

**Government policy and choice of undergraduate programme in
Ecuador**

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Abstract

This thesis investigates how government policy has related to the choice of undergraduate programme in Ecuador, and introduces a typology of political dispositions as influential in the selection process. The study relies on the motivations for choosing STEM (Science, Technology, Engineering and Mathematics) majors as reported by the students themselves, and their background factors of gender, socio-economic status, geographical region, and prior academic attainment. Data was collected by using a combination of online surveys and in-person structured interviews to first-year undergraduates from two universities: one focused on STEM education, and the other on arts, for comparison.

The study revealed that a significant minority of STEM students (45.0%) reported the government message on the importance of STEM as influential in their choice of higher education course. The students reported as top motivations the aspiration to get a high-paid job, start working to contribute to society, their own inspiration, confidence in the subject, interest in the subject, and monetary issues. The government message was more influential among STEM students who were women, lower class, coastlanders, and high achievers.

The results confirm previous findings in other countries, in that the government can influence young people to choose STEM subjects. This study advances the literature by showing that students react differently to the government's message, and affects their choice. This thesis sheds light on what drives the choice of STEM undergraduate programmes in a developing country.

Keywords: career decision-making, government policy, higher education subject choice, STEM, mixed methods, *Buen Vivir*

Table of Contents

Abstract.....	2
Table of Contents.....	3
List of Tables.....	8
List of Figures.....	10
Acknowledgements.....	11
Author’s declaration.....	13
Chapter 1: Introduction.....	14
1.1 Background to the research study.....	14
1.2 Reflection on the extent to which Ecuador is a particular case for this study.....	16
1.3 Contribution to knowledge.....	18
1.4 Organisation of the thesis.....	19
Chapter 2: Review of the literature.....	21
2.1 Introduction.....	21
2.2 Literature search strategy.....	21
2.3 Definition of key terms in the current study.....	24
2.4 Higher education in Ecuador before and after the CR government.....	25
2.4a Background on the change of the Ecuadorian HES.....	30
2.4b The CR impact on Ecuadorian universities.....	32
2.5 Good Living and the CR government.....	50
2.6 Ecuadorian government policy in relation to STEM and higher education.....	53
2.7 Conclusion.....	60

Chapter 3: Factors that influence the choice of STEM majors	62
3.1 Introduction	62
3.2 Ecuadorian government messages on the choice of STEM undergraduate programmes	63
3.2a What research says about the influence of government messages on the choice of STEM undergraduate subjects	70
3.3. Comparison of higher education government policy in Ecuador and other countries ..	73
3.4 Motivations for the choice of STEM undergraduate courses	77
3.4a Getting a high-paid job	81
3.4b Helping others.....	82
3.4c Own inspiration and significant persons’ influence	83
3.4d Confidence in the subject	87
3.4e Interest in the subject	88
3.4f Financial problems	92
3.4g Science and math course taking in high school in STEM aspirations	93
3.4h School influence and the choice of STEM	94
3.5 Influence of students’ background characteristics in the choice of undergraduate STEM programmes	95
3.5a Gender.....	97
3.5b SES	99
3.5c Geographical region.....	101
3.5d Attainment	101
3.6 Conclusion.....	103
Chapter 4: Methodology	105
4.1 Introduction	105

4.2 Scope of the study	105
4.3 Rationale for using a mixed methods research design	110
4.4 Participants and sampling.....	112
4.5 Instruments	117
4.5a Surveys.....	118
4.5b Interviews	126
4.6 Ethical considerations	129
4.7a Survey data analysis.....	135
4.7b Interview data analysis	135
4.8 Conclusion.....	138
 Chapter 5: The extent to which the Ecuadorian government’s message about the importance of STEM subjects influenced undergraduates’ subject choice	 141
5.1 Introduction	141
5.2 The influence of the government’s message on the participants’ choice of HE course	 142
5.3 Analysis of the participants’ positions concerning the influence of government on their choice of HE course	 145
5.3a Positively influenced students	148
5.3b Active rejecters	155
5.3c Passive rejecters	161
5.3d Apolitical participants.....	168
5.4 Conclusion.....	169
 Chapter 6: Motivations reported by the participants for selecting their HE course.....	 171
6.1 Introduction	171
6.2 Participants’ motivations for their choice of HE course	172

6.3 Analysis of motivations for the choice of HE course.....	177
6.3a Get a high-paid job	177
6.3b Start working to contribute to society.....	179
6.3c Inspiration did not come from other people, but from the student	181
6.3d Confidence in the subject	187
6.3e Interest in the subject	189
6.3f Monetary issues.....	195
6.4 Conclusion.....	198
 Chapter 7: Variations of the motivations reported by STEM undergraduates in terms of their demographic and academic characteristics	 200
7.1 Introduction	200
7.2 Variations of participants' motivations for their choice of HE course in terms of demographic and academic characteristics	 202
7.3 Analysis of variations in participants' motivations for their choice of HE course in relation to demographic and academic characteristics	 207
7.3a Gender.....	207
7.3b SES	211
7.3c Geographical region.....	215
7.3d Attainment	218
7.4 Conclusion.....	222
 Chapter 8: Discussion	 223
8.1 Introduction	223
8.2 Influence of the Ecuadorian government's message about the importance of STEM subjects on the choice of STEM undergraduate courses in Ecuador	 226

8.3 Motivations reported by undergraduate students enrolled on STEM degree programmes for selecting their courses.....	231
8.4 Variations in the motivations reported by STEM undergraduates in terms of demographic and academic characteristics	236
8.5 Conclusion.....	240
Chapter 9: Conclusion.....	243
9.1 Answers to research questions	243
9.2 Strengths and limitations of the study	244
9.3 Implications for theory and practise	245
9.4 Recommendations for further research	246
Appendix A.....	248
Appendix B	260
Appendix C.....	263
Appendix D.....	268
Appendix E	282
List of Abbreviations and Acronyms	284
References.....	286

List of Tables

Table 2. 1. Ecuadorian government investment across fields of study between 2009 and 2011 (percentages in relation to the total of R&D investment).....	38
Table 2. 2. Number of students enrolled at Ecuadorian HEIs by gender, 2012-2015	47
Table 2. 3. Number of students enrolled at the Arts and STEM University in 2014 and 2015	47
Table 2. 4. Percentage of enrolled students by field of knowledge, 2012-2015	48
Table 4. 1. Survey and interview participants by geographical region, ethnicity, gender, sex and disability	113
Table 4. 2. Number of participants by ethnic group at each university and its comparison with the total student population.....	114
Table 4. 3. Comparison between percentage of respondents in the sample and at each institution	124
Table 5. 1. Participants’ motivation to study at the Arts/STEM universities (survey data, n=108).....	146
Table 5. 2. Motivational factors for the choice of HE courses and university concerning students’ political dispositions.....	147
Table 5. 3. HE courses available at the Arts and STEM University.....	149
Table 6. 1. Motivational factors influencing HE course choice (survey data).....	173
Table 6. 2. Cross-tabulations of motivational factors and institutions	175
Table 6. 3. Typology of political dispositions crosstabulated with subject choice motivational factors	176

Table 7. 1. Typology of political dispositions crosstabulated with demographic and academic variables, and institution.....	205
Table 7. 2. Variation of the 6 subject choice motivational factors in relation to demographic and academic characteristics at both universities	206
Table 7. 3. Crosstabulation between gender, typology of dispositions in relation to the influence of government's message, and institution	208
Table 7. 4. Variations of the 6 subject choice motivational factors in relation to gender and institutions	210
Table 7. 5. Crosstabulation between ses, typology of dispositions in relation to the influence of government's message, and institution	212
Table 7. 6. Variations of the 6 subject choice motivational factors in relation to SES and institutions	213
Table 7. 7. Crosstabulation between geographical region, typology of dispositions in relation to the influence of government's message, and institution	216
Table 7. 8. Variations of the 6 subject choice motivational factors in relation to geographical region and institutions	218
Table 7. 9. Crosstabulation between attainment, typology of dispositions in relation to the influence of government's message, and institution	220
Table 7. 10. Variations of the 6 subject choice motivational factors in relation to attainment and institutions.....	221

List of Figures

Figure 2. 1. Number of undergraduate and postgraduate international scholarships awarded by the Ecuadorian government between 1995 and 2014. Adapted from Secretaría de Educación Superior, Ciencia, Tecnología e Innovación, 2014b, 26.....	28
Figure 2. 2. Number of PhDs awarded in Ecuador between 2009 and 2011	30
Figure 2. 3. Number of HEIs in Ecuador across the years. The number of universities in this figure is cumulative and shows a decrease after the CR government put into action the evaluation and categorization of HEIs.....	34
Figure 4. 1. Sequential Explanatory Design used in the current study.....	111
Figure 4. 2. Data collection and analysis process during the pilot and main study	134
Figure 5. 1. The typology of political dispositions concerning the influence of the government's message on participants' subject choice (data obtained from Q7 in the survey).....	143
Figure 8. 1. Answers to the three research questions in this study and the overarching argument of the Discussion Chapter.....	225

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Author's declaration

I declare that this thesis is a presentation of original work and I am the sole author. This work has not previously been presented for an award at this, or any other, University. All sources are acknowledged as References.

Chapter 1: Introduction

1.1 Background to the research study

The Ecuadorian government has been establishing education policies to improve higher education (HE) across the country since 2007. For a decade, President Rafael Correa and his Citizens' Revolution (CR) government have worked in the aforesaid and other strategic areas in an attempt to leave behind the old Ecuador that had seven presidents between 1996 and 2006, and which was governed amidst political and economic instability. Now, the country is facing a new era towards a goal: reaching the society of *Sumak Kawsay*, *Buen Vivir* or Good Living.

The government had a clear idea that the betterment of the tertiary education system in Ecuador, with a particular emphasis on developing specific STEM fields, is the engine of Good Living and economic development. In this respect, the CR government created its 4 emblematic or flagship universities that are public (free of charge) and world-class according to the words of President Correa during a lecture at Yale University (Ecuador's political, science and knowledge transformations, 2014; Yale University, 2014). During that event, Correa went further and mentioned one of the four institutions which he described "as the most important project in our country's history". Precisely that Science, Technology, Engineering and Mathematics (STEM) university will be the focus of the current research which attempts to contribute to the body of knowledge on higher education subject choice. For the purpose of this investigation, student prospects refer to individuals who requested admission into an undergraduate STEM (or arts) course, and were already enrolled in their first year at university. In this regard, the analysis of the choice of HE course is retrospective.

Despite the vast literature on the mixture of motivations for individuals to select a university programme, this study is based on the identification of three research gaps. First, it

is largely unknown the extent to which the Ecuadorian government's message on the significance of STEM subjects has influenced the decision making of undergraduate students currently enrolled in higher education in Ecuador. Related to this theme, the amount of research on this topic in the Ecuadorian context is relatively new if we consider that the STEM university which will be the focus of this study officially opened its doors in March 2014 (Yachay Tech, 2016).

Second, the drivers that undergraduate students enrolled on STEM courses report for selecting their field of study seem to be unexplored within the recently created university. Concerning this matter, available studies on what motivates undergraduate students to select their subjects at this STEM oriented university might not be found at the moment which contrasts with the presence of several studies in other countries regarding motivational factors that influence the choice of HE courses. (Ahmad & Buchanan, 2015; Bieri Buschor, Berweger, Keck Frei & Kappler, 2014; Chachashvili-Bolotin, Milner-Bolotin & Lissitsa, 2016).

Lastly, it is unknown whether the drivers mentioned by STEM undergraduate students in the described Ecuadorian context vary in terms of their background characteristics such as their gender, socioeconomic status (SES), geographical region, and attainment. Findings regarding this matter may not only shed light on the impact of background characteristics, but also understand what should be done to build a more inclusive university system that fits the ideology proposed by the Good Living model.

