centuries the thing has been taken as a model of the actual entity. There are three ways in which past thinkers have defined, described, and determined what a thing is: (a) the thing is a substance with accidents, (b) the thing is perceptible through sensation, and (c) the thing is formed by matter. However, Heidegger says that these are erroneous manners of relating the essence of the thing. These definitions of the thing do not adequately fit the essence of the thing - neither the essence of that which is useful nor the work of art.

Heidegger uses the phenomenological method, which is a method that he adopts in his philosophical masterpiece, *Being and Time,* to explain what a work of art is. For him, there is nothing behind the phenomenon and to describe it something (aletheia) come forth from concealment; beauty is one way in which truth occurs as unconcealedness.

Heidegger (2006) discovers that the essence of that which is useful is rooted in its usefulness, which he calls "being of confidence", or when the useful thing is used - that is, when the useful thing makes apparent what in reality it is. This entity approaches the state of unconcealment of its being. Based on this conclusion, he establishes that in the work of art has set into operation the truth of that entity.

The existence of the work of art is due to the fact that such a work opens a realm, it creates a clearing. In that clearing truth, as unconcealment can be encountered. Art exists only in that space, in that clearing (Heidegger, 2006). The work of art is complete in itself, taken in isolation, but only within a set of relationships which transcends its particular entity to integrate it into the surrounding world.

The work of art pre-exists to its appearance a set of beings but it is the work of art that enlightens beings and becomes the center which unifies them and constitutes them in a world.

The work of art illustrates a world not in the sense of the mere collection of the countable or uncountable, familiar and unfamiliar things which are simply there; nor is it merely the imagine of framework added to our representation of the sum of such given objects. The world is the consciousness that turns on a light to tell beings to account for their existence and their positions in the midst of other existent beings; all things acquire their rhythm, their remoteness and closeness, their breadth and narrowness. Beings become aware of their historical destiny, from their dependence on gods who can give or deny their grace. This world is not an abstract world but rather a way of intelligibility of all beings (Heidegger, 2006).

Every work of art is made up of what is called raw materials, which are extracted from nature. By manifesting a world in the artistic work which causes the earth to be nature, the presentation sets up a world: rocks make a foundation, metal brings forth shine and sparkle, colors show up, sounds sound, and speech articulates. In other words, all those materials, through art, can bring forth the essence of beings from concealment. Admittedly, that which is useful is also made of matter, but subsequently disappears because what counts is the service. In addition, after using that which is useful, it suffers wear (Heidegger, 2006).

Heidegger (2006) perceives that matter is not merely a 'thingly foundation' of the work of art, but it within its full being its own value. He recognizes that in painting and sculpture, the brilliance of colors or the precious qualities of a marble carving, or sounds in music, or varied timbres of instruments are susceptible demonstrations of the essence of the internal constitution of the materials used in their production.

For Heidegger (2006), the creation of a beautiful work of art requires that the work set up a world and an openness in which truths will emerge from concealment. The world and the earth struggle because they are antagonistic elements. The world patently is exposed to light; while the earth, in contrast, moves into the open, is self-secluding. In this struggle, there is something that tears a break in the deepest of earth, but it is precisely in this break where a gathering can be found. The world that is expressed in the work of art is no longer a requirement, but a specified content, a content of ideas, feelings, and projects which will make intelligible what is singular and concrete.

On the one hand, Liessman (2006) holds that to a greater or lesser extent the philosophical approach identifies art with truth. The same idea applies to other philosophers such as Schelling, Hegel, and Schopenhauer. On the other hand, Heidegger argues that truth is non-truth. But the truth exists only as the struggle between birth and concealment in the interaction between the world and the earth. The truth will be fixed in the work of art; the creation is nothing but truth fixed by form. Art is the truth of what it has set itself to work into. Indeed, the work of art itself retains its latent content until beings

may stand back and relate with awe to it, become attuned to it; creations in art can be distinguished where a clearing emerges; an attunement to the work of art, of its radiant appearance. Heidegger's esthetics (2006) is very closely related to the sense of sustainability: simultaneously possessing and attracting a certain metaphysical extent.

Then, how may we stimulate, lead, or foster the process of change toward education for sustainability? If sustainability is a process of the creation of a new world with new institutions, products, processes, and relationships, and art is characterized as a search process that is not stuck in systematic scientific methodology (Dieleman, 2007a), much room is left to associations, imagination, intuition, and mysticism, and as consequences, art transcends existing boundaries.

The sciences, field of action of HEI, are weakened due to analytical rationality which they apply in understanding reality. The process of change toward sustainability is `more than rational´. It responds to desires, emotions, fears, lifestyles, identities, and intuitive notions. It lies in visions and future expectations or multiple futures. In essence, the change toward sustainability is the 'art of being different', the use of different products, designing different lifestyles, and engaging in different practices, doing things in different ways, and seeing reality in diverse forms (Dieleman, 2007b).

Art is a powerful change agent; whenever it has been included in teaching and research activities, it has also produced effects on beliefs, habits, and values; even when students, faculty, or administrators developing art activities are attuned to art (as Heidegger states) with no purpose (Keeney, 1994). This way, art can be executed to fit the demands in the principles of education for sustainability.

HEI can include elements and heuristic principles mentioned above to design learning environments where play and art take into account, once and for all and without prejudices, that they are not 'serious' activities in higher education. To include them would respond to the demands of the principles of education for sustainable development (see Table 1.1).

4.2.2 Area of community management

According to the model developed in this study, moral norms play a decisive role in management of collective resources. That is, in the area of community management, group pressure is exerted through participatory processes and modification of individual behavior. Group psychotherapy and personnel management both offer examples of cases where individuals in a given community have been able to modify their behavior. Accordingly, if the management intervention area is applied toward a redefinition of the individual's role in industrial development, material gain, and social and cultural evolution to meet essential needs, then people may be guided toward sustainable behavior.

Gardner & Stern (2002) believe that a strong community, in psychological and sociological sense, is a group characterized by relative stability among its population, direct long-term social

interactions, strong social networks, and a set of shared norms. These authors use the term 'community management' to reflect the fact that administration within the group is much easier to organize and maintain if these four characteristics are met.

A key characteristic of community management is that social norms become shared rules, as fulfillment works upon a self-imposed rule that the participatory process develops from the bottom up among group members, and because people believe that what they are doing is correct, or at least necessary. As the majority of people internalize community norms and make them their own, surveillance by authorities is minimal, and individuals do not feel coerced. Rules for interaction exist among group members that lead to informal social pressure and therefore self control.

Successful communities are those in which find easy and inexpensive ways to share information, enforce rules, resolve conflicts swiftly and effectively, with appropriate, graduated penalties through a structure of incentives when sanctions are insufficient. In addition, accurate and relatively inexpensive systems assure that members comply with regulations. Authorities responsible for enforcing rules should be subject to control by users, so that they may be controlled or removed if they become corrupt or unjust. In organizational terms, keys for community management are participatory decision-making, monitoring, social norms, and sanctions throughout all community processes (Gardner & Stern, 2002).

Gardner & Stern (2002) state that the success of community management of any social group ultimately depends on controlling behavior of individuals: how does a set of rules affect community management of individual behavior? What makes people follow rules when they can gain something by breaking them? The key is that most people do what is good for the group because they internalize the interests of the group, rather than acting out of compliance based on a set of external incentives.

People internalize group norms because they have participated in creating them, because they have seen their value for themselves and their community, and because norms have become part of community meaning by which sharing with others helps to maintain trusted relationships (Gardner & Stern, 2002). Recalling the list of needs identified by Maslow (see the beginning of section 4.1), community members feel that their needs of belongingness and responsibility in the group have been met, their safety needs provided for by the group, and they have been allowed to achieve their needs for self-actualization. In the words of Maslow (p. 17, 2005): the fulfillment of these needs may be one main unconscious reason for projecting an inner problem into the outer world i.e., just so that it can be worked on with less anxiety.

Gardner & Stern (2002) set out principles for intervention to change behavior: (1) use of multiple intervention types to address the factors limiting behavior change, (2) understanding the situations from the actor's perspective, (3) when limiting factors are psychological, applying understanding of the processes of human choice, (4) addressing conditions beyond the individual which

constrain sustainable choice, (5) setting realistic expectations about outcomes, (6) continually monitoring responses and adjusting programs accordingly, (7) staying within the bounds of the actor's tolerance for intervention, and (8) using participatory methods in decision making. Table 4.5 lists limiting factors for each of these principles.

Intervention to change beliefs and values also can come from therapeutic, self-help, and self-support groups, as well as from the group process inside labor organizations, since the great majority of people develop their daily activities at work, within a wide system of relations.

Table 4.5 Principles of intervention to change behavior
according Gardner & Stern (2002)

Principles	Limiting factors
(1) Use of multiple intervention types to address the factors limiting behavior change, situation and time.	Technology, attitudes, knowledge, money, convenience, trust.
(2) Understanding the situations from actor's perspective	Scientific approach of control (pilot experiment) or participatory approach (social interaction with informal feedback).
(3) When limiting factors are psychological, apply understanding of human choice processes	Commitment, credibility, face-to-face communication, conflict resolution, credibility, obligation and norms.
(4) Address conditions beyond the individual that constrain sustainable choice	Incentive structure as indirect conditions.
(5) Set realistic expectations about outcomes	Trial and error method Experiences from other programs.
(6) Continually monitor responses and adjust programs accordingly	Flexibility and experimental interventions.
(7) Stay within the bounds of the actor's tolerance for intervention	Participation, education.
(8) Use participatory methods in decision making	Participation, promotion of justice, internalization of new rules.

A) Group psycho-therapy

In the community management area, groups, as social systems, perform an important role in both the interaction and integration processes that individuals have with institutions. Group psychology makes an unquestionable contribution to promotion, prevention, treatment, recovery, and intervention in the health realm. If health is understood according to the definition of the World Health Organization as a state of physical, psychological, and social well-being, and not only absence of illness (Sanchez, 2002), so in turn, healthier groups also healthier systems of relations (Maslow, 2005).

This leads to understand health as a state of social welfare, understood in socioeconomic terms as the part of the socio-political sphere which protects the interests and basic needs of individuals in society. In addition, welfare is defined as a component of the quality of community life which, along with economic and psychological welfare, shapes the overall welfare of the community and individuals who are part of that community (Sanchez, 2002).

That is, in healthier groups, systems of relationship are stronger or "healthier", or rephrasing Maslow (p.129, 2005): when we are healthy enough to see a higher unity, social synergy exists. Keeney (1994) speaks from the systems point of view, and of insanity: pathology arises when conscious and unconscious mental order is not connected to resources as part of a self-corrective feedback and any feeling, perception, or idea is always a fragment of the integral system or context in which it is found.

The promotion of social welfare in the health arena may be classified according to three approaches which appeared throughout the twentieth century and had a formative period between the years of 1903 and 1967, a second period of expansion between 1952 and 1967, and a third period of consolidation between 1968 and 1981 (Sanchez, 2002). These guidelines are: (1) therapeutic groups, (2) support groups, and (3) self-help groups.

First, the term therapeutic group includes those groups which adhere to the concept of clinical groups as a whole rather than psycho-therapeutically categories. These groups originally had teaching or educational purposes (e.g. groups in 1905 who gathered for information about tuberculosis hygiene or treatment) and subsequently spread to pathological situations or personal growth experiences.

Some examples of such groups are: Bethel laboratory for social training or Lewin and Bradford T groups, Milan family therapy (Boscolo *et al.*, 1987), personal growth groups, group analytical therapy, therapeutic communities (such as alcohol and drug addiction groups), etcetera. Such variety considers various a range of group procedures, inspired by different psychological traditions such as Freud`s classical psychoanalysis or humanistic psychology represented by gestalt therapy groups (Perls, 2004), Rogers encounter groups, and Berne`s transactional analysis, Reich`s bio-energy, Hellinger's systemic approach, or the cognitive method, and various forms of intervention aimed at individuals, relationships, or institutions (Sanchez, 2002). Such groups enable individuals to get at the root of their experiences.

Over time, some groups evolved towards a more religious and transcendental dimension. The transcendental dimension followed two trends, one inspired in eastern religions such as Zen meditation (Watts, 1957; Trungpa, 1976; Osho, 2006b) and yoga (de la Ferrier, 1971), and another, more secular trend, inspired by Fromm`s humanist socialism (2006).

The underlying therapeutic precept in self-help groups is that learning within groups produce more efficient results, because such experiences allow individuals to move deeply into their own experiences. These different approaches share a commonality, which is that the group may constitute a

powerful instrument for intervention, learning, and change, thus improving people's quality of life (Sanchez, 2002).

Second, according to Sanchez (2002), support groups aim to facilitate people`s adaptation to circumstantial pressures which require them to manage new skills or and their psychosocial positioning. Common features of these groups are: they are small and consist of volunteers; they meet regularly, sometimes under a professional supervision; they share experiences, strategies, coping skills, feedback, identification of resources, etc.; and their main objective is to provide mutual help towards achieving a particular purpose.

These groups are usually composed of people who share some kind of difficulties which alter or modify aspects of their normal functioning. Thus, the group provides these people new links and social relationships to compensate for their psychosocial deficiencies through interaction with people with the same problems, gaps, and/or common experiences. These groups include professionals responsible for initiating and controlling situations in order to facilitate people's adaptation to change.

These groups can be classified into groups: (a) those who either suffer a problem directly (widowed, divorced, diabetics, etc.) or indirectly (persons associated with those suffering from the problem); and (b) according to the type of problem (chronic, specific, or relating to changes of various kinds, such as legislative). The success of such groups will depend on the extent of self-management they are able to achieve.

The third category is the self-help group. According to Sanchez (2002), self-help groups are those who manage their own goals and ways of operating; therefore, they operate autonomously, independent of professionals and with no time limit. These promote group development based on social support.

The different types of groups analyzed are valuable tools and strategies for intervention in social programs within community management to optimize people's psychosocial quality of life.

B) Labor management

Organizations begin to realize that groups are fundamental units for carrying out a variety of productive activities. A more progressive vision is to move from the individual, as a unique entity, to the group. Group effectiveness is not only the final result obtained by its members, but also the process followed in order to obtain that outcome (Sanchez, 2002). The group has widely been recognized as a social entity which performs a critical and fundamental role, because groups can influence the effectiveness and productivity of organizations in a great variety of ways. Currently there is a unanimous agreement that groups are the cornerstone of modern organizations (Edersheim, 2007) because in groups we grow up (families), work (organizations), learn (schools), decide (meetings), play (teams), and fight together (wars) (Sanchez, 2002).

However, there has not been a constant interest in groups among organizations. Sanchez (2002) notes that in the early Twentieth Century. Frederick W. Taylor and his followers believed that groups were enemies of efficiency at work because they are potential hotbeds of organized resistance to efficient production.

At the end of the twenties, G. Elton Mayo, one of the first social psychologists, along with collaborators initiated efforts to systematize the study of the role played by groups, emphasizing that working groups are a social context which strongly influences people's behavior.

The late thirties witnessed the birth of group dynamics by Lewin, a scholar of organizations at Bethel Laboratories. Lewin incorporated Mayo's conclusions. Mayo was a social psychologist who led theoretical and empirical research promoting increased incorporation of the applied field of human relationships in organizations. He revealed how the group can influence behavior, attitudes, and emotional states of people in the functioning of groups.

The end of the World War II witnesses two independent directions: one scholastic and other applied. Amid these trends emerges one which prefigures some features contained in more modern approaches, and in the context of psychology of organizations focused on socio-technical approaches of studying groups. From this perspective, the group is a social system and a social entity capable of achieving high levels of productivity. This perspective focuses on the distinction between activities related to production and social activities implicit to the functioning of working-groups. It also highlights distinguishable goals which can be realized if organizational circumstances are suitable. The fundamental implications of this approach for working groups are the prescription of autonomy and self-regulation.

During the late fifties, the socio-technical approach generated a rich applied research on the importance of groups within organizations. At that time, Maslow (p. 1, 2005), who gave up clinical psychology because he realized that individual psychotherapy was incapable of improving the situation of humanity, subsequently moved toward education as a way of reaching the entire human species. Maslow developed his "hierarchy of needs", developing a new branch of psychology, humanistic psychology, in the field of social psychology. He recognized that people in the process of transforming their relationships (self-actualizing) provide a better work environment for their colleagues and organizations. That is, proper management of the work lives of human beings - of the way in which they earn their living - can improve individual quality of life and improve the world.