Beyond exploring these research gaps, the objective of this study is essentially to examine how government policy has influenced the choice of STEM undergraduate programmes in Ecuador. In order to address the objective and the research gaps abovementioned, three research questions are proposed:

RQ1. To what extent has the current Ecuadorian government's message about the importance of Science, Technology, Engineering and Mathematics (STEM) subjects influenced the subject choices of students currently enrolled in higher education in Ecuador?

RQ2. What motivations do undergraduate students enrolled on STEM degree programmes report for selecting their course?

RQ3. Do the motivations reported by STEM undergraduates vary in terms of background characteristics (i.e. by gender, socioeconomic status, geographical region, and attainment)?

1.2 Reflection on the extent to which Ecuador is a particular case for this study.

There is a shared government policy in several countries around the world in relation to investment and increasing the number of young people going into STEM (Freeman, Marginson & Tytler, 2016). This is exactly what the Ecuadorian government has been doing during the last decade. There exists a significant higher allocation of resources in STEM education in terms of what used to be the case in Ecuador before 2007, that is combined with governmental messages to encourage HE enrolment in STEM majors in the discursive context of the transformation of the production matrix for Good Living. One evidence of the higher allocation of resources in STEM education that also included governmental messages to promote STEM can be seen in the creation of Yachay Tech, which according to former President Correa was the most important project of his government (*René Ramírez: “Cuatro universidades, 2013*).

As other countries, government policy in Ecuador is motivated by economic imperatives. From an economic development perspective, the last decade has seen the efforts of the Ecuadorian government to change its production matrix. This transformation of the production matrix in the context of Ecuador means to move from an oil-dependent and extractivist economy to an economy that is based on the production of knowledge (Buen

Vivir TV, 2014, 8:10). With respect to this, four government universities were created during Correa's administration, two of which provide STEM education and research. In addition, a prominent scholarship programme to promote graduate studies for Ecuadorians in world leading universities, with a focus on STEM majors, has been implemented since 2007 (*SENESCYT invirtió \$400 millones*, 2016). By saying that the scholarship programme has been prominent, these lines mean that during the decade before the CR government came to power (1995-2006), the number of scholarships awarded to study abroad was 237 while that number increased to 20,000 by early 2017 as it will be shown in Chapter 2 (see Figure 2.1). The HE investment, which was 0.7% of the GDP in 2006, reached 2.1% which means that the country invested more in HE than other Latin American countries such as Argentina, Bolivia, Brazil, Chile, Colombia, Mexico and Uruguay (*Secretaría de Educación Superior, Ciencia, Tecnología e Innovación*, 2014b). In this respect, Lloyd (2017), mentioned that this spending is by far the highest proportional in Latin America and “significantly higher than the average of OECD – Organisation for Economic Co-operation and Development – member countries.”.

The Ecuadorian case is also similar to other countries since there are inequalities across different demographics. In this respect, the focus on social inclusion in the politics of Ecuador during the last decade is believed to be the leading force behind going from a lower-middle-income to an upper-middle-income economy in the World Bank classification (The World Bank, n.d.-a; The World Bank, n.d.-b). In line with this growth, there has been a reduction in income inequality. The Ecuadorian social inclusion discourse has at its core the education policy and expansion in HE access for vulnerable populations. Regarding this, there was an increase in access to HE of Indigenous and Afro-descendant people, showing that the gross rate percentages regarding attendance of these historically excluded populations

between 2006 and 2013 augmented 8 and 11.4 percentage points, respectively (Logros SNNA, n.d.).

Other similarities of Ecuador to other nations are the increasing numbers of people going to HE (see Figure 2.1 and Table 2.2), the big access to STEM fields (see Table 2.4), and academic quality issues in HE (in the case of some South American countries as it will be seen in Chapter Two). Nevertheless, Ecuador is an interesting particular country where there has not been much work done until now and this study has a contribution to make.

1.3 Contribution to knowledge

This thesis focuses on the Ecuadorian government initiative to raise the number of young people taking STEM courses at university. A typology of political dispositions in relation to government's influence on subject choice was developed in this study, which had four types of students: positively influenced, active rejecters, passive rejecters, and apolitical. Positively influenced students were those participants who agreed with the idea of being influenced by the government's messages when they selected their HE course; active rejecters were students who actively reject the idea that they were influenced by the government when they chose their HE course; passive rejecters were students who were aware of the government's message and passively stated that it did not influence their subject choice; and apolitical students were those participants who reported that the government did not influence their subject choice and they were not interested in politics.

The literature on higher education subject choice has shown that government initiatives to persuade young people to choose STEM subjects can be effective (Henriksen, Jensen & Sjaastad, 2015; Smolentseva, 2016). This study confirms these previous findings since the Ecuadorian government initiative to persuade young people to select STEM subjects influenced a significant minority of respondents. This research revealed that the

government message on the importance of STEM influenced almost half of the STEM participants when they selected their subject (21.4% of the sample were STEM students who reported that they were influenced by the government while 26.2% were STEM students who reported no influence from the government on their choice of subject). This study advances the literature on higher education subject choice demonstrating that there are different political reactions to the government's message, which we did not know before. The contribution to knowledge of this thesis is the development of the typology that was introduced above, which has not been addressed before in the literature, showing that a significant minority of STEM students were influenced by the government message when they chose their subject, and that is related to particular motivational factors, and the students' demographic and academic characteristics.

1.4 Organisation of the thesis

After this introduction, this thesis has eight more chapters. Chapter Two presents the political and historical context of Ecuador and the changes in higher education during the last decade. Chapter Three presents a review of the literature on the factors that influence the choice of STEM subjects, focusing on government messages, motivational factors beyond the government, and students' background and academic characteristics. Chapter Four presents the methodology that was used in this study. Chapter Five is the first empirical chapter and it focuses on the findings in relation to the first research question. Here I introduce the typology of political dispositions in relation to the influence of government's message on subject choice. In Chapter Six, I present the top six motivational factors regarding the choice of subject that emerged from the survey data, which are beyond government's messages. Chapter Seven presents the findings in relation to how the six motivational factors varied by participants' background and academic characteristics. Chapter Eight presents a discussion of

the findings in the three empirical chapters and compares these results with those presented in the literature review. Lastly, Chapter Nine presents the conclusion of this thesis and will address the limitations and the recommendations for policy making and further research.

Chapter 2: Review of the literature

2.1 Introduction

This review of the literature draws on educational and economic material to contextualise my current research on government policy and choice of STEM undergraduate programmes. This chapter starts with the literature search strategy that is described in 2.2 while a definition of key terms for the current study is provided in 2.3. The chapter then explores the history on higher education in Ecuador before and after the CR government in 2.4 where background on the change of the Ecuadorian HES and the CR impact on Ecuadorian universities will be addressed. Section 2.5 will explore Good Living and the CR government before reaching the conclusion of this chapter in 2.6.

2.2 Literature search strategy

The process of reviewing the literature was carried out by using educational research databases, library catalogues and books to gather information on how undergraduates choose their major based on governmental messages, people and events in their lives, and background characteristics. This systematic approach to searching the literature involved the use of the following subject keywords: "Good Living", "Buen Vivir", "Ecuador", "South America", "Latin America", "governmental message", "science", "technology", "engineering", "mathematics", "student choice of STEM", "decision-making", "higher education", "higher education choice", "higher education programme", "motivation", "drivers", "undergraduate students", "STEM degree programmes", "STEM undergraduates", "course selection" and "major selection", "background characteristics", "gender", "socioeconomic status", "geographical region" and "attainment".

In this process of searching for literature, two phases can be mentioned. The first phase in order to get background on the political changes that transformed the Ecuadorian higher education system (HES) was carried out by looking for information on the websites from the two universities in this study, the Secretariat of Higher Education, Science, Technology and Innovation (SENESCYT), the Ministry of Education, the Coordinator Ministry of Knowledge and Human Talent, the Admission and Levelling National System (SNNA), the Council of Evaluation, Accreditation and Assurance of Quality of Higher Education (CEAACES), the Development and Planning National Secretariat (SENPLADES), the Census and Statistics National Institute (INEC), Ama la vida TV, Buen Vivir TV, and Geoportal SNIESE. The use of online journal articles (such as Latin American Politics and Society, Journal of Democracy, Learning and Teaching, Development, Ecuador debate, and EduSol) and Ecuadorian and Latin American newspapers was also part of this first stage. As a starting point to explore literature, I received advice during my supervision meetings to explore journals such as Higher Education, Studies in Higher Education, Journal of Further and Higher Education, and Higher Education Research and Development. A limitation of focusing on these journals was that they were not focused on the Latin American context.

The second stage of searching for literature started after the first attempt of confirmation of PhD enrolment. One of the tasks that were set for re-submission had to do with moving towards a more systematic approach to searching the literature. In this respect, I explored three databases (Google Scholar, Scopus and Web of Science) and catalogues that are available at the University of York library website. After this meeting, I had several supervision meetings with my two academic supervisors where I developed more strategies for searching the literature. During this stage, I explored the White Rose eTheses Online repository to get information from PhD theses at the University of Leeds, University of York and University of Sheffield.

Here I provide a few examples about how I used combinations of keywords on the databases. Before searching, I selected the Web of Science Core Collection database, and set the time span from 2012 until 2017. I did this to get the latest studies in the field. Since I did not get enough material with this time span, I decided to add 5 more years (2007 until 2017). Before that, I had been looking for articles without setting a time span, and that is the reason why there are articles predating 2007. Afterwards, I typed one of the subject keywords in a box, and added another field with a different keyword, and so forth. For the combination of TOPIC: (Good Living*) AND TOPIC: (Higher education*) AND TOPIC: (Ecuador*), I got 5 results. A limitation that I found here was that I tried to find two of those articles at the University of York Library, and the items were not available, and if I wanted to obtain them, I had to contact the library (I did not contact the library since I got the article on Google Scholar). In the case of the rest of articles, they were not relevant to my study. I then used the same keywords but instead of using Ecuador, I replaced it by (South America*) and (Latin America*). Again, I did not find results that were relevant to my study in each of these new combinations. After searching these keywords on Web of Science, I used the same combination of keywords on Scopus, but in this case instead of clicking on Topic, I clicked on All. For the first combination, I got 2 document results, and I downloaded one of the articles that mentioned the case of the STEM University in the current study. When I replaced the keyword "Ecuador" and used "South America", I did not find any documents. However, when I tried "Latin America", I got 4 results and only one was related to my study (it was an article that I had previously found using combinations of keywords). In terms of relevance, I had articles that had the word STEM, but this was about stem cells. In other cases, the article had several keywords, but did not have a relation to my research topic.

I also explored prior attainment in the uptake of STEM subjects at HE level. For the case of prior attainment, I used Web of Science, and I combined these keywords: (prior

attainment*) AND (STEM uptake*) AND (higher education*). This combination only had one result. When I replaced the word uptake with choice, it was the same case. I repeated the same process using Scopus with the same combination of keywords that I described above (Web of Science), and I did not get any results.

2.3 Definition of key terms in the current study

Before writing about the context of Ecuadorian HE during the last decades, I provide the definition of some of the key terms that will be found across my study in subsequent lines:

- **STEM** is “learning and/or work in the fields of Science, Technology, Engineering and Mathematics, including preliminary learning at school prior to entry into the specific disciplines.” (Freeman, Marginson & Tytler, 2016, p. 3). These authors mention that the term, as the discipline grouping, are not standardized in international education policy or practice. In relation to this, there are cases where psychology, health, computing, agriculture, and environmental fields might or might not be included in the classification.
- **Motivation** can be defined in general as “the process whereby goal-directed activities are instigated and sustained.” (Schunk, Meece and Pintrich, 2014, p. 5). According to Pintrich and Schunk (2002), motivation is a process rather than a product. People do not observe motivation directly, but rather they infer it from behaviours such as effort, choice of tasks, persistence, and verbal expressions. Rolls (2014, p. 40-41) mentions that motivation makes a person work to obtain a reward (a stimulus or event that the person works to obtain) or escape from or avoid a punisher (what the person works to avoid or escape from such as a painful stimulus). He mentions that motivation may be considered a state in which the person is working for a goal.