Since the seventies, and particularly since the eighties with the creation of "quality circles" in Japan, among organizations there has been a progressive interest in many aspects of groups. Organizations are beginning to consider groups as fundamental units of organizational analysis which perform a wide range of productive activities, and the progressive vision centered on the individual as a

basic unit begins to be replaced by the group. The reasons for this change of perspective are essentially practical rather than theoretical (Sanchez, 2002).

This history offers two aspects: the characteristics of working groups, and main criteria of effectiveness used. Groups can be classified by (1) their level of formality or interrelation with the structure of the organization, (2) their temporary nature (3) characteristics of the task based on interdependence or replicability of the goals (4) their degree of autonomy from leadership by outside the group (self-directed or self-designed), and (5) external integration and internal differentiation from their environment. The book "Teachings by Peter Drucker" edited by Edersheim (2007) contains examples of existing organizations which demonstrate such characteristics.

As for group effectiveness, criteria are evaluated based on combined models (which support the idea that internal group processes are more important than the group environment in determining its effectiveness) and structural models (which assign a priority role to the group environment). Both models are based on the premise that group effectiveness is not only evidenced by the final result obtained by the group, but also by the process followed to arrive at such an outcome (Sanchez, 2002).

The author of this study asks how HEI can foster behavior toward sustainability in people's everyday activities in the educational field and in the area of community management intervention to induce change in individuals? Apparently, Maslow's recommendation (2005, p. 51 and 52, paraphrased) more than 45 years after he wrote his book *Summer Notes on Social Psychology of Industry and Management*, might be updated the path to financial and economic success requires that people adopt a long term, broad ranged, that they pay considerable attention to what we might call personal development, by proper training of managers and workers, that they pay attention to individuals` psychopathology, that they change organization environment show interest in and commitment to workers, that they understand with complete clarity the objectives, directions, and goals of the organization. The utopian, psychological, ethical, and moral recommendations for this type of organization will improve all aspects of the situation.

In addition to that recommended by Maslow, Neuhouser (2008) establishes three characteristics of the frame of mind individuals must acquire in order to assume the stand point of reason because when individuals reason, are capable of acting correctly and rightly. First, reasoning requires one to step back from one's own particular desires and interests and to take an appropriately universal perspective (one that considers only the fundamental interest of each individual). Second, reason requires individuals to conceive of themselves as the moral equal of each of their associates, acting with the understanding that no one's individual interest has a higher claim than any one else's and that, for the purpose of forming laws, the fundamental interest of others take priority over their own individual interest. Finally, the individual must relinquish his claims to the ultimate authority of his

own will, and locate that authority in the opinions of others (in the prevailing consensus of his community subject to the appropriate constraints).

Among the lessons of labor management, these points mentioned can be applied to human economic life. Based on these lessons, Maslow (p. xxii, 2005) poses three questions. Our respond may provide guidelines to initiate paths which lead human beings toward labor management by considering that human beings generally seek a job in order to live, and their live, and their job spreads and affects all spheres of their lives: (1) How good a society does human nature permit? (2) How good a human nature does society permit? (3) How good a society does the nature of society permit?…With this we hope to achieve the goal of influencing towards a sustainable behavior, with all implications that this entails. The fields of education and community management can modify peoples' behavior to achieve education for sustainability.

CHAPTER 5

CONCLUSIONS

5.1   SUMMARY OF FINDINGS

At the outset of this study, it was stated that the main question of this investigation is to identify psychological factors related to personality features which can influence sustainable behavior of key individuals within higher educational institutions (HEI), as well as to present the areas where these individuals work, and in which higher education for sustainability is fostered.

It is important to look at the nature of the conditions under which these different key players in HEI in two countries with very different socio-economic contexts willingly foster within their organizational boundaries concepts which promote a responsible society with a just and equitable development. Also, those outcomes induce behavior which has the potential to improve the exchange in organizational policies which are widely regarded as a useful tool for decision makers in a changing world for any type of society. The challenge is to devise ways to achieve socially desirable goals, such as the ones underlying the goals of the Decade of Education for Sustainable Development, while allowing people to recognize moral norms, through latent variables as such as values, personal skills, ascription of responsibility, and awareness of consequences, as ways of explaining their behavior.

This investigation considers sustainable behavior to be "a set of effective, deliberate, and anticipated actions aimed at accepting responsibility for prevention, conservation and preservation of physical and cultural resources. These resources include integrity of animal and plant species, as well as individual and social well-being, and safety of present and future human generations".

The theoretical framework of cognoscitivism was considered in order to validate the sustainable-behavior construct, by using the approach of information processing in order to propose a social-psychology model using the existing models of attitude. Schwartz` moral norm-activation theory was the model selected, because it poses situations where social dilemmas are present, such as those faced by the education for sustainability. Schwartz's model is extended under the value-belief-norm by Stern *et al.*, based on the very important aspect of Schwartz`s set of universal values. Also, the elements of Hines *et al.*'s meta-analysis were considered because of the importance of contextual variables. Inter-personal and intra-personal intelligences from Howard Gardner's theory of multiple intelligences were also considered; these skills applied to any culture. Gardner`s theory was sifted through the psychological features of effectiveness, deliberation, anticipation, solidarity, and austerity as proposed by Corral-Verdugo and Pinheiro.

A questionnaire was prepared which consisted of 67 items in five sections according to the latent variable model. The first section of universal values includes 21 items of Schwartz's 10 value categories. At least one item was included from each value type. Fifteen of the items supported

principles underlying ESD and six items were contrary to ESD. The variables for moral norm activation from the second and third sections of the questionnaire were measured through nine items regarding awareness of consequences (AC) and nine regarding ascription of responsibility (AR). Those questions related to AC included importance to oneself, country, and other species of three actual environmental problems (climate change, loss of forests, and chemicals). In the AR section, three items concerned personal obligations, three concerned government obligations, and three concerned business obligations. The fourth section on intra-personal and inter-personal intelligences contained 20 items, sifted through five psychological dimensions of sustainability. The final section contained eight questions related to demographics such as age, gender, religious denomination, general income level, and educational training. Fifty-nine items were polytomous in four different Likert scale items and 8 demographics were dichotomous.

The questionnaire was applied to eighty individuals in a Mexican university and thirty-seven in a Germany HEI. The first is the *Universidad Autonoma Metropolitana, Azcapotzalco* (UAMA), which is located north of Mexico City, and is one of four campuses of the UAM, a public university. The other university is the *Leuphana Universität Lüneburg, Institut für Umweltkommunication* (LULIfUK), a public university 30km from Hamburg in the Federal Republic of Germany, honored with the UNESCO Chair in Higher Education for Sustainable Development.

In order to validate the proposed model, two analytical methods were applied in the following order: principal component analysis (for all data of both HEI), and the Rasch model based on Item Response Theory (only for personal intelligence data related to sustainable dimensions and participants). This study draws on social psychology which is the scientific study of the reciprocal influence of the individual and his or her social context through the behavioral expression of his or her thoughts and feelings. Therefore, the research presented here addresses a range of contexts from intrapersonal processes and interpersonal relations, to inter-group behavior and societal analyses.

Outcomes of this study are exploratory because (1) the number of individuals applying principal component analysis (PCA) was fewer than the one hundred subjects recommended in the literature; (2) the emergent concept of sustainability is elucidated by building an instrument based on four current conceptual frameworks and DESD guides; (3) PCA reveals a general pattern for the main latent variables which underlie behavior for sustainability across the three categories of participants: students, faculty and administrators; and (4) for the first time, five psychological dimensions towards sustainable action show differences between two HEI in two countries.

The results of this exploratory study show that not all of these key variables can be proven to be significant. However, ascription of responsibility, universal values, and personal intelligences seem to be the main factors explaining sustainable behavior. To a great extent, psychological variables explain the variability in individual personality characteristics, that is, people's perceptions of

themselves and others, mainly ascription of responsibility or locus of control; those intra-personal and inter-personal skills variables which are related to skills apply to any culture, and universal values, namely factors belonging to individual beliefs which motivate them and guide them to justify actions. The four important latent variables are highly correlated.

The model is highly valid and stable because it was tested with reliable analytical procedures and adequately explained up to 73% of the associated variance of those factors considered. Key individuals (students, faculty and administrators) encourage simple traits rather than more complex traits under a given context. Anticipation is the behavior most unlikely to be shown by students, faculty members, and administrators; effectiveness is the dimension most likely to be shown in universities in countries with a lower socio-economic level and austerity is the most likely for universities with a higher socioeconomic level. Students and administrators obtained the highest probability in almost every psychological dimension and faculty members obtained the lowest probability. Demographic variables did not show a decisive influence on the outcomes; however age does appear to influence communalities.

Also, in order to develop critical, fair, responsible, self-actualizing citizens, this study considers two areas of human intervention for changing behavior in the long run without coercion: education and community management. It also proposes four methods as alternative forms of learning and ways of strengthening group change – play, art, group psychotherapy, and personnel management - all grounded on the principles of EfS to be included in HEI activities.

In conclusion, this study showed that the model developed provides a real alternative for studying social dilemmas in an exploratory manner in order to promote sustainable behavior among all categories of decision-makers in HEI. The model places a decisive importance on personal norms, which, if activated, are experienced among individuals as feelings of personal obligation, either denying or not denying the consequences of their behavioral choices regarding the welfare of others. The most viable areas of intervention for changing beliefs, attitudes, and values are education and community management because in these areas people internalize their actions and no surveillance is needed. However, only long-term changes may be expected.

5.2 THE SCIENTIFIC VALUE AND PRACTICAL USE OF THE DEVELOPED MODEL

The above findings from the social-psychology field allow us to statistically infer people's behavior within an organization. The model developed enables us to explain, measure, and predict peoples's sustainable behavior within HEI as well as to understand its determinants. The framework provides a set of definitions to systematically search and construct a broader system which allowed us to test hypotheses regarding dependence upon specific factors as well as their importance in influencing willingness and behavioral change in two culturally different HEI. This model differs from others by

taking into account the full range of universal values which are considered to be found throughout the inhabited world and human inter-personal and intra-personal skills valid in all cultures.

Another contribution of this study is the integration into a developed model of the selected latent variables which further explain sustainable behavior**.** Hines *et al.*'s model provides a basic structure of contextual variables. Stern *et al.*'s theoretical framework provides theoretical and methodological bases for factors which trigger moral norms in behaviors which lead to social movements. Gardner's cognitive theory gives conceptual support to the theory that humans have evolved with several types of intelligence to treat different types of content in any cultural context; and Corral-Verdugo and Pinheiro's psychological dimensions suggest guides in peoples's intentions associated with sustainability.

An additional contribution of this research is the application of differential measurement of the trait level for each participant and level of item difficulty using psychometric testing under the framework of item response theory represented by the Rasch model. This measurement is based on rules different than those posed by classical test theory, but it provides a statistical foundation for calculating psychological-dimension likelihoods which lead participants toward a measurement of sustainable behavior by implementing a single test.

Another final contribution of the model is its generalized nature which allows for widespread use of this model in different cultural contexts, as shown in chapter 3 in two HEI. Outcomes across two HEI from two different countries added explanatory value of the model developed.

The introduction of this investigation pointed out that education for sustainable development is rooted in the extensive work of 30 years of environmental education (EE). Two common criticisms of EE are those emphasizing the study of the ecological dimension due to a widespread increase of environmental degradation and which restricted other human dimensions such as economic, social, political and cultural dimensions, although these dimensions were included in its initial premises. This study recognizes the historical evolution of the concept of sustainable development and introduces clear principles which underlie education towards sustainability.

This study also differs from others on sustainable behavior, as it expands the definition of the term. Strangely no author in the environmental psychology literature deals with the study of psychological factors which affect and are affected by the interaction between individuals and the environment, by offering a definition of sustainable behavior. The definition used in this investigation is broader, including aspects such as taking responsibility for prevention and conservation, not only preservation. It also considers the security of the individual and society, which was not present included in previous studies.

This manuscript analyzes non-traditional practices such as the introduction of play and art, as well as psychotherapy groups and labor management, as real proposals by reviewing intervention areas

where social dilemmas are presented in dealing with the common good. These alternatives, if conducted in a realistic and objective way, can produce long-term sustainable behavior, very much required in today's world.

5.3   IMPLICATIONS FOR POLICY DESIGN

The primary policy implication of this study influences the field of social-psychology in the analysis of sustainable behavior. This study proposes an instrument for analyzing the introduction of education for sustainability in HEI, allowing us to gain a better understanding and to assess possible sources of conflict among key individuals in HEI when promoting sustainable behavior.

As shown in chapters 2 and 4, this study can help to increase our understanding of the nature of the evolution of sustainable behavior in order to strengthen such behavior in among participating agents of higher educational institutions. The decision-making process can be handled well if participants (e.g. students, faculty members, and administrators) better understand the factors and potential areas for change.

In the process of promoting ESD principles mentioned in the introduction, through the intervention areas mentioned in chapter 4, participants from HEI will have a better understanding of the importance of promoting sustainable behavior. The goal should be to increase awareness of social risks generated by current unsustainable behavior through activities relevant to sustainability such as those which may be provided by higher educational institutions.

A positive attitude towards changing behavior for sustainability should be found in modified perceptions of students, faculty, and administrators of HEI, though this does not occur regularly. We suggest that institutional policy explicitly promote the social-psychological capability of generating synergies, promoting information exchange, and creating mechanisms which lead to a common vision with common goals among all types of participants. University members should aim to promote joint teaching, research, outreach, and campus management programs and projects which promote sustainable behavior. This would require linking activities to activities promoted by governmental authorities responsible for education and human development, as well as strengthening social recognition of the efforts of those institutions and individuals who show significant improvements in sustainable behavior.

Another way of using the results is for decision makers to be aware of these factors and how they interact among each other, and to use this knowledge in the process of fostering sustainable behavioral change. In this respect, decision makers should be aware that the promotion of education towards sustainability is by no means under their direct control. Governmental authorities and civil society organizations must recognize indicators which allow for promoting behavioral change. This suggests that actors involved need to increase their social-psychology skills, and above all, their

understanding of cultural change dynamics in HEI. Thus they will be more capable of promoting behavioral change.

How to implement a program to produce behavioral change towards sustainability is beyond the scope of this study. Once sustainable behavior and its factors have been determined, the question of changing behavior towards sustainability remains open. The suggested initiatives in social-psychology knowledge capability building are conceptualized as taking into consideration the minimization of the sources of conflict among the interests of the HEI players and the economic, environmental, social, political and, cultural answers which the world demands for current ethical and ecological situations.

5.4   FINAL REMARKS

The general conclusion of this investigation is taken from Gardner & Stern, (2002, p 342):

"Sustainability revolution will require profound changes in Western and non-Western institutions, economic process, values, morals. It will require changes in our basic conceptions of the relationship between humans and the rest of nature. It will require that we acknowledge the enormous complexity of global systems and our inability to manage them and mold them solely to the purpose of humans. And it will require that we more fully accept our responsibilities to future generations".

This implies that the ways to act in the world are, as Riechmann (quoted by Martinez, 2000, p. 78, emphasis added) poses:

"In order to achieve a sustainable human development it is necessary *to stop spiral growth of unlimited material wealth aspirations, linked to consumption factors, and focus on an adequate coverage of universal necessities.* And that means *acting on the structure of needs, desires, and preferences* which are prevalent in our overdeveloped societies through a cultural revolution which is not clear if it is going to take place but which certainly is absolutely necessary for stopping ethical and ecological deterioration in which we find ourselves".

APPENDIX A

Complete list of universal values ranked in four categories according Schwartz (2004)

SELF-TRASCENDENCE

Universalism

1 Equality, equal opportunities for all.
2 A world of peace, free of war and conflict.
3 Unity with nature, fitting into nature.
4 Wisdom.
5 A world of beauty.
6 Social justice, correcting injustice, care of the weak.
7 Broad-minded.
8 Preventing and protecting pollution, conserving natural resources.

Benevolence

9 Loyal, true friendship, faithful to friends.
10 Honest, genuine, sincere.
11 Amable.
12 Responsible.
13 Forgiving, willing to pardon others.

CONSERVATION

Tradition

14 Respecting the earth, harmony with other species.

15 Moderate.
16 Humble.
17 Accepting portion in life.
18 Devote.

Conformity

19 Politeness.
20 Self-discipline, self-restrain, resistances to temptations.
21 Honoring parents and elders, showing respect.
22 Obedient, dutiful, meeting obligations.

Security

23 Social order.
24 National security.
25 Reciprocation of favors.
26 Family security, safety for loved ones.
27 Clean.

SELF-ENHANCEMENT

Power

28 Social power, control over others, dominance.
29 Health.
30 Authority, the right to lead or command.
31 Preserving public image.

Achievement

32 Ambitious, wealth, material possessions, money.

33 Influential, having an impact on people or events.
34 Capable.

35 Successful.

OPENESS TO CHANGE

Hedonism

36 Pleasure.
37 Enjoying life.
38 Self-indulgent.

Stimulation

39 An exciting life, stimulating experiences.
40 A varied life, filled with challenge, novelty and change.
41 Daring.

Self-direction

42 Freedom.
43 Creativity.
44 Independent.
45 Choosing own goals.
46 Curious, interested in everything, exploring.

APPENDIX B

Complete list of inter-personal and intra-personal intelligences ranked in four categories according Boyatzis, Goleman & Hay Acquisition Co. Inc. (2002)

SELF KNOWLEDGE

1 Emotional awareness
a. Is aware of own feelings.
b. Recognizes the situations that arouse strong emotions in him/her.
c. Knows how his/her feelings affect his/her actions.
d. Reflects on underlying reasons for feelings.

2 Precise self-knowledge
a. Acknowledges own strengths and weaknesses.
b. Is defensive when receiving feedback.
c. Has a sense of humor about oneself
d. Anticipates obstacles to a goal.

3 Self confidence
a. Believes one-self to be capable for a job.
b. Doubts his/her own ability.
c. Presents self in an assured manner.
d. Has "presence".

SELF DETERMINATION

4 Emotional self-control
a. Acts impulsively.
b. Gets impatient or shows frustration.
c. Behaves calmly in stressful situations.
d. Stays composed and positive, even in trying moments.

5 Integrity
a. Keeps his/her promises.
b. ¿Tiene intereses éticos?
c. Acknowledges mistakes.
d. ¿Respeta sus valores aún a costa de su propio interés?

6 Adaptable
a. Adapts ideas based on new information.
b. Applies standard procedures flexible.
c. Handles unexpected demands well.
d. Changes overall strategy, goals, or projects to fit the situation.

7 Orientation to achievement
a. Seeks ways to improve performance.
b. Sets measurable and challenging goals.
c. Anticipates obstacles to a goal.
d. Takes calculated risks to reach a goal.

8 Initiative
a. Hesitates to act on opportunities.
b. Seeks information in unusual ways.

UNDERSTANDING OF OTHER

10 Empathy
a. Listens attentively.
b. Is attentive to peoples' moods or nonverbal cues.
c. Relates well to people of diverse backgrounds.
d. Can see things from someone else's perspective.

11 Organizational awareness
a. Understands informal structure in the organization.
b. Understands the organization's unspoken rules.
c. Is not politically savvy at work.
d. Understands historical reasons for organizational issues.

12 Orientation of service
a. Makes self available to customers or clients.
b. Monitors customer or client satisfaction.
c. Takes personal responsibility for meeting customer needs.
d. Matches customer or client needs to services or products.

SOCIAL SKILLS

13 Developing staff
a. Recognizes specific strengths of others.
b. Gives directions or demonstrations to develop someone.
c. Gives constructive feedback.
d. Provides ongoing mentoring or coaching.

14 Leadership
a. Leads by example.
b. Makes work exciting.
c. Inspires people.
d. Articulates a compelling vision.

15 Change catalyze
a. States need for change.
b. Is reluctant to change or make changes.
c. Personally leads change initiatives.
d. Advocates change despite opposition.

16 Influence
a. Engages an audience when presenting.
b. Persuades by appealing to peoples' self interest.
c. Gets support from key people.
d. Develops behind-the-scenes support.

17 Conflict handling
a. Airs disagreements or conflicts.
b. Publicly states everyone's position to those involved in a conflict.

c. Cuts through red tape or bends rules when necessary.

d. Initiates actions to create possibilities.

c. Avoids conflicts.

d. In a conflict, finds a position everyone can endorse.

9 Optimism

a. Has mainly positive expectations.
b. Believes the future will be better than the past.
c. Stays positive despite setbacks.
d. Learns from setbacks.

18 Team work and cooperation

a. Does not cooperate with others.
b. Solicits others' input.
c. In a group, encourages others' participation.
d. Establishes and maintains close relationships at work.

Applied questionnaire

QUESTIONNAIRE ON SUSTAINABLE BEHAVIOR

The purpose of this questionnaire is to gather information about factors that influence in the sustainable behavior of key actors in higher educational institutions to foster sustainable development concept in their teaching, research, extension, and campus management activities. Sustainable behavior is measured in this questionnaire on individual based however it is shown by statistics a collective attitude.

The sustainable behavior is evaluated in this questionnaire according the following definition: "*the set of effective, deliberate, and expected actions addressed to accept responsibility for prevention, conservation, and preservation of physical and cultural resources that include integrity of animal and plant species, as well as individual and social well being and material safety of actual and future human generations".*

It should take you about 12 minutes to complete this questionnaire. Any information you provide will be kept **strictly confidential** and **will only be used** for the purpose mentioned herein. Our interest for your responses is purely scientific.

- Please fill the questionnaire in by yourself, do not argue any answer with anyone else.
- Besides, do not think too much when you are answering. Try to respond spontaneously.
- There are no true or false answers. The most important is what you think.
- Please, answer every item, even if you think they are repeated over and over again.

In case you have any question, at the end of the questionnaire there is a space to express it. If you want to send it back, please mail it to Margarita Juárez-Nájera: mjn@correo.azc.uam.mx

Please, start fill in the survey now!

Next there is a list of concepts or words. We like your opinion if you identify with them; rate according to following scale at the extent to which you are strongly agreed or strongly disagreed on each item. It is included the neutral option "I-am-not-decided".

1. means **strongly agree** (SA)
2. means **somewhat agree** (A)
3. means **undecided** (U)
4. means **somewhat disagree** (D)
5. means **strongly disagree** (SD)

Please, fill in with a "X" mark on the corresponding option. Remember you can mark whatever column.

CONCEPTS, WORDS	1 SA	2 A	3 U	4 D	5 SD
1.1 World at peace, free of war and conflict.					
1.2 Influential, having an impact on people and events.					
1.3 Ambitious, wealth, material possessions, money.					
1.4 Broadminded.					
1.5 Authority, the right to lead or command.					
1.6 Creativity.					
1.7 Social power, control over others, dominance.					
1.8 Social order.					
1.9 Preventing and protecting the environment, conserving natural resources.					
1.10 Varied life, filled with challenge, novelty and change.					
1.11 Social justice, correcting injustice, care of the weak.					
1.12 Enjoying life.					
1.13 Self-discipline, self-restraint, resistance to temptations.					
1.14 Unity with nature, fitting into nature.					
1.15 Wealth.					
1.16 Responsible.					
1.17 Respectful, respecting the earth, harmony with other species.					
1.18 Moderate.					
1.19 Equality, equal opportunity for all.					
1.20 Accepting one's portion of life.					
1.21 Choosing own goals.					

In the next block, we like to rate three problems raised.

1. **very serious** problem
2. **somewhat serious** problem
3. **no serious** problem at all

Please, fill in with a "X" mark on the corresponding option. Remember you can mark whatever column.

STAMENT	1 Very serious	2 Somewhat serious	3 No serious
2.1a In general, do you think that climate change, which is sometimes called the greenhouse effect, will be a problem for you and your family?			
2.1b Do you think that climate change will be a problem for the country as a whole?			
2.1c Do you think that climate change will be a problem for other species of plants and animals?			
2.2a Next, I'd like you to consider the problem of loss of tropical forests. Do you think this will be a problem for you and your family?			
2.2b Do you think that loss of tropical forests will be a problem for the country as a whole?			
2.2c Do you think that loss of tropical forests will be a problem for other species of plants and animals?			
2.3a Next, I'd like you to consider the problem of toxic substances in air, water and the soil. Do you think this will be a problem for you and your family?			
2.3b Do you think the problem of toxic substances in air, water and the soil will be a problem for the country as a whole?			
2.3c Do you think the problem of toxic substances in air, water and the soil will be a problem for other species of plants and animals?			

In the next section, we like to rate some statements. Please rate according to following scale at the extent to which you are strongly agreed or strongly disagreed in each item. The neutral option "I-am-not-decided" is included.

1. means **strongly agree** (SA)
2. means **somewhat agree** (A)
3. means **undecided** (U)
4. means **somewhat disagree** (D)
5. means **strongly disagree** (SD)

Please, fill in with a "X" mark on the corresponding option. Remember you can mark whatever column.

STATEMENT	1 SA	2 A	3 U	4 D	5 SD
3.1 The government should take stronger action to clean up toxic substances in the environment.					
3.2. I feel a personal obligation to do whatever I can to prevent climate change.					
3.3 I feel a sense of personal obligation to take action to stop the disposal of toxic substances in the air, water, and soil.					
3.4 Business and industry should reduce their emissions to help prevent climate change.					
3.5 The government should exert pressure internationally to preserve the tropical forests.					
3.6 The government should take strong action to reduce emissions and prevent global climate change.					
3.7 Companies that import products from the tropics have a responsibility to prevent destruction of the forests in those countries.					
3.8 People like me should do whatever we can to prevent the loss of tropical forests.					
3.9 The chemical industry should clean up the toxic waste products it has emitted into the environment.					

Next there is a list of actions. Please, rate according to the following scale at the extent to which you never do or consistently do it, in each affirmative item.

1. means **never** (N)
2. means **rarely** (R)
3. means **sometimes** (S)
4. means **often** (O)
5. means **consistently** (C)

Fill in with a "X" mark on the corresponding option. Remember you can mark whatever column.

ACTIONS	1 N	2 R	3 S	4 O	5 C
4.1 Anticipate obstacles to a goal					
4.2 Adapt ideas based on new information					
4.3 Solicit others' input					
4.4 Take calculated risks to reach a goal					
4.5 Relate well to people of diverse backgrounds					
4.6 Stay composed and positive, even in stressful situations					
4.7 Lead by example					
4.8 Advocate change despite opposition					
4.9 Get impatient or shows frustration					
4.10 Personally lead change initiatives					
4.11 Keep your promises					
4.12 Acknowledge mistakes					
4.13 Articulate a compelling vision					
4.14 Can see things from someone else's perspective					
4.15 Believe yourself to be capable for a job					
4.16 Cut through red tape or bend rules when necessary					
4.17 Doubt own ability					
4.18 Establish and maintain close relationships at work					
4.19 Hesitate to act on opportunities					
4.20 Change overall strategy, goals, or projects to fit the situation					

Finally we include a set of personal questions for statistical purpose.

Please, fill the survey in and mark with an "X" on the corresponding option according your actual situation.

5.1 What level of studies have you obtained? Please mark the highest obtained!

		Only one answer
1	Incomplete secondary studies	
2	Complete secondary studies	
3	Incomplete higher educational studies	
4	Complete higher educational studies	
5	Complete postgraduate studies	
6	None	
7	Incomplete secondary studies	

5.2 What kind of housing do you have? (Mark only one)
( ) House   ( ) flat/ apartment

5.3 Do you own your house/ apartment?
( ) I am owner ( ) Rent

5.4 Under what religious denomination were you born? (Choose only one option)
( ) Roman Catholic   ( ) Lutheran Protestant   ( ) Calvinist Protestant
( ) Jews   ( ) None/ Atheist   ( ) Other, clarify:_____

5.5 Sex: ( ) Masculine ( ) Feminine

5.6 Year of birth: _____

5.7 Are you: (If you have more than one activity, please choose the most important one and tell at the ending section the other one). Only one answer!

Student ( )   Faculty ( )   Administrator ( )

5.8 What is the name of your Higher Educational Institution:-
_____

Thank you very much for your collaboration!
_____
If you want to express any opinion or comment, use these lines.
_____
_____
_____
_____
_____
_____
_____
_____

APPENDIX D

STATISTICAL TECHNIQUES FOR TESTING THE MODEL

Two statistical techniques are applied to validate the model developed to analyze decision-makers at HEI: the principal component analysis (PCA) and the Rasch model. This appendix provides a brief historical description of each method, their scope, and their mathematical expressions. Also, their application and further interpretation are provided. The language used in the mathematical description for each procedure is less rigorous than it would be for statisticians or engineers. For more details see Jolliffe, 1986; Bartholomew, 1987; and Basilevsky, 1994.

D1   Principal Component Analysis (PCA)

PCA is probably the oldest and most well known multivariate analysis technique (Jolliffe, 1986). It has its origins in 1889 when Galton devised the concept of the variable or latent trait to explain the relationship between measured variables, but Pearson in 1901 extended the Galton`s concept of regression by developing correlation measurements (Gardner, 2003). However, Spearman in 1904 (Basilevsky, 1994) developed the first model of common factors in the context of the psychological "general intelligence" test and subsequently introduced the term "factor".

Spearman used the concept to support his assertion that measurements were composed of two factors, an overall capacity common to all measurements and a set of specific skills for each measurement. Other researchers, such as Thomson (1956), have disagreed with this concept, and argue that only groups of common factors exist. A third group of researchers alternatively suggested the existence of a hierarchy of capabilities from general to specific. Many of these developments and discussions focused on Great Britain (Gardner, 2003).

In the United States in 1947, Thurstone presented arguments against the concept of a common factor and in favor of the concept of multiple factors which he called primary mental abilities (Bartholomew, 1987). He introduced the simple structure concept and suggested that any given factor must be defined primarily by a subset of non-transplant variables. Also he proposed turning factors to discover such simple structures. Subsequently, other researchers such as Hotelling and Girshick proposed analytical procedures capable of identifying the simple structure, but it was not until the advent of computers that their use spread widely. Nowadays PCA is rooted in virtually every statistical package (Jolliffe, 1986).

The term "principal component analysis" is a common term in statistical literature, and is adopted in this research. We do not use other phrases such as "empirical orthogonal functions" or "factor analysis" which are confusing; or "eigenvectors analysis " or "latent vector analysis" that camouflage PCA. There are several procedures for principal component analysis. All procedures have many things in common but differ in the nature of the mathematics employed. In addition, all methods

tend to respond very similarly in terms of the underlying dimensionality of any given set of variables (Jolliffe, 1986; Gardner, 2003).

The central idea on PCA is to reduce the dimensionality in a set of data in which there is a great number of interrelated variables, while retaining as much as possible the actual variation of the entire set of data. This reduction is achieved by transforming the entire set of data into a new set of variables, *principal components*, which are not correlated and are ranked by the first few variables thus maintaining the majority of the variation present in *all* original variables. Principal component analysis reduces the solution of a problem of eigenvalues (own values) to eigenvectors for a symmetric, semi defined, positive matrix. Thus, the definition and calculations of principal components are direct, apparently simple, and have an ample variety in many applications (Jolliffe, 1986). PCA does not address the manner in which some variables influencing the construct, but rather deals with variable relationships among variables. It also fails to determine factor significance, but the factor explains the percentage of total variance[1], and also how highly this variable is related to such factor (Gardner, 2003).

PCA consists of three stages (Gardner, 2003). Stage 1 calculates relationships among variables. This is usually expressed as a *correlation matrix*. Principal component analysis "extracts" the matrix dimensions. In this context, the fundamental theorem of principal component analysis is that correlation between any two variables can be expressed as the sum, in all dimensions, of cross-correlation products between these two variables and dimensions. The theorem is expressed as follows (for a more rigorous statistical and mathematical language, see Basilevsky, 1994, Chapter 6):

$$r_{XY} = \alpha_{XJ}\,\alpha_{YJ} + \alpha_{XJI}\,\alpha_{YJI} + \,....\, + \alpha_{XK}\,\alpha_{YK} \quad (D.1)$$

where:

α_{XJ} is the correlation between X variable and I factor (first dimension)

α_{YJ} is the correlation between Y variable and I factor, etcetera.

α is also known as factorial saturations.