- **Major** will be defined as “the subject one is primarily studying at university, similar to ‘course’ in the UK.” (US-UK Fulbright Commission, n.d.). The words *major*, *HE course*, and *subject* will be used interchangeably in this study.
- **TPM or Transformation of the Productive Matrix (change of the production matrix)** is an economic development plan that is designed to face the Ecuadorian historic dependence on exports of unprocessed natural resources, low levels of technological development and productivity, high levels of social exclusion, and structural dependence on foreign exchange earnings resulting from the export of oil (Purcell, Fernandez and Martinez, 2017). This means leaving behind the oil and extractivist economy in order to go towards the only economy that is based on infinite resources, based on human talent: the economy of ideas, knowledge and innovation (Universidad Yachay Tech, 2016).

2.4 Higher education in Ecuador before and after the CR government

From 1972 until 1979, Ecuador was under a military dictatorship (Sarzoza: “No hubo ayuda, 2011). After these years, the country returned to democracy, and the first president of this new era was Jaime Roldós Aguilera who died in an airplane accident. His vice-president replaced him and completed Roldós’ period. In 1984, León Febres-Cordero won the presidency and stayed in power until 1988 when Rodrigo Borja was elected President of the Republic and started his 4-year mandate. Sixto Durán-Ballén came to power in 1992 and he led the country until 1996 (“La décima elección presidencial”, 2013).

The political context from 1996 until 2006 was surrounded by instability which was a characteristic in Ecuador during those years. Generation of instability was caused within the Ecuadorian National Congress where opposition congressmen gathered to complicate the job of Presidents of the Republic. With respect to this, Mejia-Acosta and Polga-Hecimovich

(2011) found that intense congressional opposition was the most important repetitive factor for presidential ousting. Their article mentions how the rapid erosion of fickle government coalitions in the National Congress and the resulting policy deadlocks in the post-1996 era contributed to institutional crisis (such as the 1999 bank holiday to avoid the banking system collapse) and the premature termination of presidential mandates. During these ten years there were seven presidents (one faced the impeachment process and two were overthrown). The presidents were Abdalá Bucaram, Rosalía Arteaga, Fabián Alarcón, Jamil Mahuad, Gustavo Noboa, Lucio Gutiérrez, and Alfredo Palacio (“La décima elección presidencial”, 2013). This political instability had a negative effect in Ecuadorian HE. In CEAACES (2013), Guillaume Long, the former Minister Coordinator of Knowledge and Human Talent, mentioned that perhaps one of the most palpable elements of the public sector decomposition during the neoliberal period in Ecuador was the deregulation of HE in which there was an increase of privatization and commodification of HE, in particular through the proliferation of private universities without adequate planning and quality assurance policies, in which the National Congress was dedicated to create and distribute universities around the country. In April 2012, there were 45 universities that were created between 1992 and 2006 which meant a growth of 273% in only 14 years. In 2007, the country started a period of political and economic stability when Rafael Correa Delgado came to power via elections. Conaghan (2008) wrote about this political “left turn” in which Correa promised to end what he frequently referred to as “the long and sad night of neoliberalism” and put the country on its way to “socialism of the twenty-first century”.

Before becoming president, Rafael Correa promised that if he was elected head of state, he would implement *Los cinco ejes de la Revolución Ciudadana* (The five axes of the Citizens’ Revolution). Those five axes, which would be the policies of his government, were the Constitutional Revolution, the Ethics Revolution, the Production Revolution, the Social

Revolution, and the Sovereign Revolution (Presidente Rafael Correa Delgado República Ecuador, 2012). The Social Revolution emphasized quality in education and health as its cornerstone. During his political campaign in 2006, Correa mentioned that,

Education and health have become a privilege of a few people when they are fundamental rights of everybody. May the national pride consist in having education and health of massive access, of excellent quality and absolutely free for everyone who cannot afford it. (Presidente Rafael Correa Delgado República Ecuador, 2012)

Regarding the key principles in this Social Revolution, massive access had to do with ensuring that no one would be left behind in the abovementioned areas. Excellent quality meant that standards in all the levels of education would be raised in order to reach academic excellence. Eventually, the last key principle was related to ensure that all Ecuadorians had the opportunity to get free-of-charge education (which includes higher education) and health. With respect to free-of-charge education, there are other countries such as Finland where HE is provided without tuition fees (Dobson, 2016). Academic excellence and free-of-charge education are of importance in the current study and they will be explored in more detail later among the Ecuadorian government's messages in Chapter 3.

Once Rafael Correa became the President of Ecuador, the social revolution and the improvement of the educational system continued to be a priority of his team (“¿Cuánto ha cambiado Ecuador”, 2015). Part of the betterment can be perceived if we analyse the information on Figure 2.1, which was obtained from the Secretariat of Higher Education, Science, Technology and Innovation (Secretaría de Educación Superior, Ciencia, Tecnología e Innovación, 2014b). We can realize that after the CR government came to power, the number of higher education scholarships augmented considerably.

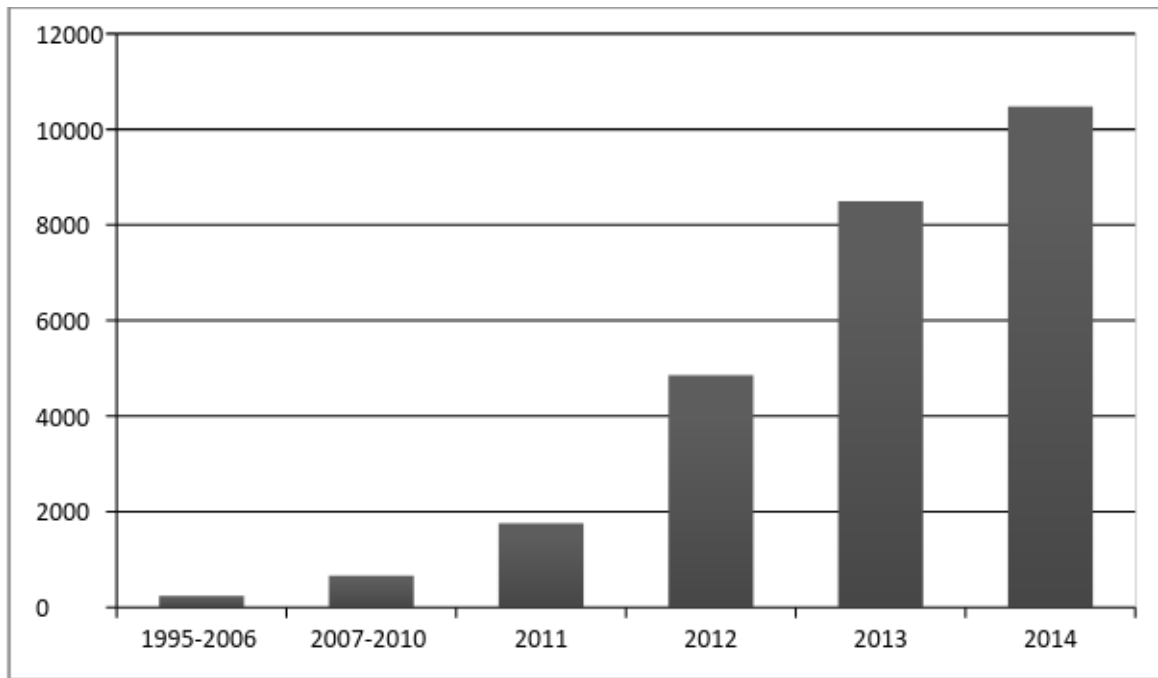


Figure 2. 1. Number of undergraduate and postgraduate international scholarships awarded by the Ecuadorian government between 1995 and 2014. Adapted from Secretaría de Educación Superior, Ciencia, Tecnología e Innovación, 2014b, 26.

Before Correa and his team could put into action their ideas, the new government had to stabilize since there was the risk for the head of state to be overthrown as other presidents in the former decade. This fear almost came true on September 30, 2010 (which was known as the 30-S), when elements of the Ecuadorian National Police organized a mutiny in Quito and other cities of the country in which, according to Correa, there were many infiltrators of political parties (“Para Correa, detrás de la revuelta”, 2010). José Miguel Insulza, the Secretary-General of the Organization of American States referred to the events as a coup d’état attempt (“Consejo Permanente de la OEA repudia hechos”, 2010). At the end of this crisis, Correa continued in power. He even won a new election and came into power for the third time (“Rafael Correa asume su tercer mandato”, 2013).

After the abovementioned events, Correa and his team returned their focus to improving the educational system within the universities and polytechnic schools. At this

point, it is worth reflecting on Correa's own educational background. Correa earned a *Maitre en Sciences Economiques* at the Catholic University of Louvain in Belgium, and both, a Master of Science and a Doctor of Philosophy degree at the University of Illinois at Urbana Champaign in the United States of America (Secretaría de Educación Superior, Ciencia, Tecnología e Innovación, n.d.). It seems that this personal academic background contributed to give him ideas on what had to be done with the entire system of universities in Ecuador. Besides studying in Europe and North America, he also advocated social justice missions. In this regard, an element that shaped his understanding of extreme poverty was his experience during a mission in an Ecuadorian highland village where he worked for a year among very poor indigenous people who traditionally had been excluded by governments (Tenemos a Rafael, 2013).

Dereliction of universities around the country had been a common denominator in recent years. An example of how HE was neglected was the low amount of PhDs that Ecuador was producing previously. In this respect, statistics from the *Secretaría de Educación Superior, Ciencia, Tecnología e Innovación* (2014a) that can be seen in Figure 2.2 show the low number of PhD students who graduated in Ecuador between 2009 and 2011 (7, 7, and 14 PhDs in 2009, 2010 and 2011, respectively). With respect to this, the insufficient amount of university tutors trained at a PhD level is not only something that happens in Ecuador, but also in other South American countries. Brazil, for instance, is working to improve the qualifications of the academic and research staff at Brazilian universities where only 28% had a PhD in 2010 (Horta & Lisboa Filho, 2016). Limitations are also found in the Venezuelan HES, where just a few tutors at the Bolivarian University of Venezuela had master or PhD degrees, being a Bachelors' degree the only requisite to teach (Ivancheva, 2013). Undoubtedly, Correa inherited a HE system that was facing serious problems. It seemed that it was not a business for politicians before Correa to prepare other people

academically since this would mean that educated minds would control their actions. The more uneducated citizens, the better for corruption among politicians. In this regard, Beets (as cited in Kaffenberger, 2012) mentions that higher education levels are linked with lower rates of corruption for different education indicators. Truex (2011) adds more information and expresses that more educated people are more critical of corruption, and concludes that education is a key element in shifting from corruption acceptance to corruption rejection.

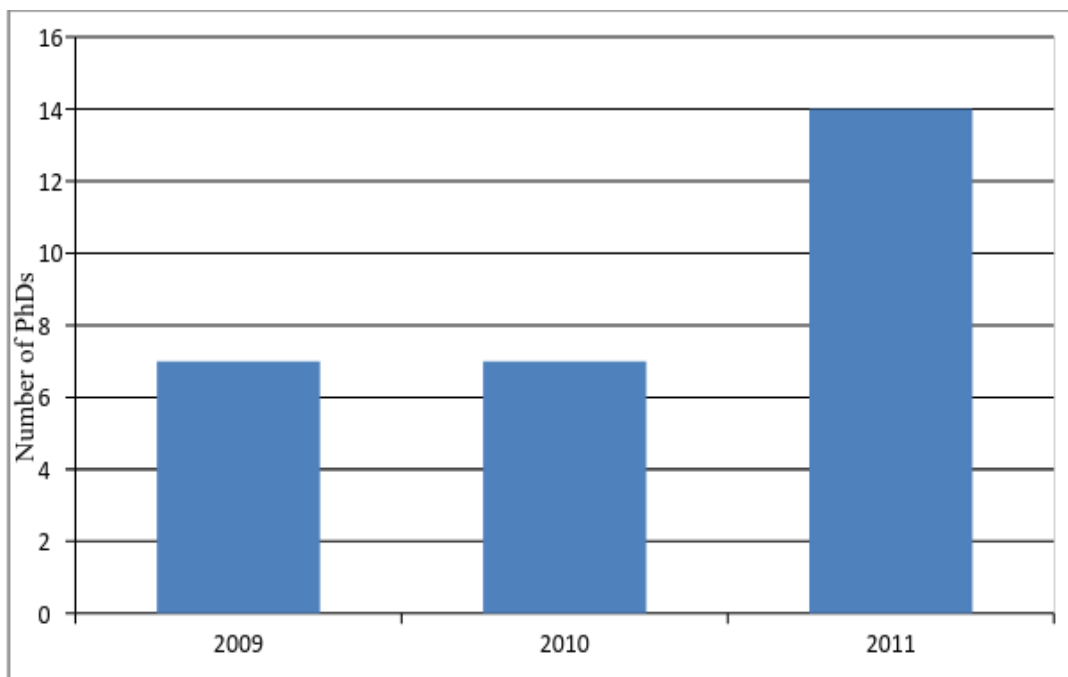


Figure 2. 2. Number of PhDs awarded in Ecuador between 2009 and 2011

2.4a Background on the change of the Ecuadorian HES

In order to understand the changes that the HES in Ecuador has undergone in recent years, it is necessary to mention some important events that facilitated the improvement of HEIs around the country. One of the first steps in this sense was to do something with the Ecuadorian National Congress which was dissolved in 2007 by the Ecuadorian Constituent Assembly or Constituent Assembly of Montecristi because of the alleged high level of dishonesty of its deputies (“Ecuador forum dissolves Congress”, 2007). As will be mentioned later, the National Congress created some low-quality universities without any planning or

taking into account the risks for the country. The replacement of the National Congress was the National Assembly of Ecuador under the 2008 Constitution (which replaced the 1998 Constitution).

In 2008 the Constituent Assembly of Montecristi started a new era in the Ecuadorian HES and the recovery of HE as a public good. In the socialist view of the CR government, the definition of a public good can be summarized as a free-of-charge service or element that is a right of all the citizens of a country (SENPLADES, 2013). During the debates, the assemblymen issued the Constituent Mandate Number 14 in which two of its articles ordered the elimination of the creation law of the *Universidad Cooperativa de Colombia* because of corruption, basically the trade of HE degrees (Minteguiaga, 2010 as cited in CEAACES, 2013). The Evaluation of the Institutional Performance of the Universities and Polytechnic Schools of Ecuador carried out by the CONEA (Ecuadorian Higher Education Evaluation and Accreditation National Council) classified all the universities and polytechnic schools of the country in five categories (A, B, C, D and E) and identified 26 universities that were in category E which had a deficient performance. The report determined that, excepting few cases, these universities had precarious equipment and infrastructure. They were premises such as houses where classes were taught in improvised schoolrooms or laboratories, without working spaces for lecturers and students, and spaces for libraries that were recognized with difficulty as spaces of research and reading. These universities responded to a commercial vision that did not show a compromise and ability to face social problems. (CONEA, 2009)

The CONEA was replaced by the CEAACES (Council of Evaluation, Accreditation and Quality Assurance of Higher Education). After evaluating all the Category-E universities, the CEAACES prepared a final report on the evaluation. Among the findings, there were serious limitations in terms of percentages of full-time lecturers, meritocracy in the selection of lecturers in order to get tenure positions, excessive workload for full-time lecturers

(tutoring and supervision of students), amount of lecturers holding a PhD, research and publications produced at those institutions, presentation of libraries, availability of student associations (CEAACES, 2013).

The following section will explore the attempts of the Ecuadorian government to improve the HE system. It will help the reader understand why the improvement of HE is important for the government's plan to change the production matrix of the country.

2.4b The CR impact on Ecuadorian universities

In order to better understand the philosophy of working of President Correa's team, a main concept should be introduced. The 2008 Ecuadorian Constitution (Constitución de la República del Ecuador 2008, 2008) mentions the concept of *El Buen Vivir* (Good Living), or *Sumak Kawsay*, which is a way of human living, based on diversity and harmony with nature. Gudynas (2011) establishes a difference between Ecuador's *Buen Vivir* and Bolivia's *Vivir Bien* (Living Well) in that the conceptual framework in *Buen Vivir* is not an ethical principle for the state, but a complex set of several rights, for example, the rights of nature. He adds that *Buen Vivir* acknowledges that there are several ways to give value (aesthetic, historical, environmental, cultural, spiritual), and other cultures will have to explore and develop their own *Buen Vivir*. Gudynas (2009b) mentions that Good Living has different contributions that in some cases come from indigenous knowledge, and in others, from academic reflections or the practice of politics. *El Buen Vivir* is a main concept that is championed by the CR government on television, newspapers, educational institutions, radio, etc. In this respect, the plans for accreditation of Ecuadorian universities must meet the objectives that are mentioned in *Buen Vivir Plan Nacional 2013-2017* (2015) which is the National Plan for Good Living. An important part of reaching Correa's *Buen Vivir* has to do with ameliorating the way HEIs

work around the South American country which are mentioned in articles 277 and 387 of the 2008 Ecuadorian Constitution.

During the first years of the CR government some HEIs in Ecuador were not meeting the minimum standards to be considered universities. In “Suspended due to lack of quality”: the closure of fourteen universities in Ecuador (CEAACES, 2013), it is mentioned that on April 12, 2012, Ecuador had 71 universities (45 of them were created between 1992 and 2006), which means that in only 14 years there was a growth of 273% (see Figure 2.3). According to the book, the National Congress of Ecuador irresponsibly created several universities. It also mentions the process that the CEAACES followed to close 14 universities due to lack of academic rigour and the Plan of Contingency that was implemented after the suspension in order to guarantee the continuity and the quality of the studies of the pupils who were getting education at those universities. In 2015, the total number of HEIs in Ecuador was 54 (CEAACES, n.d.).

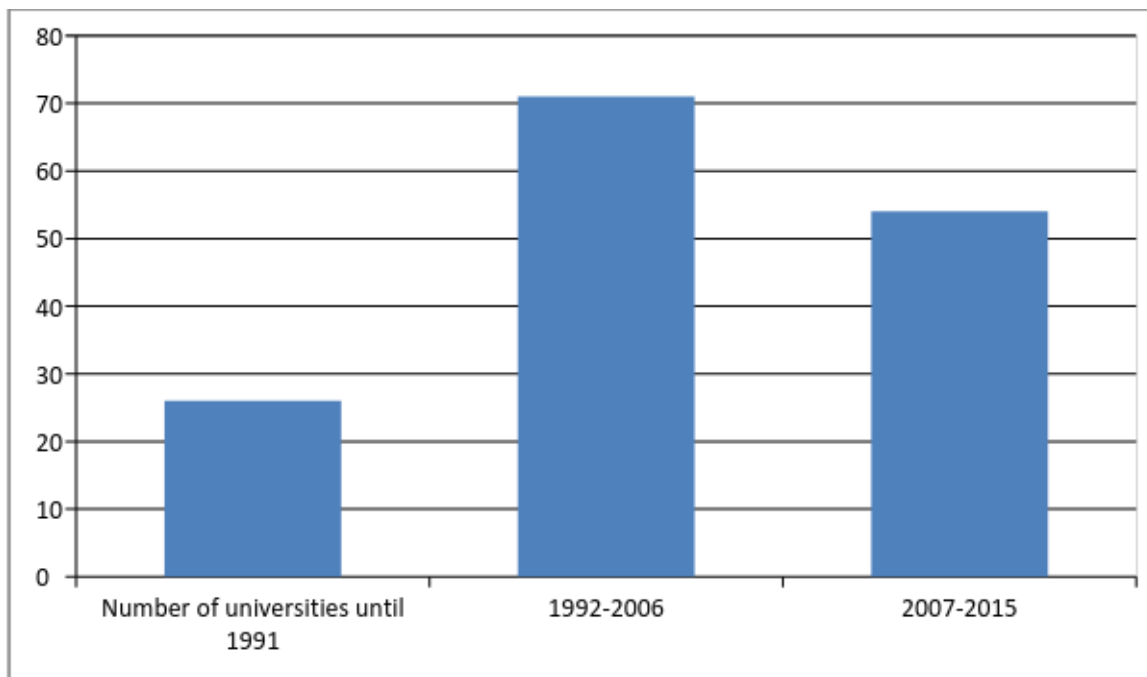


Figure 2. 3. Number of HEIs in Ecuador across the years. The number of universities in this figure is cumulative and shows a decrease after the CR government put into action the evaluation and categorization of HEIs.

During Correa’s mandate, the investment regarding higher education in 2014 was 2.1 % of the gross domestic product (GDP) which determined that the country invested more in higher education than other countries of the region such as Bolivia, Argentina, Uruguay, Colombia, Chile, Brazil and Mexico. Before Correa’s presidency, this percentage was 0,7 in 2006 and it has been increasing during his government. Never in the history of Ecuador a government had invested so much in higher education. In seven years of government, the investment was US\$9 billion (Secretaría de Educación Superior, Ciencia, Tecnología e Innovación, 2014b). Lloyd (2017), mentioned that this spending is by far the highest proportional in Latin America and “significantly higher than the average of OECD – Organisation for Economic Co-operation and Development – member countries.”. Correa’s government even has the goal of having Yachay Tech among the top 100 universities in the world as it will be shown in the next chapter (section 3.2). This means that Yachay Tech is to

some extent the embodiment of the Traditional Flagship University. However, it is also the embodiment of the New Flagship University (Douglass, 2016). According to Douglass, the former is a leading national university that has historical links to maintaining the socioeconomic and power elites, with the best students and faculty, and the first claim on resources. The latter is a more comprehensive university in the range of its activities and self-identified social purpose. The primary goal of its leaders is regional and national relevance leaving global rankings as a secondary concern. Yachay Tech combines elements from both models such as having the best faculty, the best students and having the first claim on resources at the same time that the regional and national relevance and the social purpose of the institution are taken into consideration. Unlike the New Flagship University model, global rankings are a primary concern among those who are in charge of Yachay Tech. Yachay Tech could be considered as a third paradigm that combines the Global Ranking and the National Relevancy paradigm.

A concept that is frequently mentioned by the government has to do with the production matrix. In this respect, an idea that has been introduced is the *cambio de la matriz productiva* or transformation of the productive matrix (TPM) which, for the Ecuadorian context, it is envisaged as a production revolution through knowledge and human talent. The transformation of the production matrix has to do with switching from a model of extractivist economy and primary products to a model that privileges the diversity of production, eco-efficiency, higher value added and the services based on biodiversity and the economy of knowledge. In this process, Ecuador is taking the example of South Korea as a case of transformation of its production system. The South Korean case grabbed the attention of the Ecuadorian government since that country went from an underdeveloped economy to one that leads the production of knowledge and technology in a period of five decades. In order to better understand the philosophy of change within the Korean system, the Ecuadorian

government is getting technical cooperation via the Knowledge Sharing Program (KSP) which was established by South Korea to aid countries that want to learn from their economic experience (SENPLADES, 2012). Here we can also mention the case of Taiwan, which has extremely limited resources unlike Ecuador. Development of science and technology was important to transform its economic structure from an agricultural economy to a silicon economy in the last three decades of the 20th century. This change has given this state one of the highest living standards in Asia. (Gao, 2016b)

Regarding whether education was instrumental in South Korea's economic development or part of the outcome of development, Shin (2012) argues that South Korea's economic development contributes to its HE and vice versa, given that HE contributes to economic development by providing human resources training and the knowledge-base for industrial development. Korean HE and economic growth reinforce one another in this way: well-trained human resources accelerate the economy, and economic growth generates resources to use in HE development. Glaeser, La Porta, Lopez-de-Silanes and Shleifer (2004) found that South Korean institutions are the outcome of economic development after 1950 rather than its cause. They found evidence that economic growth and human capital accumulation cause institutional development, rather than the opposite. With respect to the use of the term human capital, Rafael Correa does not seem to use a version of human capital theory which is less focused on purely economic outcomes and GDP. In this regard, Correa (2018) "rejects the term human capital because human beings are not one more factor of production, but its end." He instead prefers the term human talent.