Stage 2 extracts factors. These factors are dimensions on mathematical bases which describe principal components from the variance in the correlation matrix; the correlation matrix across these variables and dimensions constitute the *matrix of initial factors*. The dimensions in themselves are nothing more than aggregated weighted variables expressed as standard scores. In other words, an individual score is a factor, expressed as a standard score. It is as follow:

$$F_i = w_1\,Z_{1i} + w_2\,Z_{2j} + \,.....\, + w_m\,Z_{mi} \quad (D.2)$$

where:

---

[1] Variance is a scale or dispersion statistics. It is the square means of the deviation. It is usually denoted with S^2. The formula is: $S^2 = [\Sigma\,(X - Xbar)^2] / n$

F_i is an individual score in the factor.

w_1, w_2, etc., are weighs

Z_{1i}, Z_{2j}, etc., are individual standard score in variables.

The principal component method uses matrix algebra to select the weights for each factor, so that the variance of scores for the factor is as great as possible. The scale of these weights is adjusted to the sum of their square values equal to 1.0. The set of weights (w) for each factor is called eigenvector (or own vector). A matrix of these weights would have as many columns and rows as factors and variables. All factors are independent of each other due to a process of partitioning correlations between each variable and individual factors. This could be demonstrated by calculating a score for each factor in each individual and correlating their scores. All resulting correlations between factors would be 0 (zero). The variance of each factor could also be calculated. That is, factor variances are called *eigenvalues* or own values.

A highly positive correlation between a variable and a factor indicates that the variable tends to measure something in common with that factor. A highly negative correlation indicates that the variable tends to measure the opposite of what is described by the factor. A very low correlation indicates that the variable has nothing in common with the factor.

If the factorial saturation (α) is squared for each variable and the sum of resulting values for each factor is obtained, the eigenvalues are subsequently obtained. These eigenvalues are the variance for each factor, and can be calculated with the following equation:

$$\lambda = \alpha^2_1 + \alpha^2_2 + ... + \alpha^2_m \quad \text{(D.3)}$$

where:

λ = eigenvalue for a factor

$\alpha_1{}^2$ = Factorial square weight for variable 1 for the factor; $\alpha_2{}^2$ factorial square weight for variable 2, and so on for *m* variables

If the sum of squares of factorial saturation is obtained for all factors for each variable, resulting values would be *communalities* for each variable. Commonalities, designated by h^2, for a variable is a measurement of how much variance that variable has in common is with all other variables in the matrix, at least with respect to factors which were extracted. The formula for calculating them is as follows:

$$h^2 = \alpha^2_1 + \alpha^2_2 + ... + \alpha^2_p \quad \text{(D.4)}$$

where:

h^2 = variable communality.

$\alpha_1{}^2$ = square of factorial weight for variable 1 for the factor; $\alpha_2{}^2$ square of factorial weight for variable 2, and so on for *p* factors.

Stage 3 identifies factors which describe, in the simplest possible manner, relationships among variables. A problem of principal component analysis is that factors are extracted in order to explain variance, not in terms of how well they really describe the relationship among variables. This is achieved by rotating factors described in the initial factor matrix to produce an initial structure more susceptible to interpretation. The resulting matrix of associations among variables and rotated factors is the *matrix of rotated factors*.

It is possible to use many types of rotating procedures (Jolliffe, 1986) but the nature of the solution they produce may vary. Solutions can be orthogonal or oblique. In the orthogonal solutions, rotated factors retain independence characterized by principal component analysis. The oblique solutions, on the contrary, allows for a correlation between factors. This implies that interpretations of factors may have some overlap, depending on the extent of the correlation between two given factors.

As in all multivariate procedures, PCA has several aspects to consider: sample size and number of factors. Traditionally, it has been argued that samples must contain at least 100 and 300 measurements. However, a Monte Carlo study of rotated principal components found that the most important feature influencing the stability of the results is factor saturation (Gardner, 2003). If those factors are well-defined (that is, if the saturation of either is large in 0.8 in the population), a sample size as small as 50 is relatively stable (Basilevsky, 1994). In any case, sample sizes of 100 to 200 are more adequate.

A primary objective of PCA is to reduce the number of dimensions needed to describe relationship among variables (Jolliffe, 1986; Bartholomew, 1987; Basilevsky, 1994; Gardner, 2003). In general, there are two ways of doing this, criteria of eigenvalue of one and proof of sedimentation. The first approach assumes that all factors with an eigenvalue greater than 1.0 mean something significant and must be retained in the final solution. The second approach involves drawing a chart of eigenvalues against factors arranged in order of 1 to m. This graph has been compared with a side view of mountains, and the problem is to determine where the mountain ends and where the ground level at the base of the mountain begins. Gardner (2003) recommends basing his decisions on first "rocks", that is, maintaining all factors prior to the first "elbow".

Both of these procedures seek to determine at what point virtually any association among variables has already been explained, and to decide when the remaining association basically reflects sampling fluctuations. This can be determined directly considering the residual matrix once the factors have been extracted. A combination of these procedures is recommended by many scholars (Gardner, 2003).

The aforementioned procedure is an exploratory method. In other words, it is part of an association matrix (for instance, correlations) and attempts to identify factors underlying such

association. That is, the intention is to find factors which are responsible for partnerships, not to test the extent of adequacy (confirmatory factor analysis). If one wishes to achieve the latter, more previous explanatory information must be available. The generation of such information is the intention of this research.

D2   Psychometric measurement applying the Item Response Theory

The psychometric method is the second procedure used to determine whether difference exists in sustainable behavior through the five psychological dimensions selected across all groups of decision-makers (students, faculty members, and staff). It is an exploratory exercise which applies the item response theory (Embretson & Reise, 2000) in the fourth latent variable of inter- and intra-personal intelligences associated with the dimensions of effectiveness, austerity, solidarity, anticipation, and deliberation. It is a function related to probability. This model describes a non-linear relationship between independent variables such as individual trait scores and item difficulty, combined additively, and the dependant variable, in this case the likelihood of person's response to a specific question.

According to Bartholomew (1987) and Embretson & Reise (2000), Lord & Novick developed IRT models in 1968 for the United States Armed Forces Educational Testing Services based on Birnbaum's 1958 study for the U.S. Air Force. Rasch's 1960 study in Europe was used for measurements of reading in the Danish army. In 1973 Fischer, from the University of Vienna, extended the Rasch Model. Subsequently, Rasch visited the University of Chicago, where he inspired a large number of doctoral dissertations in education. However, psychological field remained basically unaware of psychometrics based on IRT.

The psychometric basis of the test has changed dramatically. Although classical test theory (CTT) has served to test throughout most of twentieth century with Spearman's work in 1913 and the initial explosion of testing in the 1930s, item response theory has rapidly become the mainstream theoretical basis for measurement. Increasingly, standardized tests such as Scholastic Aptitude Test and Graduate Record Examination educational tests in the U.S.A. have been based on the IRT due to its more theoretically justifiable measurement principles and its greater potential to solve practical measurement problems.

In classical test theory, score estimates typically are obtained by summing responses across items. In IRT, estimating trait levels involves a search process for optimal estimates to model behavior. That is, the model is based on two key assumptions: first, changes in trait level are related to changes in item solving probabilities, and secondly, local independence or further relationship with item's and person's parameters explains completely interrelated data across them (Embretson & Reise, 2000).

Measurement using IRT is based on the model in which trait level depend on both the person's item response and item difficulty (Van der Linden, 2005). The multiple choice item responses appear in the non-lineal relationship between people's trait level and the likelihood of a response in a specific category as a way to determine differences across groups and people (Scheuthle, Carabias-Hütter, and Kaiser, 2005).

The psychological construct is usually conceptualized as latent variables which underlie the behavior, as mentioned above. Latent variables are unobservable entities which influence observable (or manifest) variables such as test scores or item responses (Basilevsky, 1994). The particular item response or test score is an indicator of a person's standing with respect to the latent variable, but it does not completely define the latent variable (Embretson & Reise, 2000; Van der Linden, 2005).

Measurements of psychological constructs are usually indirect; latent variables are measured by observing behavior for relevant tasks or items. The properties of both persons and items for a psychological dimension are inferred from behavior. Thus, a measurement theory in psychology must provide a rationale for relating behaviors to the psychological construct. Both CTT and IRT provide rationale for behaviorally based measurement. However, these rationales differ substantially (Embretson & Reise, 2000; Van der Linden, 2005).

The CTT model is simple; the dependent variable is the total test score for a particular person (i.e., X_{Os}). The independent variables are the person's true score for the trait, X_{Ts}, and the person's error in testing, X_{Es}. The independent variable combines additively and directly to the dependent variable, as follows:

$$X_{Os} = X_{Ts} + X_{Es} \quad \text{(D.5)}$$

Several assumptions are made regarding error for CTT. The basic assumptions are (a) the expected value for error over multiple individuals is zero, (b) error is not related to other variables (e.g., true score, other errors, other true scores). Additional assumptions regarding error are required for interpreting various indices typically derived from CTT. For example, in order to interpret the standard error of measurement, errors are assumed to be normally distributed within an individual and homogenously distributed across individuals (Embretson & Reise, 2000).

The CTT model is limited in several ways. First, X_{Ts} applies to items in a specific test with equivalent item properties. That is, since no provision for potential variation of item parameters in the CTT model, these parameters must be fixed for a particular test. Second, although the model specifies two separate independent variables for a person, these independent variables are not really separable for an individual score. Instead, the model is used to justify estimated population statistics and multiple observations are required under varying conditions. Third, item properties are not linked to behavior in Eq. D.5. That is, the omission of item properties from the model requires that responses be justified outside the mathematical model for CTT. Thus, using item difficulty and discrimination to select items

is justified by their impact on various test statistics, such as variances and reliabilities (Embretson & Reise, 2000).

IRT is known as a "strong" model because demanding assumptions must be met (Embretson & Reise, 2000). The first assumption is that item curves characteristics have an S-shape and are specified as a function relating a person's parameters and the item to probability. Additionally each characteristic curve has a different location. Location corresponds to item difficulty and describes the extent to which items differ in probability across trait levels. The second assumption is that data have local independence. Local independence is obtained when the probability of solving for any item i ($Prob(X_{is} = 1)$) from independence of the outcome of any other item i' ($X_{i's}=1$), controlling for people parameters (θ_s) and item parameters (ξ_i), is as follows:

$$Prob(X_{is} = 1 | X_{i's} = 1, \xi_i, \theta_s) = Prob(X_{is} = 1 | \xi_i, \theta_s) \quad \text{(D.6)}$$

Local independence is related to the number of different latent variables (traits) which underlie item performance. That is, local independence is evidence for unidimensionality if the IRT model contains individual's parameters on only one dimension. However, local independence also can be achieved for multidimensional data if the model contains individual's parameters for each dimension.

Item response theory currently includes a large family of models. The simplest model is the Rasch model, the dependent variable is the dichotomous response (i.e., success/ failure or reject/ accept) for a particular person to a specified item. The independent variables are the person's trait score, θ_s, and the item's difficulty level, β_i. The independent variables are combined additively, and the item's difficulty is subtracted from the person's ability, θ_s. The relationship of these differences to item response depends on which dependent variable is modeled, log odds or probability.

In the second version of the Rasch model, the dependent variable is the simple probability of a person correct answer i, $Prob(X_{is} = 1)$. Independent variables, a person's trait score, and item difficulty combine additively by linking dependent variable to independent variables through a non-linear function. In this case, the logistic function provides the prediction as follows:

$$P(X_{is} = 1 | \theta_s, \beta_i) = \exp(\theta_s - \beta_i) / 1 + \exp(\theta_s - \beta_i) \quad \text{(D.7)}$$

where:

X_{is} = person s correct answer i

θ_s = person's trait score s

β_i = item's difficulty level i

$\exp(\theta_s - \beta_i)$ = indicates to take the natural antilog of the differences between the people parameter and the item parameter. This also may be written as $e^{(\theta_s - \beta_i)}$.

Equation 3.7 is also known as the one-parameter logistic (1PL) measurement model, due to its exponential form in predicting probabilities and to the inclusion of only one item parameter (i.e., difficulty) to represent item differences.

The Rasch model can be extended in the two-parameter logistic model (2PL). Item discrimination is included in the measurement, as follows:

$$P(X_{is} = 1|\ \theta_s, \beta_i, \alpha i) = \exp(\alpha i\ (\theta_s - \beta_i))\ /\ 1 + \exp(\alpha i\ (\theta_s - \beta_i)) \quad (D.8)$$

where:

αi = discriminating power of the item

Rost (1990) develops this model and Scheuthle, Carabias-Hütter, and Kaiser (2005) use it. Additionally, the IRT can be used to estimate the trait level if this is unknown.

IRT differs substantially from CTT as a model-base system of measurement. First, unlike IRT, CTT does not include item properties in the basic model, which implies that the true score can apply only to a particular set of items or their equivalent. By contrast, IRT trait levels have meaning for any set of calibrated items because IRT models include item properties. Second, the properties of items are not explicitly linked to behavior in CTT. Third and final, separate estimates for independent variables are not feasible in CTT without additional observations. That is, a people's true score and error score may not be inferred from a single administration of the test. In an IRT model, independent variables are trait level and item properties (Embretson & Reise, 2000; van der Linden, 2005).

ANNEX E1.1 Correlation matrix of the UAMA sample

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65
1WorldatPeace	1																																																																	
2Influential	-0.371	1																																																														
3Ambitious	0.079	0.099	1																																																													
4Broadminded	-0.055	0.063	-0.090	1																																																												
5Authority	0.067	0.236	0.346	-0.100	1																																																											
6Creativity	0.025	-0.139	-0.175	0.354	-0.212	1																																																										
7SocialPower	0.212	0.096	0.355	0.132	0.308	-0.059	1																																																								
8SocialOrder	0.147	-0.081	0.038	0.285	0.018	0.135	0.123	1																																																							
9Prevention	0.045	-0.080	-0.039	0.329	-0.203	0.285	-0.178	0.104	1																																																					
10Variedlife	0.027	0.175	0.181	-0.198	-0.040	0.265	-0.026	-0.162	-0.148	1																																																			
11SocialJustice	-0.048	0.076	0.021	0.351	-0.048	0.373	-0.161	0.105	0.099	-0.277	1																																																		
12Enjoyinglife	0.061	0.283	0.155	-0.136	0.249	0.161	0.112	-0.074	-0.014	0.446	-0.440	1																																															
13SelfDiscipline	-0.022	0.002	0.007	0.172	-0.081	0.219	0.056	0.120	-0.031	-0.307	0.191	-0.180	1																																													
14Unitynature	0.065	0.129	0.091	0.055	0.007	0.253	0.103	0.079	0.198	-0.250	0.146	-0.277	0.248	1																																											
15Wealth	0.149	-0.025	-0.025	0.245	-0.004	0.493	0.098	0.322	0.152	-0.089	0.230	0.250	0.146	0.355	1																																										
16Responsible	0.112	0.049	0.136	0.249	-0.048	0.373	-0.061	0.263	0.161	-0.161	0.169	0.161	0.263	0.161	0.654	1																																							
17Respectful	0.052	-0.029	0.138	0.186	-0.081	0.219	0.056	0.120	0.284	-0.018	0.043	0.050	0.174	0.201	0.677	0.488	1																																				
18Moderate	0.173	-0.042	-0.010	0.241	-0.138	0.337	0.103	0.031	0.315	0.031	0.056	0.039	0.293	0.306	0.545	0.677	0.285	1																																	
19Equality	0.079	0.037	0.219	0.321	-0.170	0.291	-0.026	0.116	0.264	-0.250	0.197	-0.231	-0.010	0.278	0.287	0.306	0.200	0.313	1																														
20AcceptingLife	0.198	0.094	0.034	0.176	-0.153	0.126	0.075	0.308	0.142	-0.152	0.188	0.029	0.377	0.291	0.152	0.306	0.200	0.370	0.255	1																											
21Choosingoals	0.016	0.027	0.069	0.357	-0.224	0.349	-0.017	0.263	0.293	-0.264	0.062	-0.180	0.234	0.289	0.190	0.355	0.457	0.322	0.384	0.250	1																							
22a2imitateyou	-0.170	0.041	-0.031	0.117	-0.106	-0.042	-0.268	0.120	0.404	-0.275	0.043	-0.034	-0.120	0.025	-0.102	-0.006	0.248	0.001	0.231	-0.004	0.045	1																					
23aClimatecountry	-0.056	0.008	0.115	0.191	-0.058	0.020	-0.021	0.046	0.246	-0.125	0.056	0.039	-0.059	-0.005	0.039	-0.042	0.125	-0.079	0.222	-0.147	0.291	0.483	1																		
24cClimateplants	-0.136	0.016	-0.038	0.159	0.107	0.035	-0.055	0.049	-0.160	-0.065	0.029	0.056	-0.088	-0.068	-0.068	-0.090	-0.069	-0.023	-0.023	0.059	0.647	0.474	1																
25aForestsyou	-0.128	0.113	0.060	0.243	-0.073	0.077	-0.270	0.119	0.182	-0.347	0.327	-0.178	0.056	-0.067	0.182	0.180	0.210	0.137	0.266	0.194	0.208	0.399	0.159	0.239	1													
26bForestcountry	-0.043	-0.128	-0.093	0.087	-0.073	-0.061	-0.264	0.108	-0.018	-0.192	0.062	0.045	-0.078	-0.083	-0.083	0.040	0.224	0.047	-0.068	-0.118	0.017	0.157	0.280	0.041	0.115	1											
27cForestplants	-0.096	-0.015	-0.082	0.087	-0.126	0.171	-0.017	0.241	0.145	-0.018	0.328	-0.156	0.086	0.161	0.367	0.332	0.253	0.204	0.189	0.127	0.021	-0.099	0.183	0.268	0.346	0.114	1										
28aToxicyou	-0.080	0.102	-0.043	0.065	-0.143	0.075	-0.045	0.052	0.040	-0.075	0.140	-0.040	-0.161	0.213	0.210	0.102	-0.005	-0.005	0.045	0.076	0.277	0.200	-0.035	0.006	0.019	0.153	0.249	1									
29bToxiccountry	0.038	-0.083	0.027	0.137	0.011	0.130	0.076	0.210	0.229	0.029	0.126	-0.060	-0.003	0.390	0.203	0.433	0.280	0.349	0.019	0.378	0.054	0.183	0.086	0.017	0.086	0.285	0.186	0.144	1								
30cToxicplants	-0.111	-0.017	0.061	0.053	0.055	0.076	0.033	0.189	0.265	0.140	0.140	-0.160	-0.130	0.144	0.123	0.213	0.119	0.224	0.416	-0.015	0.176	0.082	0.086	0.246	0.125	0.074	0.072	0.251	0.144	1							
31Government1	-0.001	-0.095	-0.007	-0.046	-0.107	0.107	-0.121	0.125	0.171	-0.158	0.305	-0.051	0.284	0.017	0.055	0.031	0.171	0.134	0.315	0.002	-0.011	0.046	-0.053	0.193	0.047	0.177	0.028	0.040	0.040	-0.116	1					
32IreEobligation	-0.027	0.131	0.068	0.140	0.069	0.146	0.076	0.146	0.076	-0.018	0.242	0.171	0.218	0.144	0.030	0.193	0.171	0.247	0.312	0.239	0.302	-0.099	0.055	-0.057	0.346	-0.103	-0.084	0.023	-0.048	0.018	0.072	1				
33IIfeelasense	-0.096	0.073	-0.043	0.264	-0.031	0.211	0.057	0.092	0.040	-0.210	0.155	-0.077	0.194	0.505	0.197	0.431	0.280	0.306	0.030	0.378	0.277	0.200	-0.143	0.050	0.171	0.019	0.285	-0.051	0.253	0.205	0.106	0.342	1			
34Business	-0.074	0.117	0.193	0.171	-0.013	0.194	0.118	0.049	-0.160	0.029	0.140	-0.088	-0.049	0.144	0.203	0.213	0.119	0.095	-0.100	0.231	0.054	0.268	-0.033	0.137	0.017	-0.032	-0.123	-0.041	0.145	0.117	0.221	0.020	0.059	1		
35Government2	-0.042	-0.112	0.021	0.053	-0.113	0.202	0.030	0.189	0.265	-0.214	0.140	-0.160	0.080	0.315	0.123	0.025	0.388	0.210	0.210	0.176	0.082	0.226	-0.262	0.246	0.142	0.074	-0.066	0.196	-0.016	0.110	0.221	0.296	0.102	0.307	1	
36Government3	-0.041	-0.034	-0.006	0.104	-0.107	0.107	-0.121	0.125	0.171	-0.158	0.305	-0.039	0.218	0.017	0.102	0.031	0.171	0.247	0.315	0.002	-0.040	0.291	0.181	0.193	0.115	0.177	0.005	0.007	0.007	0.063	0.488	0.453	0.063	0.360	-0.002	1
37Companies	0.299	-0.077	0.058	0.068	-0.017	-0.061	-0.069	-0.013	-0.013	-0.015	-0.039	0.171	-0.006	0.017	0.030	-0.103	-0.087	-0.015	-0.006	-0.015	0.239	-0.006	-0.099	0.055	-0.057	-0.103	-0.084	-0.048	0.017	0.007	-0.036	0.193	0.171	-0.212	-0.258	0.024
38Peoplelike	-0.116	0.138	0.260	0.182	0.150	0.075	-0.176	0.020	0.020	-0.075	0.075	0.076	-0.066	0.390	0.159	0.433	0.399	0.306	0.174	0.156	0.142	0.142	0.183	0.050	0.359	0.086	0.285	-0.051	0.017	0.205	-0.129	0.342	0.378	0.107	-0.109	-0.082
39Industry	-0.085	0.106	0.171	0.017	0.009	-0.080	-0.151	-0.083	-0.019	-0.147	0.010	0.052	0.082	0.144	-0.145	0.213	0.197	0.095	0.155	-0.051	0.246	0.246	0.149	0.137	0.120	0.193	-0.123	0.253	0.145	0.117	-0.147	0.038	0.183	-0.183	0.132	-0.107
40Anticipatesobsta	-0.005	0.008	-0.063	0.010	0.009	-0.136	0.010	-0.118	-0.010	0.168	0.010	-0.057	0.027	-0.064	-0.064	-0.044	-0.104	-0.046	-0.196	-0.196	-0.120	-0.120	-0.191	-0.054	-0.080	-0.098	-0.147	-0.086	-0.044	-0.044	-0.037	-0.044	0.021	-0.049	-0.004	0.026
41Adaptsideas	0.301	-0.020	-0.189	-0.114	0.032	-0.116	-0.069	-0.072	0.073	0.164	-0.072	0.051	-0.170	-0.103	-0.071	-0.097	-0.076	-0.076	0.054	0.114	-0.144	-0.102	-0.070	0.015	-0.147	0.016	0.016	0.079	0.079	-0.072	-0.016	-0.030	-0.167	-0.145	-0.035	-0.051
42Solicitsinput	0.134	-0.069	-0.039	-0.302	-0.058	-0.119	0.171	-0.082	0.016	0.325	-0.250	0.171	-0.225	-0.226	-0.073	-0.319	-0.167	-0.184	0.015	-0.237	-0.154	-0.105	-0.087	-0.125	-0.148	0.152	0.152	0.090	0.090	0.048	-0.017	-0.110	-0.186	0.038	-0.035	0.024
43Takesrisks	0.134	-0.191	-0.065	-0.076	0.049	-0.176	0.057	-0.085	-0.166	-0.222	-0.187	-0.077	-0.088	-0.157	0.061	-0.090	-0.069	0.030	-0.073	-0.068	-0.137	-0.031	-0.194	-0.008	-0.013	0.023	0.064	0.081	-0.033	-0.052	0.038	-0.145	-0.041	-0.183	-0.012	-0.107
44Relateswell	0.116	-0.058	-0.229	-0.286	-0.022	-0.026	0.118	-0.083	-0.249	0.274	-0.195	0.118	-0.063	-0.069	0.089	-0.081	-0.064	0.030	0.093	0.144	-0.241	-0.024	-0.329	-0.111	-0.204	-0.034	0.031	-0.049	0.030	-0.038	0.038	-0.195	-0.189	-0.049	-0.285	-0.139
45Stayscomposed	0.007	0.070	-0.135	-0.170	-0.145	-0.260	-0.149	-0.118	-0.260	0.225	-0.041	0.202	-0.178	-0.163	-0.163	-0.223	-0.223	-0.171	-0.015	-0.260	-0.135	-0.121	-0.191	-0.054	-0.183	-0.149	-0.032	-0.139	-0.139	-0.196	-0.045	-0.361	-0.070	-0.014	-0.046	0.097
46Actsimpulsively	-0.027	-0.070	0.075	-0.124	-0.089	0.088	0.014	-0.017	-0.017	0.195	-0.104	0.112	-0.016	-0.412	-0.183	-0.352	-0.380	-0.149	-0.012	-0.144	-0.377	-0.048	-0.169	-0.128	-0.053	-0.142	-0.027	-0.156	-0.094	-0.026	-0.093	-0.016	-0.043	-0.079	-0.025	-0.138
47Advocateschange	0.134	-0.080	-0.110	-0.302	0.047	-0.102	0.042	-0.082	-0.261	0.336	-0.307	0.150	-0.165	-0.174	-0.174	-0.123	-0.121	-0.073	-0.078	-0.023	-0.313	-0.105	-0.306	-0.124	-0.209	-0.047	-0.104	-0.059	-0.237	0.065	-0.217	-0.110	-0.186	-0.074	-0.162	-0.179
48Actsintuitively	0.149	-0.058	-0.240	-0.076	-0.038	-0.213	0.009	-0.083	-0.054	-0.032	-0.240	-0.077	-0.077	0.072	0.072	0.085	-0.090	-0.085	-0.057	-0.068	-0.244	0.070	-0.264	-0.187	-0.013	-0.013	-0.009	0.081	-0.089	0.081	-0.035	-0.145	-0.001	0.011	0.025	0.095
49PersonalHeads	-0.003	-0.022	-0.229	-0.286	-0.022	-0.279	0.009	-0.083	-0.249	0.274	-0.041	0.126	-0.149	-0.069	-0.069	-0.060	-0.081	0.000	-0.100	0.100	-0.156	-0.065	-0.252	0.110	-0.204	-0.034	0.122	0.000	-0.049	0.000	-0.060	-0.195	-0.183	0.203	0.124	0.027
50Keepsproni	0.273	0.007	-0.075	-0.144	-0.126	0.079	0.091	-0.018	-0.260	0.225	-0.311	0.171	-0.264	-0.300	-0.163	-0.223	-0.114	-0.137	-0.171	-0.089	-0.001	0.061	-0.121	-0.054	-0.183	-0.073	-0.117	-0.112	-0.221	-0.112	-0.084	-0.099	-0.070	0.075	0.034	0.075
51aKnowledgeinst	0.172	0.061	0.112	-0.131	-0.016	0.088	0.081	0.050	0.055	0.037	0.058	0.061	-0.157	-0.013	0.011	0.039	0.115	0.093	-0.015	0.101	0.009	0.187	-0.340	0.039	-0.072	-0.027	0.042	0.096	-0.065	0.096	-0.057	-0.175	0.033	-0.039	0.177	-0.106
52cKnowledgesecure	0.032	0.049	0.126	-0.239	0.107	-0.102	0.162	0.050	-0.240	0.336	-0.145	0.092	-0.133	-0.221	-0.034	-0.050	-0.087	0.003	0.074	0.108	0.233	0.023	-0.172	-0.177	-0.209	-0.104	0.012	-0.134	0.012	-0.039	-0.044	-0.004	0.206	-0.113	0.456	-0.182
53cCaresethings	0.175	0.050	0.036	-0.170	-0.038	0.026	0.019	0.198	-0.001	0.239	0.096	0.096	-0.138	-0.088	-0.004	-0.225	-0.177	-0.088	0.034	-0.071	-0.288	0.070	-0.252	-0.065	0.002	0.009	0.037	-0.102	0.037	0.030	-0.089	-0.060	0.183	0.043	0.302	0.201
54Believescapable	-0.006	0.061	0.043	0.074	0.114	0.082	-0.055	0.153	-0.026	0.026	0.032	0.082	-0.083	0.038	0.174	0.122	0.290	-0.048	0.093	0.064	0.105	-0.065	0.068	0.110	-0.056	0.061	-0.072	-0.004	0.000	0.997	-0.032	-0.060	0.126	0.053	0.198	0.075
55Bendsstats	0.028	0.024	-0.034	-0.168	-0.042	0.005	0.192	-0.061	-0.282	0.031	0.052	-0.019	0.025	0.118	-0.157	-0.095	0.026	0.137	-0.026	0.185	-0.059	-0.101	-0.087	-0.011	-0.157	-0.065	-0.019	-0.134	0.078	-0.193	0.012	-0.029	-0.059	-0.086	0.084	0.175
56Doutswnability	-0.022	0.050	0.057	0.132	-0.127	0.057	0.114	0.042	0.127	-0.143	0.042	-0.019	-0.133	-0.106	0.022	0.136	0.024	0.137	0.034	0.027	0.158	0.099	0.011	0.152	-0.056	-0.030	-0.087	-0.126	0.012	-0.102	0.053	-0.097	-0.075	0.162	0.162	-0.053
57Establisheschose	0.129	-0.134	0.083	-0.198	-0.122	-0.129	-0.051	0.153	0.065	0.041	0.194	0.034	0.128	-0.062	0.014	-0.083	0.228	-0.089	0.151	0.043	-0.027	0.011	-0.091	-0.103	0.015	0.086	0.013	0.131	0.037	0.131	0.030	0.026	-0.027	-0.034	-0.206	-0.081
58Hesitatesotaxt	-0.152	0.105	0.104	0.074	0.043	-0.051	0.118	0.153	-0.160	0.106	0.199	0.084	0.371	-0.164	-0.174	-0.083	-0.049	-0.088	-0.123	0.064	-0.257	-0.103	-0.056	-0.056	-0.175	0.086	-0.030	-0.092	-0.013	-0.122	0.081	-0.233	-0.300	0.162	0.254	0.157
59Changesstrategy	-0.006	0.029	0.043	0.321	-0.065	-0.076	-0.055	-0.061	-0.249	0.026	0.032	0.082	0.083	-0.062	-0.174	0.083	0.239	-0.048	0.093	0.064	-0.187	0.068	0.068	0.319	-0.175	0.061	-0.072	-0.004	0.294	0.374	0.126	-0.060	-0.206	0.096	0.181	-0.150
60whatwasusing	0.028	0.021	-0.054	-0.168	-0.043	0.005	0.192	0.069	0.059	0.031	0.052	-0.019	0.025	0.118	0.022	-0.095	0.024	0.137	-0.026	0.185	0.027	-0.101	-0.087	-0.061	0.064	0.115	0.064	-0.087	0.012	0.042	-0.045	-0.089	0.214	-0.017	0.007	-0.223
61owinvent	-0.188	0.023	0.083	-0.198	-0.122	0.146	0.046	0.019	-0.021	0.041	0.194	0.034	-0.128	-0.106	0.014	0.136	0.228	0.012	0.151	0.027	0.099	0.059	0.011	0.152	0.115	-0.030	-0.087	0.012	0.012	-0.102	0.053	-0.097	-0.075	0.134	-0.030	-0.057
62Indewindatreligion	0.129	-0.134	0.104	0.074	0.043	-0.129	-0.051	0.198	0.065	0.065	0.199	-0.059	0.371	-0.164	-0.174	-0.083	-0.049	-0.234	-0.123	0.012	0.024	-0.103	-0.091	-0.103	-0.030	0.086	0.013	0.131	0.037	0.131	0.030	0.026	-0.027	0.041	0.066	-0.186
63Gender	-0.179	-0.083	-0.206	0.074	-0.126	-0.076	-0.287	-0.073	-0.282	0.065	-0.072	-0.061	-0.059	-0.194	-0.114	-0.259	-0.327	-0.235	-0.087	-0.264	-0.187	-0.041	-0.056	0.053	-0.300	-0.194	-0.175	-0.011	-0.149	-0.122	-0.004	-0.031	-0.184	0.000	-0.334	-0.136
64Age	-0.152	-0.130	-0.130	-0.033	-0.043	0.115	-0.062	-0.238	-0.132	0.065	-0.072	0.050	0.121	-0.176	-0.197	-0.259	-0.327	-0.163	-0.117	-0.264	-0.193	-0.193	-0.087	0.319	-0.300	-0.194	-0.040	-0.040	-0.204	0.042	-0.125	-0.031	-0.184	0.149	0.041	0.237
65Areyou	-0.107	-0.112	-0.020	-0.083	-0.100																													0.296	-0.059	0.418

ANNEX E1.2 Anti-image correlation from the anti-image matrices for UAMA sample

Row labels (1–65):