During the last decade, there have been efforts of progressivist governments in South America to leave behind the developing condition of their countries, and start the transition from exporters of raw materials to creators of knowledge. This change of the production matrix is associated with the creation of cities of knowledge as in the case of Bolivia

(*Gobierno boliviano creará ciudad*, 2015). In the case of Ecuador, the newly created city of Yachay is intended to be the first city of knowledge that is planned in Latin America since Brasilia, but in this case it is not for the government, but for science and technology (Correa, 2015). Yachay is inspired in the university citadels such as the existent in Incheon, South Korea, which is one of the most dynamic cities in northeast Asia, and it is developed with the technical advice of Incheon Free Economic Zone – IFEZ (*Ciudad del Conocimiento se*, 2012). In Ecuador, more than one billion US dollars were invested for the creation of the four emblematic or symbolic universities of the CR government: Yachay Tech (which functions as a city of knowledge), the *Universidad de las Artes*, the *Universidad Regional Amazónica* and the *Universidad Nacional de Educación* (“¿Cuánto ha cambiado Ecuador”, 2015).

According to Correa, Yachay, which is an indigenous Quechua word that means knowledge, is the most important project of his government which will be the first city of knowledge in Latin America related to nanotechnology, life sciences and renewable energies at the same time that it will be a knowledge hub for the region (“René Ramirez: Cuatro universidades son el pretexto simbólico”, 2013). During recent years, the government has been talking about Yachay as a city that will change the future of Ecuador based on the creation of technology. The reason why Correa gives a lot of emphasis to this university can be found in part of his speech during the Citizen Outreach number 478, in which he mentioned that all the public sector research institutes will be in the newly created city of Yachay, and that the project is a cornerstone for the new economy of Ecuador to leave behind the oil and extractivist economy in order to go towards the only economy that is based on infinite resources, based on human talent: the economy of ideas, knowledge and innovation (Universidad Yachay Tech, 2016).

Regarding the transformation of the production matrix, Correa’s team had a clear prioritization of STEM education and research. According to the Secretaría de Educación

Superior, Ciencia, Tecnología e Innovación (2014a), in 2009, 2010 and 2011, the percentage of investment in Research and Development (R&D) regarding STEM fields (natural and exact sciences, engineering and technology, and agriculture science) was 77.1, 84.8 and 80.3, respectively (see Table 2.1). This prioritization of STEM education and research in Ecuador's Citizens' Revolution is different from the focus of Venezuela's Bolivarian Revolution.

Unlike the most important CR's emblematic university in Ecuador, the Bolivarian University of Venezuela (UBV), which was founded in 2003, is more directed towards teaching and applied knowledge over research and publication, being a mix of some STEM majors and legal studies, media and communication studies, social management, education, politics and government. The creation of UBV was followed by the establishment of Misión Sucre, a higher education policy that together with the literacy campaign Misión Robinson, and the vocation training Misión Ribas I and II, were aimed to give education for all, especially to entire poor generations that had been excluded from tertiary education (Ivancheva, 2013). Regarding this last point, while the Ecuadorian government focuses on inclusion of historically excluded groups through meritocracy (ENES examination), the Venezuelan government focuses on HE massification.

Table 2. 1. Ecuadorian government investment across fields of study between 2009 and 2011 (percentages in relation to the total of R&D investment)

Fields of study	2009	2010	2011
Engineering and technology	36.9%	43.3%	25.0%
Natural and exact sciences	18.4%	22.4%	32.9%
Agriculture sciences	21.8%	19.1%	22.4%
Social sciences	15.3%	9.1%	13.9%
Medical sciences	4.9%	3.6%	3.5%
Humanities	2.7%	2.5%	2.3%
Total	100.0%	100.0%	100.0%

During the CR government, a special group of students have been able to get national and international scholarships based on meritocracy, which is a term that was coined by Young (1961) and adopted by the Ecuadorian government. Meritocracy is conceived by Correa's government as the way to get public service of excellence by recruiting ideal candidates that will be the future public servants of the nation (Instituto Nacional de la Meritocracia, n.d.). This group of students is special because they are high attainers in the National Exam for Higher Education (Examen Nacional para la Educación Superior [ENES]), which is designed by Secretaría de Educación Superior, Ciencia, Tecnología e Innovación (2014c). In this regard, the IFTH (Institute of Human Talent Encouragement) mentions that the GAR (Group of High Performance) is made up by those students who are trying to study at a HEI and who got the best scores after taking the ENES, that is promoted by the SNNA, which is the Admission and Levelling National System (Grupo de Alto Rendimiento (GAR), n.d.). This group is made up of students who took the ENES and are among the top 0.1% scores of all the evaluated universe provided that it is beyond 2,5 standard deviations of the population mean (Secretaría de Educación Superior, Ciencia, Tecnología e Innovación, 2014c).

According to the SNNA, 84.0% of the GAR students who accepted the special levelling out are already studying in some universities around the world such as The University of British Columbia, Bristol University, University of Glasgow, School of the Art Institute of Chicago, Pennsylvania State University, University of Amsterdam, University of Austin, University of California, Berkeley, University of California, Santa Barbara, and Sorbonne I. The students do not have to worry for money since the scholarships are full-paid. The Ecuadorian government takes care of the fact that students could end up emigrating, so their scholarship contract mentions that once they finish their studies, they have to return to Ecuador to start the period of compensation that is twice the time of study funding. In case

the grantee does not want to return to Ecuador, s/he would have to return the money and pay interests for it (Becas SENESCYT, n.d.-a), which could be quite difficult to enforce, particularly in the case of those students who are from the lower class. Regarding the favourite fields of study of the GAR students the majority get into STEM HE courses (44.0%) which are related to engineering, ICT and mechatronics, 28.0% prefer life sciences, 18.0% opted for social sciences, 6.0% decided to study basic science while the remainder of pupils expressed a preference for other kinds of fields (Secretaría de Educación Superior, Ciencia, Tecnología e Innovación, 2014b).

By using the ENES scores in the selection of the GAR group, it is likely that advantaged groups will be privileged if we read studies on university access in other countries (Liu, 2013; Valente, 2017). Because of this, Correa's investment in GAR scholarships could be considered as regressive. Nevertheless, the CR government claims that the ENES is not based on knowledge that students have, but on verbal, numeric and abstract reasoning (El Examen Nacional para la Educación Superior, 2016). The fact that knowledge is not measured in the ENES means that some GAR students from disadvantaged backgrounds could face problems during their studies in other countries. In this respect, the Ecuadorian government provides training that lasts between 8 to 11 months, in which the students receive 8 weeks of intensive English preparation, 24 weeks of academic levelling, and 12 weeks of Citizen Civil Service (Instituto de Fomento al Talento Humano, n.d.).

At this point, an explanation regarding the BGU (Unified General Baccalaureate) is provided. The BGU is a study program created by the Ministry of Education for teenagers that have finished EGB (Basic General Education), that according to the *Ministerio de Educación* (n.d.-b) consists of 10 years usually starting at age 5 and ending at age 14. The *Ministerio de Educación* (n.d.-a) mentions that the BGU has first, second and third year (ages 15 to 17), and all the students must study subjects from a common core. Besides the common

core, students have two options depending on their interests: Science Baccalaureate or Technical Baccalaureate. Those who chose the Science Baccalaureate, besides acquiring common basic learning from the BGU, will have access to optional subjects that will help them study in detail certain academic areas of their interest. On the other hand, those who select Technical Baccalaureate will also acquire the BGU common basic learning, and they will develop the specific competences of the profession that they have chosen.

The Ministry of Education of Ecuador lists six reasons for the implementation of the BGU: 1) the former baccalaureate model had an excessive specialization and dispersion of the curricular offer caused the graduation of students with different kinds of knowledge without a common learning base that hindered their access to equal educational opportunities; 2) the former baccalaureate demanded an early specialization in which students generally had to choose a specialty before they were 14 years old. This caused that some students made mistakes regarding this choice that affected them for the rest of their lives. The BGU provides the same common base regarding knowledge to all the students so that they are not limited in their future choice regardless of the kind of baccalaureate that they choose; 3) in the former baccalaureate model, students could gain access to different specializations that did not allow them to acquire basic knowledge in other areas (for instance, the case of social science students that generally did not have enough knowledge about maths); 4) the BGU has an updated curriculum that emphasizes the Ecuadorian reality in relation to the context in Latin America and the world. The former Science Baccalaureate had not been updated and its study plans dated back to the late 70s; 5) the former Technical Baccalaureate offered little options of higher education to their graduates since they were limited to their area of specialization. The BGU ensures that these students are also exposed to common basic knowledge that allow them to gain access to any HE course; 6.) former baccalaureate curricula were not articulated with the EGB and higher education levels. The BGU is an

extension of the EGB curriculum in the different subjects and it is concatenated to HE entrance requirements. With the unified baccalaureate the government addresses equity for all the high school graduates and augments their options after graduating from high school. The common base of knowledge and skills that all the high school graduates get, regardless of the kind of baccalaureate, will give them equal opportunities to continue studying at a university in any academic field or go directly to the working or entrepreneurship world (*Ministerio de Educación, n.d.-a*). In relation to equal opportunities among children and teenagers, Van de Werfhorst and Mijs (2010) found that there are lower levels of inequality of educational opportunity in those countries that have a more standardized system than those with unstandardized educational systems. Nevertheless, a limitation of the BGU is that knowledge deficiencies in some subjects may cause difficulties in relation to teaching and learning during the first years in university. Some students that choose STEM HE courses without having enough background in STEM high school subjects may have problems to understand the contents that their lecturers impart.

After explaining how the Unified General Baccalaureate system works, it is time to elaborate on the admission process to public universities in Ecuador. In the words of President Correa (*Presidente Correa destaca democratización, 2015*), during the CR government, “the systems have permitted transparency. Before, entrance (to universities) was mafia. Now there is a meritocratic system according to what our fatherland needs, it is a fairer system for all women and men”. The aforesaid meritocratic system starts when any high school student in their last year, or people -even foreigners and refuge candidates (*Secretaría de Educación Superior, Ciencia, Tecnología e Innovación, 2014c*)- of any age who already have their high school diploma decide to study in a public HEI across the country. The next step is to create an account to enrol in the SNNA website in order to take the ENES, a paper-based test which is not based on knowledge, but on verbal, numeric and

abstract reasoning. After taking the ENES, the candidates who get at least 601 out of 1000 points, will be able to continue with the candidature stage and participate in the nomination and acceptance of a place to study at a public university (El Examen Nacional para la Educación Superior, 2016). Nonetheless, the ENES is not required at private HEIs, and this has brought criticism. In relation to this, Zambrano-Ramirez (2016) questions the exclusion of private universities to request the ENES and suggests that this could foster inequality by privileging people who can pay for tertiary studies. Additionally, the ENES has a limitation since it is not based on knowledge of science, for instance, like the National College Entrance Examination (NCEE) in China, which is largely based upon the contents in the standardized science teaching textbooks in that country (Gao, 2016a, p. 52). Issues in first-year teaching at Ecuadorian STEM universities may arise because of possible deficiencies in STEM knowledge during high school years.

The SNNA, which is the SENESCYT's entity that is in charge of implementing the public policy to ensure the principles of meritocracy, transparency and equal opportunity to study at public Ecuadorian universities, has two components: admission and levelling. The former has to do with the process of enrolling to take the ENES and be admitted in a HEI, while the latter takes into consideration the heterogeneity of baccalaureate formation to teach the necessary skills that students will need during their undergraduate studies (SNNA descripción, n.d.-c). The levelling course lasts one semester, the tutors are selected and trained by SENESCYT, it is mandatory in all the majors across public HEIs, and has to be passed by the student with a point average of at least 8 out of 10 and 70% of attendance in order to go to the first level of their fields of study. A special levelling course is designed for GAR students to prepare them for their studies in universities around all the continents. All the process is free of charge, the student chooses between one and five HE courses (according to the government with liberty and responsibility), and the SENESCYT

determines the acceptance based on the ENES scores, the order of preference of majors chosen by the students, and the availability of places. The SNNA also recognizes academic merit and gives the *Examen de Exoneración* (EXONERA), a knowledge test so the best students can be exonerated from taking the levelling course (Secretaría de Educación Superior, Ciencia, Tecnología e Innovación, 2014c; SNNA características, n.d.-b).

Nonetheless, the choice of majors “with liberty”, as it is stated by the SENESCYT, has been questioned by politicians and media around the country (*Que jóvenes elijan su*, 2017). The political campaign of some of the 2017 presidential candidates considered the elimination of the ENES and in other cases the elimination of the SENESCYT in order to give freedom to the students to choose their majors without the intervention of the government.

With the implementation of the SNNA, the Ecuadorian government attempts to reduce corruption regarding processes to get a place in higher education. In the past, the characteristics were excessive payments in public universities, and leverage among authorities, tutors, leaders, etc. The SNNA gives the opportunity to citizens around the country to go to university regardless of their origin, economic background, or social vulnerability. Nevertheless, public examination systems in other countries tend to favour the advantaged people. For instance, Liu (2013) found that China’s Gaokao selection induced lower social groups such as peasants and working class to think that they were scholastically inferior in relation to competing for higher education opportunities. Valente (2017) found that students whose parents had better levels of education (particularly mother’s education), higher income, and came from private schools were more likely to score higher in Brazil’s *Exame Nacional do Ensino Médio* (National Secondary Education Exam [ENEM]).

Access to HE of human groups that were historically excluded has changed. In relation to this, the gross rate percentages in relation to attendance of indigenous and afro-descendants between 2006 and 2013 augmented 8 and 11.4 percentage points, respectively.

The Ecuadorian government has worked to improve not only the quality, but also the equity of the HES around the country by implementing actions in order to ensure that more Afro-Ecuadorian and Indigenous people can have access to universities, in both private and public institutions. Those groups that represent 15% of the 14 million people in Ecuador have traditionally been a minority in Ecuadorian HEIs. However, universities now are required to reserve 10% of their admissions for these groups. This has meant that their share has doubled, and the proportion of first-generation students increased four times since 2010 (Lloyd, 2017). If we compare this percentage to their representation in the general population in 2010 (the year of the last population and housing census), 71.9% identified themselves as *Mestizos* (people of mixed race, especially those having American Indian and Spanish ancestry), 7.4% as Montubio, 7.2% as Afro descendant, 7.0% as Indigenous, and 6.1% as White from a total of 14,483,499 Ecuadorians (*Censo revela que los*, 2011; INEC, n.d.). The INEC (Census and Statistics National Institute) only presents information of the general population, but not of those in the younger age range. Regarding STEM underrepresented groups in other countries, Freeman (2016, p. 188) indicated that Australian indigenous students are underrepresented in HE generally and specifically in STEM disciplines. In New Zealand, there exists underrepresentation of Maori (indigenous) and Pasifika (ethnic minority) students in STEM education, which is perceived to be a major social and economic disadvantage for this country. Pasifika and Maori students underachieve at all levels of the educational system and by year 13, 39% of the former and 49% of the latter group met the requirements to gain access to university compared to 74% for New Zealand Europeans and Asian pupils (McKinley, Gan, Bunting, & Jones, 2016).

Even PPLs or *personas privadas de su libertad* (people deprived of their liberty) have had the opportunity to better their lives (296 inmates were studying in jails located in the provinces of Guayas and Cotopaxi). By 2013, the retention rate at the undergraduate level

had improved 12 percentage points. Furthermore, around 84% of the GAR students who passed the special levelling are studying in universities around the world and 56.6 % of these students come from a public high school. Eventually, 7 out of 10 students that accept a place in a public HEI come from a public education unit (Logros SNNA, n.d.). If we compare this to the distribution of students across the types of education units provided by Antamba-Chacua (2015, p. 7), we have that most of the institutions in 2013-2014 were public (75%). The rest of education units were private (21%), *fiscomisional* or religious institutions that get funding from the government (3%), and municipal (1%).

In terms of contextual data about patterns of participation in Ecuadorian HE, Geoportal SNIESE (n.d.-a) shows that the trends in overall participation rates regarding male and female students enrolled in Ecuadorian HEIs between 2012 and 2015 is higher for females in all these years (see Table 2.2). Taking as examples 2012 and 2015, there were 555,413 students enrolled in the former case (246,596 males and 308,817 females), while this amount was 587,799 students (276,714 males and 311,085 females) in the latter case. Table 2.3 shows the number of students enrolled by gender at the two universities in this study since they started working in 2014. If we compare Tables 2.2 and 2.3, we can see that there are less percentage of females than males at the two universities in the current study, while we see the opposite situation at the national level where there are more females than males enrolled in HE.

Table 2. 2. Number of students enrolled at Ecuadorian HEIs by gender, 2012-2015

Year	Male	% (males)	Female	% (females)	Total
2012	246596	44.4%	308817	55.6%	555413
2013	251831	45.1%	306894	54.9%	558725
2014	256821	45.7%	305652	54.3%	562473
2015	276714	47.1%	311085	52.9%	587799

Source: Geoportal SNIESE

Table 2. 3. Number of students enrolled at the Arts and STEM University in 2014 and 2015

Year		Arts University	%	STEM University	%
2014	Male	-	-	274	66.0%
	Female	-	-	141	34.0%
	Total	-	-	415	100.0%
2015	Male	332	57.8%	371	63.5%
	Female	242	42.2%	213	36.5%
	Total	574	100.0%	584	100.0%

Source: Geoportal SNIESE

Geoportal SNIESE also provides the distribution of students across subjects between 2012 and 2015. The most demanded fields of study were business administration and law, health and welfare, engineering, industry and construction, education, and social sciences, journalism and information. There are STEM fields such as natural sciences, mathematics and statistics, and information and communication technologies that had less demand (4.8% and 3.9%, respectively). Arts and humanities appear with 3.3% as the second to the last in the list shown in Table 2.4.

Table 2. 4. Percentage of enrolled students by field of knowledge, 2012-2015

	2012	2013	2014	2015	<u>X</u>
Business administration and law	34.0%	34.6%	34.3%	33.3%	34.1%
Health and welfare	12.5%	12.8%	13.1%	13.9%	13.1%
Engineering, industry and construction	11.5%	12.2%	12.9%	13.6%	12.6%
Education	15.8%	12.9%	10.2%	8.1%	11.8%
Social sciences, journalism and information	8.6%	9.9%	11.1%	11.3%	10.2%
Natural sciences, mathematics and statistics	3.4%	3.6%	4.1%	8.2%	4.8%
Information and communication technologies	5.1%	5.1%	5.1%	0.1%	3.9%
Agriculture, silviculture, fishing, and veterinary	3.4%	3.4%	3.5%	4.1%	3.6%
Arts and humanities	3.2%	3.2%	3.3%	3.3%	3.3%
Services	2.5%	2.4%	2.3%	4.0%	2.8%
Total	100.0%	100.0%	100.0%	100.0%	100.0%

Source: Geoportel SNIESE

The enrolment data for higher education provided by the SENESCYT (2018) shows that there was an increase of undergraduates in universities and polytechnic schools from 2012 to 2016 (514625 to 567854 students, respectively), which is in line with trends in other countries regarding increasing number of young people attending higher education during the last years. There is further information in this document on how the enrolment data varied by field of study, but this information is only provided for one year (2016) and not across several years to check whether there were more students choosing STEM subjects than previous years. The majority of students in 2016 were enrolled in business administration and law (198505 students), followed by engineering, industry and construction (85361 students), and health and welfare (83530 students). The considerable number of students in business administration and law was addressed by Rafael Correa (see Section 3.2) as a concern and he urged young people to choose different undergraduate courses that were relevant to change the Ecuadorian production matrix. If we check Table 2.4, we can notice that the percentage of students taking business administration and law drops between 2012 and 2015 while the

percentages increase in STEM subjects such as engineering, industry and construction, natural sciences, mathematics and statistics, agriculture, silviculture, fishing and veterinary. This suggests a relationship between the message of the government in terms of discouraging business and law and encouraging the study of STEM subjects that will be useful to change the production matrix of the country.

Regarding the scholarships awarded for undergraduate, master and PhD students to be educated abroad, investment was low before the CR government. According to the Secretaría de Educación Superior, Ciencia, Tecnología e Innovación (2014b), between 1995 and 2006, the country was experiencing a period of political and economic instability, and during this 11-year period, the number of scholarships was 237. During the first 3 years of the CR government (2007-2010), 660 scholarships were awarded, and that number has increased year after year. By the end of 2014, the number of scholarships was 10,482 (see Figure 2.1). In March 2017, 20,000 scholarships had been awarded around the country (*Gobierno ecuatoriano otorgó la, 2017*).

The Ecuadorian government has also drawn criticism for the changes in HE. Lloyd (2017) mentions that university professors and students protested on the streets against the 2010 HE law, which threatens university autonomy by the increasing government control over HEIs. Also, academics and rectors have criticized the current PhD requirements, mentioning that only a few Ecuadorian universities offer PhD programs. Regarding this last point, only 5 Ecuadorian HEIs can offer PhD programs, which are mainly oriented to social sciences (Gordón, 2015). Lloyd also mentions the decision of the Ecuadorian government in 2013 to deny accreditation to the Amawtay Wasi Intercultural University since it failed the governmental accreditation process for several years. In relation to this, Martin-Diaz (2017) addresses the difficulty of implementing indigenous educational approaches that involve epistemologies which are different from the hegemonic in universities on the world level.

2.5 Good Living and the CR government

This section will introduce the concept of Good Living from the perspective of the Citizens' Revolution government. The origins of this idea will be traced, as well as the modern ideas that helped to reach the philosophy that is being implemented in Ecuador.

Sumak Kawsay, *Buen Vivir* or Good Living is a concept that has three key elements: respect towards the communities, oneself, and Mother Nature (SENPLADES, 2013). Based on the life of indigenous people of The Andes and the Ecuadorian Amazon region, the CR government implemented a national plan to help all Ecuadorians live a life that seeks happiness, social justice and cohesion, solidarity and harmony with other people with different cultural backgrounds, at the same time that *Pachamama* (Quechua for Mother Earth) is respected and considered an important element. *Sumak Kawsay*, as envisaged by the indigenous people and the Ecuadorian government is against trying to find opulence or infinite economic growth on our finite planet (SENPLADES, 2013). Good Living is about teaching people to share and collaborate instead of competing.

In relation to nature, the awareness of the need to protect it is also addressed by Giddens (1998) in *The Third Way: the renewal of social democracy*, where he mentions that both, classical social democracy (the old left), and Thatcherism, or neoliberalism (the new right) were characterized by low ecological consciousness. He went further and suggested that "the overall aim of third way politics should be to help citizens pilot their way through the major revolutions of our time: globalization, transformations in personal life and our relationship to nature." (p. 64). As regards to the relationship to nature, the CR government demonstrates determination to defend this idea, which could be seen in the legal wrangle between President Correa's government and Chevron for accusations against the oil company of polluting a large area of the Ecuadorian Amazon region affecting crops, animals, and the

health of local people. (“Amazon pollution: Chevron hits,” 2011). Nonetheless, we also have to bear in mind criticism regarding the weak policies that progressivist governments in South America have regarding environmental protection, which will be addressed in subsequent lines.