1 Worldpeace
2 Influential
3 Ambitious
4 Broadminded
5 Authority
6 Creativity
7 Socialpower
8 Socialorder
9 Prevention
10 Variedlife
11 Socialjustice
12 Enjoyinglife
13 Selfdiscipline
14 Unitywithnature
15 Wealth
16 Responsible
17 Respectful
18 Moderate
19 Equality
20 Acceptinglife
21 Choosingowngoals
22 Acleanworld
23 Aworldinbeauty
24 Aworldofbeauty
25 Truefriendship
26 Aworldinbeauty
27 Aforestplants
28 Atoxicyou
29 Toxicunity
30 Choicenplants
31 Government
32 Theobligation
33 Meetonesense
34 Business
35 Government2
36 Government3
37 Companies
38 Peoplelike
39 Industry
40 Antiquestisobota
41 Adaptideas
42 Leadisystem
43 Externalism
44 Realiaswell
45 Staysocomposed
46 Leadtoknow
47 Advocatexchange
48 Actsintrusively
49 Personalpixels
50 Measrispromi
51 Acknowledgeneist
52 Articulatesascompe
53 Caresanthings
54 Beliveescapable
55 Beinstories
56 Goodsanvoability
57 Establisherectiose
58 Hesitatestoact
59 Changesstrategy
60 Withathousing
61 Ownrivent
62 Informationreligion
63 Gender
64 Age
65 Areyou

Measures of Sampling Adequacy (MSA)

ANNEX E1.3 Matrix of residual correlation of the UAMA sample

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1 Worldatpeace	0.009																			
2 Influential	-0.014	-0.107																		
3 Ambitious	-0.048	0.033	-0.040																	
4 Broadminded	0.020	-0.065	0.023	-0.010																
5 Authority	0.003	0.015	0.036	0.002	0.042															
6 Creativity	0.002	0.018	-0.010	-0.007	-0.045	-0.027														
7 Socialpower	-0.036	0.009	0.026	0.010	-0.021	-0.003	0.054													
8 Socialorder	-0.006	0.030	0.032	-0.009	-0.011	-0.028	0.008	-0.041												
9 Prevention	0.005	-0.049	-0.014	0.003	-0.022	0.007	-0.085	-0.080	0.016											
10 Inrediie	0.033	-0.033	0.063	-0.046	0.010	-0.044	0.049	0.010	-0.001	0.057										
11 Socialjustice	0.031	0.009	-0.048	0.028	-0.035	0.024	-0.066	-0.009	-0.018	0.014	-0.005									
12 Enjoyinglife	0.046	-0.021	0.010	-0.017	0.073	-0.029	-0.020	-0.051	0.047	-0.102	-0.011	0.026								
13 Selfdiscipline	0.016	0.046	0.072	0.030	-0.075	0.000	0.002	-0.014	0.023	-0.039	-0.032	0.015	0.009							
14 Unluyournature	-0.005	-0.049	-0.050	0.014	-0.018	-0.019	-0.053	-0.054	0.004	0.011	-0.048	0.060	-0.028	-0.001						
15 Wealth	-0.018	0.016	-0.018	-0.002	-0.056	0.010	-0.044	-0.054	-0.038	-0.059	-0.048	0.040	-0.053	-0.046	0.026					
16 Responsible	0.003	0.042	0.028	-0.010	-0.035	0.047	0.024	-0.009	0.004	-0.025	-0.011	0.016	-0.021	-0.026	0.016	0.033				
17 Respectful	-0.038	0.029	-0.033	0.013	0.079	-0.039	-0.039	-0.031	0.047	-0.102	-0.032	0.026	-0.009	0.012	-0.003	0.040	0.005			
18 Moderate	0.000	0.032	-0.049	0.011	-0.018	-0.019	-0.020	-0.026	0.023	-0.039	-0.003	0.015	-0.028	-0.065	-0.003	0.025	0.017	0.013		
19 Equality	0.006	0.063	0.029	-0.034	0.022	0.044	0.054	-0.053	0.004	0.011	0.019	0.026	0.041	-0.046	-0.048	0.005	0.040	-0.026	0.002	
20 Acceptinglife	-0.021	0.039	-0.084	0.010	0.022	-0.005	-0.012	0.050	-0.042	0.050	0.019	-0.031	-0.021	-0.009	-0.021	-0.005	0.017	0.013	-0.018	-0.023

(Lower-triangular residual correlation matrix, variables 1–65; columns 21–65 continue the pattern.)

Variables:
1 Worldatpeace · 2 Influential · 3 Ambitious · 4 Broadminded · 5 Authority · 6 Creativity · 7 Socialpower · 8 Socialorder · 9 Prevention · 10 Inrediie · 11 Socialjustice · 12 Enjoyinglife · 13 Selfdiscipline · 14 Unluyournature · 15 Wealth · 16 Responsible · 17 Respectful · 18 Moderate · 19 Equality · 20 Acceptinglife · 21 Choosingoals · 22a Climateyou · 23b Climatecountry · 24c Climateplants · 25e Forestyou · 26b Forestcountry · 27c Forestplants · 28a Toxicyou · 29b Toxiccountry · 30c Toxicplants · 31 Government1 · 32 Governmt1 · 33 Reelisense · 34 Business · 35 Government2 · 36 Government3 · 37 Companies · 38 Peoplelike · 39 Industry · 40 Anticipatesohsta · 41 Adaptsideas · 42 Solctbsinput · 43 Takesrisks · 44 Relatoswell · 45 3aysecomposed · 46 Leadsbyexam · 47 Advocatechange · 48 Actsimpusively · 49 Personalyleads · 50 Keepspromi · 51 Acknowledgesmist · 52 Articulatesaxcompe · 53 Canchangeyourmind · 54 Believescapable · 55 Benitsels · 56 Doubtsownability · 57 Establishesclose · 58 Heelatestouct · 59 Changesstrategy · 60 Withathousing · 61 Own/rent · 62 Underwhatreligion · 63 Gender · 64 Age · 65 Areyou

Extraction Method: Principal Component Analysis.

Residuals are computed between observed and reproduced correlations. There are 250 (12.0%) nonredundant residuals with absolute values greater than 0.05.

ANNEX E1.4 Correlation matrix of the LULIfUK sample

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1 WorldSpace	1																			
2 Influential	0.116	1																		
3 Ambitious	-0.093	0.489	1																	
4 Broadminded	0.124	-0.143	-0.193	1																
5 Authority	-0.258	0.390	0.503	-0.283	1															
6 Creativity	-0.170	0.186	0.176	0.203	-0.025	1														
7 Socialpower	-0.009	0.522	0.512	-0.039	0.435	0.018	1													
8 Socialorder	0.149	-0.047	-0.045	0.043	-0.170	0.007	-0.025	1												
9 Prevention	0.308	0.391	0.381	-0.109	0.279	0.139	0.051	0.061	1											
10 Variedlife	0.149	0.199	0.364	0.202	0.370	0.052	0.219	-0.287	-0.134	1										
11 Socialjustice	0.114	0.023	0.394	0.221	0.217	0.217	0.052	0.370	0.386	-0.078	1									
12 Enjoylife	0.250	0.364	0.333	0.233	-0.260	0.170	0.254	0.078	-0.134	0.247		1								
13 Selfdiscipline	0.114	0.233	0.533	0.045	-0.059	0.219	-0.287	0.370	0.254	0.316	0.128	0.188	1							
14 Unhmyownature	-0.296	-0.360	-0.320	-0.209	-0.148	0.007	0.219	0.250	-0.229	-0.059	0.479	0.333	0.188	1						
15 Wealth	0.197	0.296	0.371	0.261	0.037	-0.138	0.240	0.254	0.501	0.103	0.272	0.006	0.059	0.296	1					
16 Responsible	0.408	0.274	0.104	0.244	-0.027	0.134	-0.029	0.056	0.101	0.292	0.298	0.315	0.147	0.307	0.285	1				
17 Respectful	0.073	-0.049	0.394	0.221	0.146	0.137	0.315	0.248	0.003	0.026	0.503	0.396	0.034	0.050	0.301	0.017	1			
18 Moderate	0.183	0.246	0.183	0.074	-0.068	0.100	0.270	0.233	0.247	0.170	0.581	0.129	0.316	0.184	0.088	0.375	0.088	1		
19 Equality	0.062	0.208	0.261	-0.042	0.092	0.167	0.091	0.167	0.141	-0.051	0.214	0.113	0.209	0.333	0.215	0.021	0.227	0.315	1	
20 Accomplishlife	0.039	-0.014	0.159	-0.082	0.025	0.184	-0.186	0.271	0.415	-0.289	0.500	0.351	0.008	0.110	0.344	0.193	0.257	0.128	0.034	1

	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
21 Choosinggoals	1																			
22 Climateyou	-0.059	1																		
23 Climatecountry	0.022	0.512	1																	
24 Climateplants	0.105	0.144	0.376	1																
25 Foresteryou	0.043	0.399	0.133	-0.051	1															
26 Forestcountry	0.048	0.399	0.512	0.376	0.766	1														
27 Forestplants	0.110	-0.221	-0.135	0.348	-0.133	-0.090	1													
28 Toxicyou	0.075	-0.058	-0.082	-0.191	-0.031	-0.086	0.678	1												
29 Toxiccountry	0.160	-0.023	0.057	0.160	0.112	0.157	0.538	0.449	1											
30 Toxicplants	0.255	0.188	0.203	0.058	0.089	0.299	0.134	0.255	0.310	1										
31 Government1	0.328	0.373	0.355	0.516	0.529	0.412	0.065	0.185	0.238	0.238	1									
32 Techobligation	0.112	0.186	0.089	0.115	0.373	0.226	0.027	0.065	0.404	0.140	0.310	1								
33 Relaxsense	0.208	0.254	0.135	-0.102	0.131	0.516	-0.216	-0.083	0.373	0.328	0.543	0.199	1							
34 Business	0.373	-0.029	0.187	0.157	0.138	0.189	-0.153	-0.184	0.059	0.112	0.199	0.434	-0.014	1						
35 Government2	0.396	0.152	-0.191	-0.177	0.766	-0.112	-0.131	-0.006	0.139	0.288	0.421	0.533	0.125	0.117	1					
36 Government3	0.315	0.050	0.075	0.157	0.133	0.138	-0.087	-0.153	0.139	0.398	0.020	0.112	0.119	0.143	-0.230	1				
37 Companies	0.396	0.027	0.071	0.192	0.071	0.244	-0.199	0.135	0.106	0.188	0.233	0.296	0.188	0.135	-0.230	0.188	1			
38 Propelike	-0.075	-0.210	-0.172	-0.059	-0.043	-0.039	0.033	-0.039	0.174	-0.043	-0.197	0.150	0.093	0.000	0.182	0.093	0.296	1		
39 Industry	-0.108	-0.117	-0.134	-0.198	-0.127	-0.199	-0.199	0.135	-0.043	-0.254	-0.221	-0.043	-0.315	0.000	0.093	0.109	-0.039	0.296	1	
40 Intogateinstasta	0.036	0.320	0.282	-0.310	0.218	0.165	0.375	0.192	-0.027	-0.069	-0.249	0.165	0.036	-0.249	0.122	-0.249	0.165	0.135	-0.249	1

	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
41 Adaptssuas	0.320	1																		
42 Selfoutput	0.189	0.082	1																	
43 Takesrisks	0.166	0.159	0.140	1																
44 Relateswell	0.323	0.264	0.314	0.247	1															
45 Syncomposed	-0.099	0.082	0.050	0.192	0.317	1														
46 Leadsbypraism	0.320	0.112	0.159	0.125	0.057	0.273	1													
47 Acknowledgesmist	0.282	0.236	0.314	0.339	0.581	0.220	0.430	1												
48 Actsimpulsively	-0.113	-0.051	0.050	0.058	0.192	-0.345	-0.192	-0.286	1											
49 Personalyleads	0.010	0.123	0.192	0.304	0.273	0.506	0.377	-0.069	-0.287	1										
50 Keepspromi	0.082	0.072	0.140	-0.089	-0.027	0.057	0.105	0.158	0.209	-0.037	1									
51 Acknowledgesmist	-0.335	-0.195	-0.074	-0.133	-0.074	-0.047	-0.047	-0.066	0.143	-0.112	0.088	1								
52 Articulatesacompe	0.005	0.056	0.057	0.209									1							
53 Advocateschange	0.235	0.197	0.000											1						
54 Actsettings	0.299	0.513													1					
55 Believescapable	0.104	-0.113														1				
56 Enlistsotes	0.255	0.218															1			
57 Outdoorsnability																		1		
58 Establishesclose																			1	
59 Hesitatestoact																				1

	61	62	63	64	65
60 Changesstrategy					
61 Ownerrent	1				
62 Underwhamationloan	-0.388	1			
63 Gender	-0.161	-0.121	1		
64 Age	-0.028	-0.177	-0.246	1	
65 Areyou					1

ANNEX E1.5 Matrix of residual correlation of the LULIfUK sample

Row variables (top to bottom):

1 Worldatpeace
2 Influential
3 Ambitious
4 Broadminded
5 Authority
6 Creativity
7 Socialpower
8 Socialorder
9 Prevention
10 Variedlife
11 Socialjustice
12 Enjoylife
13 Selfdiscipline
14 Unityvnature
15 Wealth
16 Responsible
17 Respectful
18 Moderate
19 Equality
20 Acceptinglife
21 Choosingoals
22a Climateyou
23b Climatecountry
24c Climateplants
25a Freesyou
26 Forestcountry
27b Forestplants
28a Toxicyou
29b Toxiccountry
30c Toxicplants
31 Government1
32 Feelobligation
33 Feelsense
34 Business
35 Government2
36 Anticipatesobsta
37 Companies
38 Peoplelike
39 Industry
40 Anticipatesobsta
41 Adaptsideas
42 Solicitsinput
43 Takesrisks
44 Relatieswell
45 Stayscomposed
46 Leadsbyexam
47 Advocatischange
48 Actsimpulsively
49 Personalyleads
50 Keepsgroing
51 Acknowledgesmist
52 Articulatesscope
53 Canseethings
54 Believescapable
55 Lendsruies
56 Doubtsownability
57 Establisheschose
58 Hesitatestoact
59 Changesstrategy
60 Wellhousing
61 Govinvt
62 Undervaluereligion
63 Gender
64 Age
65 Areyou

Extraction Method: Principal Component Analysis.

Residuals are computed between observed and reproduced correlations. There are 238 (11.0%) nonredundant residuals with absolute values greater than 0.05.