Good Living is linked to ecoliteracy ideas, as seen earlier when *Pachamama* was mentioned. The term ecoliteracy was published for the first time by Capra (1997 as cited in McBride *et al*, 2013), and it has to do with sustainability. According to McBride *et al* (2013), Capra drew heavily on the work of Orr (1992) to advance ecoliteracy focusing on sustainable societies. Ecoliteracy is important in this modern age in which the ecological crisis discourse is in the public domain, especially when we talk about global warming. People around the world are being exposed to news about this issue and its possible implications for life in planet Earth. Concerns about how the human race is altering the balance of ecosystems are in the agendas of many governments around the world. In the case of Ecuador, the 2008 Constitution is the first in the world that enshrines the rights of Nature (Gudynas, 2009b; Harvard University, 2014).

Sumak Kawsay is a lifestyle of indigenous people that has to do with protecting and living in harmony with nature at the same time that they respect themselves and other cultures. The concept of Good Living in the CR government combines this ancient concept with modern terms such as the knowledge economy. Good Living is a proposal about social and environmental justice within our modern society. It is a way of living in which a government does not seek economic growth without first considering the human being, communities and nature. This paradigm that states that human beings and nature are above profit has been questioned by the Uruguayan environmental thinker Eduardo Gudynas. The term progressivist neoextractivism is presented by Gudynas (2009a) as a new form of extractivism that is a style of development which is based on appropriation of nature that

feeds a hardly diversified production system that is very dependent on supplying raw materials to other countries. Gudynas (2010) addresses how neoextractivism is destroying nature and causing displacement and health problems in South America. He mentions how neoextractivism is deemed among progressivist governments, such as the Ecuadorian, as the motor of development and an important economic contribution to fund social programs. However, there are concerns about the social sacrifices of the people who are displaced and weak policies for environmental protection. Gudynas (2009*b*) suggests the adoption of biocentrism rather than anthropocentrism, and warns that separating nature and society leads to anthropocentrism which justifies the environmental impacts to get economic benefits. He goes further and says that if that limitation is not overcome, there is the risk of having a concept of Good Living that is a South American variant of the classic ideas in terms of consumption or life quality. Furthermore, Good Living is not possible if the environment where human beings live is destroyed or polluted.

Correa's government proposes a solution to criticism like the one expressed by Gudynas. During a conference on "Transition to knowledge economy: Challenges and strategies for Ecuador", authorities of SENPLADES and SENESCYT proposed that Ecuador should develop a knowledge economy in which the extractivist economy be replaced by an economy based on knowledge in order to reach Good Living (SENPLADES, n.d.-b). In a visit to Yale University, president Correa said, "We seek to move from the economy of finite resources (extractivist) to the economy of infinite resources (knowledge-based) which we have called the social economy of knowledge and innovation." (Yale University, 2014). He went further to mention that during this 21st century, the challenge will be to achieve the supremacy of humans over capital and that knowledge must be a public good which means not to privatize it treating it as a commodity. In relation to the commodification of knowledge, Ramírez (n.d.), mentioned the case of Epibatidine which is an analgesic that was

obtained from an Ecuadorian frog. The information was obtained from ancestral knowledge which pharmaceutical companies used to get profit without giving money to the communities that shared it. Both, Ramirez and Correa share the idea that patenting knowledge is bad for a country since market will subjugate human beings. In this respect, Childs and Hearn (2017) posed a question regarding how Ecuador can go through its social knowledge imaginary of having public commons within a worldwide cognitive capitalism that commodifies and privatises knowledge. Swimming against the stream of cognitive capitalism will have its difficulties, but that does not mean that putting knowledge as a public good in Ecuador cannot be achieved.

2.6 Ecuadorian government policy in relation to STEM and higher education

In order to select policy documents for analysis in this chapter, I first considered the Ecuadorian Constitution since it is the most important legal document in the country and it is above all the policy documents in Ecuador. The current Ecuadorian Constitution was created during Correa's government in an attempt to help his government reorganise the country to reach *Buen Vivir*. I searched for information regarding STEM within the Constitution and some sections of it led me to other documents such as the LOES (Higher Education Organic Law) and the National Development Plan, both of them also created during Correa's government. All these three documents are discussed in this chapter but the main focus is on the National Development Plan since it is identified by the CR government as its roadmap, which seeks the construction of an Intercultural and Plurinational State, and that articulates, for the first time in the history of Ecuador, the government management and the public investment to twelve National Development Objectives (SENPLADES, n.d.-a). This document has sections that elaborate on the Ecuadorian government STEM policy in relation to higher education and it is relevant to the present study since it presents information on the government's attempt to move from an extractivist to a knowledge-based economy, which is a policy that is similar in other nations, by focusing on the country's biodiversity to create science and technology from it. Regarding

the SENESCYT, information in relation to STEM government policy or a national plan for science and technology was not found during the search.

In order to better understand the changes to HE government policy during the last decade in Ecuador, it is necessary to discuss the Constitution, which is the supreme law of the country. All the government policy documents in Ecuador must take into consideration what is written in the Constitution for legal purposes. In this regard, the document that will be discussed here is the 2008 Constitution of the Republic of Ecuador (2008) that was issued during Correa's government as an attempt to generate considerable changes in the nation. The Constitution does not mention the acronym STEM and the words *ingeniería* (engineering) and *matemáticas* (mathematics) are not found in this law. Instead, it uses related terms such as 'science and technology' or 'research, science, technology and innovation'.

The 2008 Constitution lists six general duties that the State has in order to achieve Good Living in its Article 277. The sixth of these duties is to 'Promote and drive science, technology, the arts, indigenous knowledge and in general the activities of the communitarian, associative, cooperative and private creative initiative.' The importance of science and technology in the plans for *Buen Vivir* are evidenced not only in Article 277, but are further discussed in the eighth section of the Constitution, which is titled Science, technology, innovation and indigenous knowledge. Article 385 in this section addresses these four elements as a national system and mentions among its aims: 1. The generation, adaptation and dissemination of technological and scientific knowledge; 2. Recover, strengthen and develop indigenous knowledge; and 3. Develop technologies and innovations that impulse the national production, augment the efficiency and productivity, improve the quality of life and contribute to the fulfilment of Good Living. Article 387 mentions among the responsibilities of the State: '2. Promote the generation and production of knowledge, foster scientific and technological research, and develop indigenous knowledge in order to contribute to the fulfilment of Good Living, Sumak Kawsay.' Article 388 of the Constitution mentions, 'The State will allocate the necessary resources for scientific research, technological development, innovation, scientific formation, the recovery and development of indigenous knowledge and the dissemination of knowledge.' As seen,

science, technology and innovation are important in the Ecuadorian Constitution. Additionally, an important element of this document (and the *Buen Vivir* plan) is indigenous knowledge. The preservation and development of indigenous knowledge seems to be an important element within the plans to strengthen science and technology in Ecuador.

After discussing what the 2008 Constitution mentions in relation to science, technology, innovation, indigenous knowledge and Good Living, I have to mention another document that is relevant to this study of higher education: the Higher Education Organic Law (*Ley Orgánica de Educación Superior*, 2010). This law mentions in its Article 13 (paragraph b) that one of the functions of the Higher Education System is to ‘Promote the creation, development, transmission and dissemination of science, technique, technology and culture’. Article 81 of this law mentions that the Admission and Levelling System will regulate the entrance to public HEIs. The SENESCYT and the Ministry of Education will coordinate the articulation of the baccalaureate level and public HE. In the context of Ecuador, the SENESCYT acts as a ministry of higher education while the Ministry of Education is in charge of primary and secondary education. Article 137 mentions that the institutions of the higher education system will obligatorily provide the information that is requested by the SENESCYT. Article 183 of the LOES recognizes among the functions of the SENESCYT the identification of subjects and programmes considered of public interest and prioritize them according to the Development National Plan (paragraph d), which is also known as the Good Living National Plan (GLNP). Two GLNP policy documents will be discussed in this literature review: The Good Living National Plan 2009-2013 (SENPLADES, 2009) and the Good Living National Plan 2013-2017 (SENPLADES, 2013).

The GLNP 2009-2013 (SENPLADES, 2009) mentions that the greatest advantage that Ecuador has is its biodiversity and this should be profited by its conservation and the development of national industries related to bio and nanotechnology. In this sense, the new government strategy is oriented to develop a society of bio-knowledge and communitarian ecotourism services. This policy document mentions that there is neither the industry, nor the knowledge that allow Ecuadorians to value the biodiversity and generate value added from its knowledge and considers indigenous

knowledge as one of the important elements in the transformation of the economic structure of the country (p. 95). The importance of science and technology in higher education is addressed in section 6.5 when the document indicates the transformation of higher education and knowledge transfer through science, technology and innovation (p. 110). This section mentions that the quality of life and progress of a country is linked among other things to the investment in science, technology and innovation. Ecuador is one of the Latin American countries with the lowest coverage in higher education, and it should be a priority to augment access to this educational level, giving the same opportunities to all the Ecuadorians to transform instead of reproducing the structure of social classes. Part of putting into action the equality of opportunities is promoting access of first generations to higher education. Academic excellence regarding teaching and research is also addressed in this section.

The GLNP 2009-2013 also mentions that research that is done at universities has to be one of the cornerstones of the transformation of the extractivist economy that Ecuador currently has. In relation to this, the Ecuadorian universities should generate knowledge (through research) and not only transmit it. Research at tertiary education seems to be vital for the government in an attempt to have universities that are not only reproducing what has been developed and written in other countries, but also contributing to knowledge. Given that the biodiversity is one of the main advantages of the country, it is vital that universities and research institutes generate information from this natural wealth. The universities will develop seed and tissue, germplasm, and DNA banks to better understand and protect the natural heritage of Ecuador. The construction of a 'biopolis' implies researching the production of clean and efficient energies. Also, it will be public policy the investment in human talents that study in specific and priority areas linked to the development needs of the country through master, doctorate and post doctorate programmes at world-class universities. In line with this, there should exist policies to avoid brain drain and actions to repatriate highly educated Ecuadorians. Development of the internal ability to generate technology is vital in the government plan since external technological dependence is a barrier to achieve Good Living. The production of national goods will focus on the combination of indigenous knowledge, technology and biodiversity.

Other goals that are mentioned in this document are: Increase progressively the funding for higher education (p. 172); promote science and technology activities and projects in all the educational levels (p. 173); and reach the average of Latin America regarding higher education enrolment rate in 2013 (p. 174).

The Good Living National Plan 2013-2017 (SENPLADES, 2013) addresses the Revolution of Knowledge that proposes innovation, science and technology as fundamentals for the change of the production matrix, viewed as a different form of producing and consuming. In this regard, the Fourth Objective in the GLNP 2013-2017 considers the strengthening of the role of knowledge through promotion of scientific and technological investigation responsible with society and nature. The transformation of the production matrix will take the country from a phase of dependence of limited resources (finite) to one of unlimited resources (infinite) such as science, technology and knowledge. This transformation plan reveals that the focus of the Ecuadorian government policy is on STEM. It also mentions the 2008 Constitution that confirms the preponderance of the human being over capital through the establishment of a solidary and social economic system. This is a model that seeks the satisfaction of human needs from knowledge, science and technology, respecting nature and which is in contraposition to the principles of capitalism. This evidences the government focus on science and technology in the development plans of the country.

This national development plan addresses technology, innovation and knowledge in 5.1.2. It mentions the focus on the development of human talent and the generation of knowledge, innovation, new technologies, good practices and new tools of production, with emphasis on bio knowledge and its application on the production of ecologically sustainable goods and services. Additionally, knowledge produced in Good Living is seen as ‘a public, common and open good’.