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ANNEX E2. Probability of 20 observed item and 80 participant for UAMA sample

TL / P	EFFECTIVENESS probability[a] 1	2	3	4	Prob[b]	AUSTERITY probability[a] 1	3	1	4	Prob[b]	SOLIDARITY probability[a] 3	4	2	4	Prob[b]	ANTICIPATION probability[a] 2	4	3	4	Prob[b]	DELIBERATION probability[a] 1	3	1	4	Prob[b]	Probab[c]
S 1	0.98	0.27	0.73	0.73	0.141	0.95	0.88	0.98	0.50	0.412	0.88	0.50	0.88	0.50	0.194	0.50	0.73	0.73	0.50	0.134	0.50	0.73	0.95	0.50	0.174	0.0002623
S 2	0.95	0.27	0.50	0.27	0.034	0.95	0.88	0.88	0.50	0.370	0.88	0.50	0.88	0.50	0.194	0.50	0.73	0.27	0.12	0.012	0.88	0.27	0.88	0.73	0.025	0.0000007
S 4	0.98	0.50	0.73	0.73	0.262	0.73	0.88	0.98	0.73	0.462	0.88	0.95	0.95	0.27	0.113	0.73	0.73	0.27	0.27	0.105	0.73	0.27	0.73	0.73	0.105	0.0001511
S 6	0.95	0.50	0.27	0.50	0.064	0.95	0.73	0.88	0.27	0.165	0.88	0.27	0.95	0.27	0.061	0.73	0.73	0.50	0.27	0.072	0.73	0.27	0.95	0.27	0.137	0.0000063
S 7	0.98	0.27	0.73	0.73	0.141	0.95	0.73	0.88	0.27	0.165	0.50	0.50	0.95	0.12	0.028	0.50	0.73	0.50	0.27	0.049	0.88	0.27	0.98	0.27	0.063	0.0000020
S 8	0.98	0.50	0.73	0.50	0.179	0.98	0.73	0.98	0.12	0.084	0.88	0.50	0.88	0.27	0.104	0.50	0.27	0.73	0.73	0.072	0.73	0.27	0.88	0.50	0.097	0.0000109
S 9	0.98	0.50	0.73	0.50	0.179	0.95	0.73	0.88	0.50	0.307	0.73	0.50	0.88	0.27	0.047	0.73	0.27	0.50	0.50	0.049	0.95	0.12	0.95	0.50	0.050	0.0000063
S13	0.98	0.27	0.73	0.50	0.097	0.95	0.88	0.98	0.50	0.412	0.73	0.27	0.88	0.27	0.072	0.73	0.27	0.50	0.50	0.091	0.73	0.27	0.95	0.50	0.094	0.0000245
S16	0.98	0.27	0.73	0.73	0.141	0.98	0.50	0.98	0.73	0.352	0.88	0.50	0.95	0.50	0.210	0.73	0.50	0.73	0.73	0.063	0.98	0.50	0.95	0.50	0.234	0.0001525
S25	0.98	0.50	0.73	0.27	0.097	0.98	0.88	0.98	0.12	0.101	0.88	0.73	0.88	0.73	0.415	0.50	0.50	0.50	0.73	0.195	0.73	0.73	0.95	0.50	0.255	0.0022015
S26	0.98	0.27	0.73	0.50	0.097	0.95	0.73	0.98	0.73	0.500	0.88	0.27	0.88	0.73	0.415	0.95	0.12	0.73	0.73	0.235	0.50	0.27	0.98	0.50	0.066	0.0031110
S32	0.98	0.88	0.73	0.50	0.316	0.88	0.88	0.88	0.50	0.342	0.50	0.27	0.50	0.27	0.018	0.95	0.12	0.73	0.50	0.042	0.98	0.27	0.73	0.50	0.097	0.0000078
S33	0.95	0.73	0.50	0.50	0.174	0.95	0.50	0.95	0.27	0.122	0.73	0.27	0.95	0.73	0.137	0.50	0.73	0.73	0.50	0.134	0.88	0.27	0.88	0.27	0.056	0.0000218
S38	0.98	0.73	0.50	0.73	0.262	0.95	0.50	0.95	0.50	0.227	0.73	0.27	0.88	0.12	0.021	0.50	0.50	0.50	0.73	0.091	0.73	0.50	0.98	0.50	0.179	0.0000202
S79	0.98	0.50	0.50	0.50	0.123	0.98	0.88	0.88	0.27	0.205	0.73	0.50	0.73	0.73	0.195	0.73	0.50	0.50	0.50	0.091	0.73	0.27	0.88	0.50	0.087	0.0003389
F 3	0.98	0.73	0.88	0.73	0.462	0.95	0.73	0.98	0.50	0.342	0.88	0.50	0.88	0.73	0.284	0.95	0.27	0.88	0.73	0.165	0.50	0.50	0.88	0.27	0.059	0.0004379
F 5	0.98	0.88	0.50	0.12	0.052	0.95	0.50	0.88	0.27	0.113	0.50	0.50	0.73	0.27	0.049	0.27	0.12	0.50	0.12	0.002	0.88	0.12	0.88	0.27	0.025	0.0000000
F10	0.98	0.73	0.73	0.50	0.262	0.95	0.73	0.98	0.27	0.184	0.73	0.27	0.73	0.50	0.072	0.88	0.50	0.50	0.73	0.161	0.88	0.73	0.98	0.50	0.316	0.0011765
F14	0.98	0.88	0.88	0.73	0.557	0.98	0.88	0.98	0.73	0.621	0.88	0.50	0.95	0.73	0.307	0.50	0.50	0.88	0.73	0.161	0.50	0.12	0.95	0.73	0.042	0.0007087
F15	0.98	0.27	0.88	0.73	0.170	0.98	0.88	0.98	0.73	0.621	0.88	0.73	0.95	0.27	0.165	0.27	0.73	0.88	0.73	0.127	0.50	0.12	0.98	0.73	0.179	0.0003958
F17	0.73	0.27	0.73	0.50	0.072	0.95	0.50	0.98	0.27	0.126	0.88	0.27	0.95	0.95	0.011	0.73	0.73	0.73	0.50	0.195	0.73	0.73	0.98	0.50	0.043	0.0000008

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ANNEX E2. Probability of 20 observed item and 80 participant for UAMA sample

TL / P	EFFECTIVENESS probability[a] 1	2	3	4	Prob[b]	AUSTERITY probability[a] 1	3	1	4	Prob[b]	SOLIDARITY probability[a] 3	4	2	4	Prob[b]	ANTICIPATION probability[a] 2	4	3	4	Prob[b]	DELIBERATION probability[a] 1	3	1	4	Prob[b]	Probab[c]
F19	0.98	0.27	0.50	0.50	0.066	0.98	0.73	0.95	0.50	0.342	0.50	0.50	0.88	0.73	0.161	0.73	0.73	0.50	0.27	0.072	0.73	0.27	0.98	0.73	0.141	0.0000369
F20	0.98	0.27	0.73	0.50	0.097	0.98	0.73	0.88	0.27	0.170	0.88	0.50	0.88	0.50	0.194	0.73	0.27	0.50	0.27	0.026	0.73	0.27	0.95	0.50	0.094	0.0000079
F21	0.98	0.50	0.88	0.50	0.216	0.98	0.88	0.95	0.27	0.222	0.50	0.12	0.73	0.12	0.005	0.73	0.27	0.27	0.50	0.026	0.88	0.12	0.95	0.50	0.050	0.0000003
F22	0.95	0.50	0.73	0.50	0.174	0.98	0.73	0.95	0.27	0.184	0.73	0.27	0.88	0.50	0.087	0.73	0.50	0.73	0.27	0.072	0.73	0.27	0.95	0.27	0.050	0.0000100
F23	0.98	0.27	0.73	0.50	0.097	0.95	0.73	0.95	0.50	0.332	0.88	0.50	0.88	0.50	0.194	0.73	0.73	0.73	0.73	0.286	0.73	0.73	0.95	0.50	0.255	0.0004515
F24	0.98	0.50	0.73	0.27	0.097	0.98	0.73	0.95	0.73	0.500	0.88	0.50	0.88	0.73	0.284	0.73	0.50	0.88	0.50	0.161	0.73	0.12	0.95	0.50	0.042	0.0000914
F27	0.95	0.50	0.73	0.27	0.094	0.98	0.50	0.95	0.27	0.126	0.73	0.27	0.73	0.50	0.072	0.50	0.27	0.50	0.27	0.018	0.73	0.50	0.95	0.27	0.094	0.0000014
F30	0.98	0.95	0.88	0.73	0.602	0.98	0.73	0.95	0.50	0.342	0.73	0.50	0.95	0.50	0.174	0.73	0.50	0.50	0.50	0.091	0.95	0.27	0.95	0.50	0.122	0.0003998
F31	0.98	0.50	0.73	0.50	0.179	0.98	0.73	0.95	0.50	0.342	0.88	0.50	0.95	0.73	0.307	0.88	0.50	0.88	0.73	0.284	0.73	0.27	0.98	0.50	0.097	0.0005152
F34	0.98	0.27	0.50	0.73	0.097	0.98	0.88	0.98	0.73	0.621	0.88	0.73	0.95	0.73	0.448	0.88	0.73	0.88	0.73	0.415	0.73	0.27	0.98	0.73	0.141	0.0015732
F36	0.98	0.50	0.88	0.50	0.216	0.98	0.73	0.98	0.12	0.084	0.88	0.50	0.95	0.27	0.113	0.50	0.50	0.73	0.73	0.134	0.73	0.12	0.98	0.50	0.043	0.0000117
F37	0.95	0.50	0.50	0.50	0.119	0.95	0.73	0.88	0.50	0.307	0.50	0.27	0.73	0.50	0.049	0.73	0.50	0.50	0.12	0.022	0.73	0.27	0.95	0.50	0.094	0.0000037
F39	0.95	0.73	0.73	0.27	0.137	0.95	0.73	0.95	0.27	0.178	0.73	0.50	0.73	0.27	0.072	0.73	0.12	0.73	0.50	0.032	0.88	0.27	0.95	0.50	0.113	0.0000063
F40	0.98	0.27	0.88	0.73	0.170	0.98	0.88	0.95	0.50	0.412	0.50	0.73	0.88	0.50	0.161	0.88	0.27	0.88	0.50	0.104	0.95	0.12	0.88	0.50	0.050	0.0000588
F41	0.98	0.50	0.88	0.50	0.216	0.95	0.73	0.98	0.27	0.184	0.88	0.73	0.95	0.73	0.448	0.73	0.73	0.88	0.73	0.344	0.50	0.27	0.95	0.50	0.064	0.0003931
F42	0.98	0.50	0.50	0.73	0.179	0.98	0.73	0.95	0.12	0.082	0.88	0.27	0.95	0.50	0.113	0.73	0.73	0.88	0.50	0.235	0.73	0.27	0.95	0.50	0.094	0.0000364
F43	0.98	0.50	0.73	0.27	0.097	0.98	0.73	0.95	0.05	0.032	0.73	0.50	0.73	0.73	0.195	0.50	0.50	0.73	0.50	0.091	0.73	0.12	0.98	0.50	0.043	0.0000024
F44	0.95	0.50	0.73	0.50	0.174	0.98	0.73	0.95	0.27	0.184	0.88	0.50	0.95	0.50	0.210	0.88	0.50	0.88	0.73	0.284	0.73	0.27	0.98	0.50	0.097	0.0001839
F45	0.98	0.95	0.88	0.73	0.602	0.98	0.88	0.95	0.27	0.222	0.88	0.73	0.95	0.73	0.448	0.73	0.73	0.73	0.73	0.286	0.95	0.12	0.98	0.73	0.082	0.0013936
F46	0.98	0.50	0.50	0.50	0.123	0.98	0.73	0.95	0.27	0.184	0.88	0.50	0.95	0.50	0.210	0.73	0.50	0.50	0.50	0.091	0.88	0.27	0.98	0.50	0.116	0.0000503
F47	0.95	0.73	0.88	0.50	0.307	0.95	0.73	0.95	0.12	0.079	0.73	0.50	0.88	0.50	0.161	0.73	0.73	0.73	0.50	0.195	0.88	0.50	0.95	0.73	0.307	0.0002339

ANNEX E2. Probability of 20 observed item and 80 participant for UAMA sample

TL	EFFECTIVENESS					AUSTERITY					SOLIDARITY					ANTICIPATION					DELIBERATION					
P	probability a				Prob b	probability a				Prob b	probability a				Prob b	probability a				Prob b	probability a				Prob b	Probab c
	1	2	3	4		1	3	1	4		3	4	2	4		2	4	3	4		1	3	1	4		
F54	0.95	0.88	0.88	0.50	0.370	0.95	0.73	0.95	0.27	0.178	0.50	0.27	0.88	0.50	0.059	0.73	0.27	0.73	0.27	0.039	0.88	0.27	0.95	0.50	0.094	0.0000176
F57	0.98	0.27	0.88	0.73	0.170	0.98	0.88	0.98	0.73	0.621	0.88	0.50	0.95	0.73	0.307	0.50	0.50	0.88	0.73	0.161	0.50	0.50	0.98	0.73	0.179	0.0093357
F58	0.95	0.73	0.73	0.73	0.372	0.95	0.73	0.95	0.27	0.178	0.88	0.50	0.95	0.73	0.307	0.73	0.50	0.88	0.73	0.235	0.95	0.50	0.88	0.73	0.210	0.0010054
F59	0.98	0.95	0.73	0.73	0.500	0.98	0.88	0.98	0.73	0.621	0.88	0.73	0.50	0.73	0.235	0.50	0.73	0.88	0.73	0.235	0.73	0.27	0.95	0.50	0.094	0.0016105
F60	0.95	0.50	0.73	0.50	0.174	0.95	0.50	0.95	0.50	0.227	0.88	0.50	0.95	0.50	0.210	0.73	0.50	0.88	0.73	0.235	0.73	0.27	0.95	0.50	0.094	0.0001826
F61	0.98	0.73	0.88	0.27	0.170	0.95	0.73	0.95	0.27	0.178	0.73	0.50	0.88	0.73	0.235	0.73	0.50	0.73	0.50	0.134	0.73	0.12	0.98	0.27	0.023	0.0000220
F62	0.98	0.50	0.88	0.50	0.216	0.95	0.73	0.98	0.50	0.342	0.88	0.27	0.73	0.50	0.087	0.50	0.50	0.50	0.50	0.063	0.88	0.73	0.95	0.27	0.165	0.0006660
F63	0.98	0.50	0.50	0.50	0.123	0.95	0.73	0.88	0.12	0.073	0.88	0.50	0.95	0.73	0.307	0.73	0.50	0.73	0.50	0.134	0.88	0.27	0.88	0.50	0.104	0.0003384
F65	0.98	0.27	0.88	0.50	0.116	0.98	0.50	0.98	0.73	0.352	0.88	0.73	0.88	0.27	0.153	0.50	0.50	0.88	0.73	0.161	0.50	0.12	0.88	0.50	0.026	0.0002264
F71	0.95	0.27	0.73	0.50	0.094	0.95	0.88	0.95	0.50	0.400	0.88	0.50	0.88	0.73	0.284	0.50	0.50	0.73	0.50	0.091	0.88	0.12	0.95	0.50	0.050	0.0004485
F80	0.98	0.50	0.50	0.27	0.066	0.98	0.73	0.88	0.27	0.170	0.73	0.50	0.88	0.27	0.087	0.73	0.27	0.73	0.27	0.039	0.88	0.27	0.95	0.50	0.113	0.0000042
A11	0.98	0.50	0.50	0.50	0.123	0.95	0.50	0.88	0.27	0.113	0.88	0.50	0.73	0.73	0.235	0.50	0.50	0.50	0.50	0.063	0.73	0.27	0.95	0.50	0.094	0.0000191
A12	0.95	0.27	0.73	0.73	0.137	0.95	0.88	0.95	0.27	0.215	0.88	0.50	0.88	0.50	0.194	0.73	0.50	0.50	0.73	0.195	0.73	0.27	0.95	0.50	0.094	0.0001044
A18	0.98	0.27	0.73	0.50	0.097	0.98	0.88	0.95	0.27	0.222	0.88	0.50	0.95	0.73	0.222	0.73	0.27	0.73	0.50	0.072	0.50	0.12	0.95	0.50	0.028	0.0000134
A28	0.98	0.50	0.73	0.50	0.179	0.98	0.88	0.88	0.73	0.557	0.50	0.50	0.95	0.27	0.064	0.27	0.50	0.27	0.27	0.010	0.95	0.50	0.98	0.50	0.234	0.0000146
A29	0.98	0.27	0.88	0.50	0.116	0.98	0.88	0.95	0.73	0.602	0.88	0.73	0.73	0.73	0.344	0.50	0.73	0.88	0.73	0.235	0.50	0.12	0.98	0.73	0.043	0.0002428
A35	0.95	0.73	0.27	0.27	0.050	0.95	0.50	0.95	0.50	0.227	0.50	0.27	0.73	0.50	0.049	0.73	0.50	0.73	0.50	0.134	0.88	0.12	0.88	0.27	0.025	0.0000019
A48	0.98	0.50	0.88	0.50	0.216	0.98	0.73	0.95	0.27	0.184	0.88	0.50	0.88	0.50	0.194	0.50	0.50	0.88	0.73	0.161	0.50	0.50	0.98	0.73	0.179	0.0022229
A49	0.98	0.27	0.88	0.50	0.116	0.98	0.88	0.98	0.27	0.228	0.88	0.27	0.88	0.73	0.153	0.73	0.27	0.73	0.50	0.072	0.50	0.27	0.95	0.73	0.094	0.0000273
A50	0.98	0.27	0.73	0.12	0.023	0.98	0.88	0.88	0.50	0.381	0.88	0.27	0.95	0.73	0.165	0.50	0.73	0.88	0.73	0.235	0.50	0.27	0.98	0.73	0.097	0.0000329
A51	0.98	0.73	0.50	0.50	0.179	0.95	0.73	0.95	0.27	0.178	0.88	0.50	0.95	0.50	0.210	0.88	0.27	0.73	0.50	0.087	0.88	0.73	0.95	0.50	0.307	0.0001784

TL / P	EFFECTIVENESS					AUSTERITY					SOLIDARITY					ANTICIPATION					DELIBERATION					Probab[c]
	1	2	3	4	Prob[b]	1	3	1	4	Prob[b]	3	4	2	4	Prob[b]	2	4	3	4	Prob[b]	1	3	1	4	Prob[b]	
	probability[a]					probability[a]					probability[a]					probability[a]					probability[a]					
A52	0.98	0.50	0.73	0.27	0.097	0.98	0.88	0.98	0.50	0.425	0.88	0.50	0.73	0.50	0.161	0.73	0.50	0.88	0.50	0.161	0.88	0.73	0.95	0.73	0.448	0.0004764
A53	0.98	0.27	0.73	0.50	0.097	0.98	0.73	0.88	0.12	0.075	0.50	0.50	0.73	0.73	0.134	0.88	0.27	0.50	0.50	0.059	0.50	0.12	0.98	0.27	0.016	0.0000009
A55	0.98	0.27	0.50	0.50	0.066	0.98	0.73	0.95	0.05	0.032	0.88	0.50	0.95	0.73	0.307	0.73	0.50	0.88	0.73	0.235	0.50	0.27	0.98	0.73	0.097	0.0000149
A64	0.95	0.50	0.50	0.50	0.119	0.98	0.88	0.95	0.12	0.098	0.88	0.50	0.88	0.73	0.284	0.50	0.50	0.88	0.73	0.161	0.88	0.27	0.98	0.50	0.116	0.0000621
A66	0.88	0.88	0.50	0.27	0.104	0.95	0.73	0.95	0.73	0.485	0.73	0.27	0.88	0.50	0.087	0.73	0.27	0.50	0.27	0.026	0.73	0.50	0.88	0.27	0.087	0.0000100
A67	0.98	0.88	0.88	0.73	0.557	0.98	0.88	0.98	0.50	0.425	0.88	0.27	0.95	0.73	0.165	0.27	0.27	0.50	0.27	0.010	0.88	0.12	0.98	0.73	0.075	0.0000286
A68	0.95	0.27	0.27	0.27	0.019	0.95	0.50	0.88	0.05	0.020	0.73	0.27	0.50	0.50	0.049	0.73	0.50	0.73	0.27	0.072	0.88	0.27	0.95	0.27	0.061	0.0000001
A69	0.98	0.27	0.50	0.50	0.066	0.95	0.73	0.95	0.27	0.178	0.73	0.27	0.95	0.27	0.050	0.73	0.73	0.73	0.50	0.195	0.73	0.12	0.95	0.50	0.042	0.0000048
A70	0.95	0.73	0.27	0.27	0.050	0.88	0.50	0.73	0.12	0.038	0.27	0.27	0.50	0.12	0.004	0.88	0.12	0.27	0.12	0.003	0.88	0.27	0.88	0.12	0.025	0.0000000
A72	0.98	0.50	0.73	0.73	0.262	0.95	0.88	0.95	0.27	0.215	0.88	0.50	0.88	0.73	0.284	0.73	0.50	0.88	0.73	0.235	0.88	0.27	0.88	0.73	0.153	0.0005743
A73	0.98	0.27	0.73	0.73	0.141	0.98	0.73	0.98	0.12	0.084	0.73	0.50	0.88	0.73	0.235	0.88	0.50	0.88	0.50	0.194	0.50	0.50	0.98	0.73	0.179	0.0000972
A74	0.98	0.73	0.50	0.27	0.097	0.95	0.73	0.95	0.50	0.332	0.27	0.50	0.88	0.50	0.059	0.73	0.27	0.73	0.27	0.039	0.95	0.73	0.88	0.50	0.307	0.0000225
A75	0.98	0.27	0.73	0.27	0.052	0.95	0.73	0.95	0.50	0.332	0.88	0.27	0.88	0.73	0.153	0.73	0.27	0.50	0.27	0.026	0.73	0.12	0.88	0.50	0.038	0.0000027
A76	0.98	0.50	0.73	0.50	0.179	0.98	0.73	0.88	0.27	0.170	0.73	0.50	0.88	0.50	0.161	0.73	0.50	0.88	0.73	0.235	0.73	0.50	0.98	0.50	0.179	0.0002076
A77	0.98	0.50	0.50	0.50	0.123	0.95	0.73	0.88	0.50	0.307	0.88	0.27	0.88	0.50	0.104	0.88	0.27	0.73	0.27	0.047	0.88	0.27	0.95	0.27	0.061	0.0000111
A78	0.98	0.27	0.73	0.27	0.052	0.98	0.50	0.88	0.12	0.052	0.73	0.27	0.88	0.73	0.127	0.50	0.27	0.50	0.50	0.034	0.88	0.50	0.98	0.27	0.116	0.0000013
U56	0.98	0.50	0.73	0.50	0.179	0.95	0.50	0.95	0.12	0.054	0.88	0.50	0.88	0.73	0.284	0.73	0.50	0.88	0.73	0.235	0.73	0.27	0.98	0.50	0.097	0.0000625

S Students   F Faculty   A Administrators   TL = Trait level

a $P(X_{is}) = e^{(\theta s - \beta i)} / 1 + e^{(\theta s - \beta i)}$ (Equation 3.1)

b $L(\underline{X}s) = P_{1s}\, P_{2s}\, P_{3s} \ldots P_{20s}$ (Equation 3.2)

c $L(\underline{X}s) = P_{j1}\, P_{j2}\, P_{j3} \ldots P_{j80}$ (Equation 3.3)

ANNEX E2. Probability of 20 observed item and 37 participant for LULIFUK sample

TL	EFFECTIVENESS 1	2	3	4	Prob^b	AUSTERITY 1	3	1	4	Prob^b	SOLIDARITY 3	4	2	4	Prob^b	ANTICIPATION 2	4	3	4	Prob^b	DELIBERATION 1	3	1	4	Prob^b	Probab^c
P	probability					probability					probability					probability					probability					
S1	0.95	0.88	0.50	0.12	0.050	0.95	0.73	0.88	0.27	0.165	0.73	0.73	0.50	0.50	0.195	0.73	0.27	0.12	0.27	0.006	0.95	0.50	0.73	0.05	0.020	0.0000002
S2	0.95	0.50	0.73	0.27	0.094	0.98	0.50	0.88	0.50	0.316	0.50	0.27	0.88	0.50	0.059	0.88	0.50	0.73	0.50	0.059	0.88	0.50	0.73	0.12	0.038	0.0000040
S4	0.88	0.88	0.50	0.27	0.104	0.95	0.73	0.88	0.27	0.165	0.73	0.27	0.88	0.73	0.087	0.88	0.50	0.73	0.27	0.087	0.88	0.50	0.88	0.27	0.104	0.0000135
S5	0.98	0.73	0.50	0.12	0.043	0.98	0.73	0.88	0.50	0.316	0.88	0.27	0.73	0.73	0.127	0.73	0.50	0.27	0.27	0.026	0.88	0.27	0.88	0.50	0.104	0.0000047
S6	0.98	0.95	0.12	0.50	0.056	0.98	0.27	0.98	0.73	0.190	0.88	0.50	0.50	0.12	0.161	0.88	0.73	0.12	0.27	0.021	0.98	0.88	0.88	0.12	0.091	0.0000032
S7	0.88	0.50	0.73	0.12	0.038	0.98	0.73	0.88	0.27	0.170	0.73	0.50	0.50	0.50	0.161	0.73	0.50	0.73	0.50	0.134	0.88	0.50	0.95	0.73	0.307	0.0000431
S8	0.88	0.88	0.73	0.50	0.284	0.95	0.73	0.95	0.27	0.178	0.73	0.27	0.73	0.50	0.039	0.73	0.27	0.50	0.50	0.091	0.95	0.73	0.73	0.27	0.137	0.0000245
S9	0.95	0.50	0.50	0.12	0.042	0.95	0.73	0.95	0.27	0.178	0.50	0.50	0.73	0.50	0.091	0.50	0.12	0.50	0.27	0.004	0.73	0.50	0.88	0.12	0.038	0.0000001
S11	0.98	0.73	0.73	0.50	0.262	0.95	0.73	0.88	0.27	0.165	0.73	0.88	0.73	0.50	0.235	0.73	0.50	0.27	0.27	0.026	0.73	0.50	0.95	0.50	0.174	0.0000469
S14	0.95	0.50	0.50	0.27	0.064	0.95	0.88	0.88	0.73	0.540	0.88	0.73	0.95	0.12	0.448	0.27	0.73	0.50	0.73	0.072	0.95	0.27	0.95	0.50	0.122	0.0013361
S17	0.88	0.73	0.50	0.27	0.087	0.95	0.50	0.88	0.27	0.113	0.50	0.50	0.88	0.27	0.059	0.73	0.27	0.27	0.12	0.006	0.88	0.27	0.73	0.12	0.021	0.0000001
S19	0.95	0.50	0.73	0.50	0.174	0.95	0.73	0.95	0.50	0.332	0.50	0.73	0.88	0.50	0.104	0.88	0.73	0.73	0.50	0.087	0.88	0.27	0.95	0.50	0.113	0.0000589
S20	0.98	0.50	0.73	0.27	0.097	0.98	0.73	0.95	0.27	0.184	0.73	0.88	0.73	0.50	0.087	0.73	0.73	0.27	0.73	0.105	0.73	0.27	0.95	0.73	0.137	0.0000221
S21	0.88	0.88	0.50	0.12	0.046	0.95	0.73	0.95	0.50	0.332	0.73	0.50	0.73	0.12	0.032	0.73	0.27	0.27	0.27	0.014	0.88	0.12	0.88	0.12	0.011	0.0000001
S22	0.95	0.73	0.73	0.27	0.137	0.95	0.73	0.88	0.27	0.165	0.88	0.50	0.73	0.27	0.087	0.73	0.50	0.12	0.12	0.005	0.88	0.27	0.73	0.12	0.021	0.0000002
S23	0.95	0.50	0.73	0.50	0.174	0.95	0.73	0.95	0.73	0.485	0.88	0.50	0.50	0.50	0.110	0.50	0.50	0.73	0.50	0.134	0.73	0.73	0.95	0.50	0.255	0.0031162
S25	0.88	0.73	0.50	0.50	0.161	0.95	0.73	0.88	0.27	0.165	0.88	0.12	0.50	0.73	0.284	0.88	0.12	0.50	0.50	0.014	0.73	0.50	0.88	0.27	0.087	0.0000092
S26	0.95	0.50	0.73	0.12	0.042	0.98	0.73	0.95	0.27	0.184	0.73	0.50	0.73	0.50	0.134	0.73	0.50	0.12	0.12	0.005	0.88	0.12	0.88	0.27	0.025	0.0000001
S27	0.88	0.73	0.50	0.12	0.038	0.88	0.73	0.95	0.27	0.153	0.50	0.73	0.73	0.27	0.026	0.73	0.12	0.27	0.73	0.032	0.88	0.50	0.88	0.50	0.194	0.0000010
S28	0.95	0.73	0.73	0.27	0.137	0.95	0.73	0.95	0.50	0.332	0.73	0.73	0.73	0.50	0.195	0.73	0.27	0.27	0.27	0.026	0.88	0.50	0.88	0.27	0.104	0.0000245
S29	0.95	0.73	0.73	0.27	0.137	0.95	0.73	0.88	0.27	0.165	0.73	0.50	0.73	0.50	0.134	0.73	0.73	0.73	0.27	0.012	0.88	0.50	0.88	0.27	0.104	0.0000037

ANNEX E2. Probability of 20 observed item and 37 participant for LULIFUK sample

TL / P^c	EFFECTIVENESS 1	2	3	4	Prob^b	AUSTERITY 1	3	1	4	Prob^b	SOLIDARITY 3	4	2	4	Prob^b	ANTICIPATION 2	4	3	4	Prob^b	DELIBERATION 1	3	1	4	Prob^b	Probab^c
S30	0.88	0.73	0.50	0.27	0.087	0.88	0.88	0.95	0.50	0.370	0.88	0.73	0.27	0.50	0.087	0.73	0.73	0.50	0.50	0.134	0.95	0.12	0.73	0.27	0.022	0.0000083
S31	0.88	0.73	0.50	0.27	0.087	0.95	0.50	0.95	0.27	0.122	0.73	0.50	0.88	0.50	0.161	0.73	0.50	0.73	0.27	0.072	0.88	0.73	0.88	0.27	0.153	0.0000186
S33	0.95	0.73	0.73	0.27	0.137	0.95	0.73	0.95	0.50	0.332	0.73	0.73	0.88	0.12	0.056	0.73	0.27	0.27	0.50	0.026	0.88	0.50	0.73	0.50	0.161	0.0000108
S34	0.95	0.88	0.73	0.12	0.073	0.98	0.73	0.88	0.27	0.170	0.73	0.50	0.50	0.27	0.049	0.88	0.27	0.12	0.12	0.003	0.95	0.50	0.73	0.12	0.042	0.0000001
S35	0.95	0.88	0.50	0.27	0.113	0.88	0.73	0.88	0.27	0.153	0.73	0.50	0.88	0.50	0.161	0.73	0.50	0.27	0.27	0.026	0.88	0.50	0.95	0.27	0.113	0.0000083
S36	0.95	0.73	0.73	0.50	0.255	0.98	0.73	0.88	0.27	0.170	0.50	0.50	0.88	0.12	0.026	0.50	0.50	0.50	0.27	0.034	0.73	0.27	0.88	0.27	0.047	0.0000018
S37	0.88	0.73	0.50	0.50	0.161	0.98	0.73	0.95	0.50	0.342	0.73	0.50	0.50	0.50	0.091	0.50	0.50	0.27	0.50	0.034	0.88	0.50	0.88	0.27	0.104	0.0000176
F10	0.95	0.88	0.88	0.27	0.199	0.88	0.73	0.95	0.50	0.307	0.73	0.50	0.88	0.50	0.161	0.73	0.27	0.73	0.50	0.072	0.88	0.50	0.88	0.27	0.104	0.0000736
F3	0.95	0.73	0.50	0.27	0.094	0.95	0.73	0.88	0.50	0.307	0.73	0.50	0.88	0.50	0.161	0.88	0.27	0.50	0.27	0.032	0.88	0.50	0.95	0.27	0.113	0.0000166
F12	0.95	0.88	0.50	0.27	0.113	0.98	0.88	0.95	0.12	0.098	0.73	0.50	0.88	0.50	0.161	0.88	0.12	0.50	0.27	0.014	0.95	0.50	0.88	0.27	0.113	0.0000028
F13	0.95	0.73	0.73	0.27	0.137	0.95	0.50	0.95	0.27	0.122	0.50	0.50	0.88	0.50	0.110	0.73	0.27	0.27	0.27	0.014	0.88	0.50	0.88	0.27	0.104	0.0000027
F15	0.98	0.50	0.73	0.27	0.097	0.95	0.50	0.95	0.27	0.122	0.50	0.50	0.73	0.73	0.134	0.73	0.27	0.50	0.27	0.026	0.73	0.27	0.95	0.27	0.050	0.0000021
F24	0.95	0.73	0.50	0.27	0.094	0.95	0.73	0.95	0.73	0.485	0.73	0.73	0.88	0.73	0.344	0.50	0.50	0.50	0.27	0.034	0.88	0.50	0.88	0.27	0.104	0.0000548
F32	0.95	0.50	0.50	0.50	0.119	0.95	0.73	0.95	0.50	0.332	0.88	0.50	0.88	0.73	0.284	0.73	0.27	0.73	0.50	0.072	0.88	0.50	0.95	0.50	0.210	0.0001688
A16	0.98	0.73	0.50	0.27	0.097	0.98	0.73	0.95	0.27	0.184	0.73	0.73	0.88	0.50	0.235	0.73	0.73	0.50	0.50	0.134	0.88	0.50	0.95	0.50	0.210	0.0001171
A18	0.95	0.88	0.73	0.50	0.307	0.95	0.73	0.95	0.50	0.332	0.73	0.50	0.73	0.50	0.134	0.88	0.12	0.27	0.27	0.008	0.88	0.27	0.88	0.12	0.025	0.0000026

S Students   F Faculty   A Administrators   TL = Trait level

a $P(X_{is}) = e^{(\theta_s - \beta_i)} / 1 + e^{(\theta_s - \beta_i)}$ (Equation 3.1)

b $L(\underline{X_s}) = P_{1s} P_{2s} P_{3s}...P_{20s}$ (Equation 3.2)

c $L(\underline{X_s}) = P_{j1} P_{j2} P_{j3}...P_{j37}$ (Equation 3.3)

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