The possibility of achieving a productive structure that is based on technological knowledge mainly depends on the investment in research, development and innovation (R+D+i) according to this plan. In Ecuador, this investment in 2007 was 0.23% of the GDP, and two years later it was 0.44% (MCCTH, 2013). However, this investment was lower than the regional average of 0.66% and much

less than countries like Brazil and Spain, that go beyond 1%, or Germany and the US that almost reach 3% (UNESCO, 2012 as cited in SENPLADES, 2013).

As a way to reduce the inequity gaps, this policy document mentions the increase of coverage in education through the universalization of access to secondary education, and augmenting and diversifying access to higher education, besides the improvement of quality and pertinence of the educational system in all its levels. This document mentions that there has been an increase of enrolment in the Ecuadorian educational system (elementary to tertiary education) partly explained by the elimination of enrolment costs, free-of-charge textbooks, uniforms, meals, and free-of-charge HE. In the case of baccalaureate, the attendance rate increased from 54.2% in 2006 to 70.6% in 2012 at the national level. In rural zones during this period, it increased from 34.9% to 58.9%. (INEC, 2012). Nevertheless, there exists considerable attrition rates at the baccalaureate level. One of the most important achievements is the increase of higher education attendance rate (for young people between 18 and 24 years) from 13.5% in 2001 to 22.6% in 2010. According to the GLNP 2013-2017, this is a result of free-of-charge HE, the increase of coverage and the national scholarship policy that increased from 100 scholarships in 2006 to 2694 in 2012. However, there exists a historic gap in higher education access by ethnicity: indigenous (10.8%) and Afroecuatorians (16.7%) are behind in relation to the rest of the population (31%), even when there was a considerable increase regarding this indicator (INEC, 2010).

In 4.4 (paragraph i), the policy document mentions that the government has to ensure within the educational programmes the inclusion of contents and didactic and informative activities to motivate the interest in science, technologies and research for the development of a socialist society of knowledge.

Goals of the GLNP 2013-2017 are to augment to 78.0% by 2017 the percentage of people between 18 and 24-year-old who completed high school (4.2.). In 2012, this percentage was 61.6% according to the INEC – ENEMDU. In 4.4., the document mentions the increase of Internet access in educational institutions to 90,0% by 2017, which was 21.5% in 2008 and 34.1% in 2012 according to

the INEC – ENEMDU. The increase of enrolment in higher education to 50,0% by 2017 is addressed in 4.5. The percentage of enrolment rate in higher education was 33,0% in 2006 and 39.6% in 2012 according to INEC – ENEMDU. The increase of enrolment in technological and technical institutes to 25.0% by 2017 is addressed in 4.6. The percentage was 12.0% in 2010 according to the SENESCYT – SNIIESE. The increase in tertiary education enrolment is provided as a general percentage of all the courses and it does not specify the percentage by STEM subjects.

Regarding the economy of Ecuador, the 2008 Constitution mentions the change of behaviour patterns that should attempt to eliminate the neoliberal heritage of individualism and competition to develop habits and ways of producing in line with the principles of solidarity, reciprocity and cooperation to develop a solidary and social economic system (article 283).

In 7.2., paragraph n, the GLNP mentions the plans to create the Biodiversity National Institute to have a dynamic inventory of the natural heritage, promote its conservation and identify the potential uses of the biodiversity in the country as a cornerstone to generate innovation and technology. 7.4. addresses the promotion of bioknowledge generation as an alternative to the primary-exporter production in Ecuador. The investigation of the potential uses of the biodiversity for the generation and application of new technologies that support the transformation processes of the productive and energetic matrix of the country, and the ecological remediation and restoration (Paragraph e), and the promotion of education, the formation of human talent, research, the interchange of knowledge and the dialogue of indigenous knowledge about bioknowledge are addressed in 7.4.

The most important comparative advantage that Ecuador has is its biodiversity according to SENPLADES (2009), and without any doubt, the most important competitive advantage that it could have is to profit from it, through its conservation and development of own industries related to bio and nanotechnology. In this sense, the strategy is oriented to develop a society of bioknowledge and communitarian eco tourist services. Biodiversity is synonym of life and, therefore, of information.

There are fourteen imperative sectors regarding the transformation of the Ecuadorian production matrix: tourism; fresh and processed food; renewable energies; pharmaceutical and chemical products; biotechnology (biochemical and biomedicine); environmental services; metal mechanic; technology (hardware and software); plastics and synthetic rubber; clothes and shoes; vehicles, automobiles and accessories; transportation; construction; and sustainable forest production and processed wood products (GLNP 2013-2017, p. 322; Movimiento Alianza PAIS, 2012, p. 54-55). Regarding this, the GLNP 2009-2013 mentions the development of new industries to strengthen food, energy and technological sovereignty, and reduce the vulnerability and dependence of the country: biochemistry industry to guarantee the sovereignty of Ecuadorian agriculture, petrochemistry industry to guarantee the energy sovereignty, hardware and software industry and metal mechanic (p. 406). The GLNP 2013-2017 also addresses the impulse regarding the formation in non-traditional knowledge areas that help to the construction of Buen Vivir in 4.9. Paragraph a. considers the increase of educational programmes at higher education for the formation of professionals in areas that are linked to the arts, sports, handcrafts, essential services for life and ocean sciences.

Ecuador wants to achieve “the great leap” towards the scientific management of its biodiversity, and has focused its resources to strengthening the human abilities to generate knowledge, science and technology. In line with developing human talent, Yachay was created, which is considered in the GLNP 2013-2107 as the most important project of the last century in Ecuador. Human talent is also developed through the Prometeo programme in which foreign and Ecuadorian researchers who are living in other countries come to Ecuador to work and contribute to the generation and scientific knowledge transfer in the country.

2.7 Conclusion

This chapter addressed the literature search strategy used to write Chapters 2 and 3 and the limitations in terms of finding studies on Ecuador and Latin America. A definition of the key terms in the current study was provided before writing about the Ecuadorian political context years before Rafael Correa became the President of Ecuador. The political and

economic instability before the Citizens' Revolution government came to power affected the Ecuadorian university system. The chapter also addressed how the CR government attempted to ameliorate the Ecuadorian HES as a way to start the transformation of the production matrix. Among these efforts, the evaluation and closure of universities around the country due to academic quality issues and the creation of the so-called emblematic universities of the Citizens' Revolution were also discussed in this chapter. Free-of-charge education and academic excellence were two themes that were explored in this chapter since they are part of the government narrative on changing the HES in Ecuador. These themes will also appear in Chapter 3 in the section about government messages (Section 3.2). The chapter also included an introduction of the Good Living concept and how it relates to the Ecuadorian government policy before ending with a section of formal documents from the Ecuadorian government where the plans to use the country's biodiversity to create science, technology and innovation were discussed.

From this chapter, it is clear that the Ecuadorian government policy is focused on investing and increasing the number of young people taking STEM undergraduate subjects – a policy that is also shared by different countries around the world, as it was presented in Chapter 1. There is higher allocation of resources in STEM education compared to what used to be the case before Rafael Correa took power in 2007, which is combined with governmental policy to encourage HE enrolment in STEM undergraduate programmes. The Ecuadorian government main focus on developing STEM education can be evidenced with the creation of Correa's most important project: Yachay Tech. This STEM university was created as an important institution in the country's attempt to change its production matrix, leave behind the condition of developing country, and reach *Buen Vivir*.

Chapter 3: Factors that influence the choice of STEM majors

3.1 Introduction

The purpose of this second chapter of the literature review is to identify the current state of knowledge regarding the role that government policy and other motivational factors beyond the government play in the choice of STEM undergraduate programmes. This chapter will start with the Ecuadorian government messages on the choice of STEM undergraduate programmes (3.2). Within this section, a subsection on what research says about the influence of government messages on the choice of STEM undergraduate subjects (3.2a) will be developed. After this, the chapter will explore the motivations for the choice of STEM undergraduate courses (3.3) where eight factors will be considered: getting a high-paid job (3.3a), helping others (3.3b), own inspiration and significant persons' influence (3.3c), confidence in the subject (3.3d), interest in the subject (3.3e), financial problems (3.3f), science and math course taking in high school in STEM aspirations (3.3g), and school influence and the choice of STEM (3.3h). Lastly, the chapter will explore the influence of students' background characteristics in the choice of undergraduate STEM programmes (3.4) where gender (3.4a), SES (3.4b), geographical region (3.4c), and attainment (3.4d) will be considered before reaching the conclusion of the chapter (3.5).

The chapter starts with a focus on the Ecuadorian government initiative to increase the number of students taking STEM subjects at university. Then, the chapter will explore what previous studies say about the influence of government messages on the choice of STEM undergraduate subjects, where it will be noted that the literature has evidenced that government initiatives to persuade young people to take STEM subjects have been effective, but to date there is not a study that goes further to evidence that there are different political reactions to the government's message on the importance of choosing STEM undergraduate

courses. In this regard, there are not any studies in the literature on STEM subject choice that show the percentage of students that are (and those who are not) influenced by the government's message when they choose their university course, and how this influence is related to particular motivational factors, and the students' demographic and academic characteristics. Taking into consideration the aforementioned lines, this literature review pursues the following framing question: How does government higher education policy influence a person's choice of STEM undergraduate course?

3.2 Ecuadorian government messages on the choice of STEM undergraduate programmes

This section is related to the first research question in the present study that deals with the extent to which the current Ecuadorian government's message about the importance of STEM subjects has influenced the subject choices of students currently enrolled in higher education in Ecuador. This section will provide the elements to have a better understanding of the Ecuadorian government policy in relation to STEM in the last decade. Additionally, there will be a subsection where the influence of government's policy on choice of HE courses in different countries will be explored. Before starting this section, I need to define a term that will be used in the context of this research. The word *major* will have the definition provided by the US-UK Fulbright Commission (n.d.) as "the subject one is primarily studying at university, similar to 'course' in the UK.". The reader must be aware that the words *major*, *subject* and *HE course* will be used interchangeably in this study.

There is an overarching STEM policy across several emerging and developed economies around the world. All the countries mentioned in Freeman, Marginson and Tytler's (2016) *The Age of STEM: Educational policy and practice across the world in Science, Technology, Engineering and Mathematics* are trying to invest in STEM and

increase the number of young people going into STEM fields. That is exactly what has happened in Ecuador during the last decade in which the Ecuadorian government has spread messages that STEM is important for the economic development of Ecuador. The Ecuadorian government has addressed messages related to the change of the production matrix of the country, which means to move from an oil-dependent and extractivist economy to an economy that is based on knowledge production. The government messages on the transformation of the production matrix consider the improvement of the existing universities and the creation of new ones (called emblematic universities) to support the economic shift by generating human talent. A way of conveying these messages to the citizens is through the *Enlace Ciudadano* (Citizens' Outreach) programs, which are also known as *sabatinas*, since they take place on Saturdays. These programs are broadcast on several TV channels and radio stations around the country, and the internet. On December 17, 2016, and almost 10 years after Correa and his team took power, 505 Citizens' Outreach programs had been broadcast (Enlace Ciudadano, n.d.).

During one of the Citizens' Outreach programs, President Correa spoke about the problem of the Ecuadorian economy: a system that mainly depends on its agro-export sector, doing the same economic activities such as exporting bananas, roses or canned fish. In this regard, Correa expressed the need to move towards the diversification of the production matrix, which means to do new things, such as producing hydroelectricity, forest industry, biofuel production and mariculture. Second, Correa mentioned that there is the need to establish five strategic industries (oil refinery, petrochemical, copper, steel and shipyard industry). Correa stated that Ecuador has spent 40 years exporting crude oil and more than 100 years producing cacao beans, and the country has not been able to export oil derivatives or chocolate products. A third point in the change of the production matrix was a selective import substitution. Regarding this, he mentioned that even shampoo and Peruvian onions are

imported when those products could be produced in Ecuador. According to Correa, awarding scholarships to help citizens study in universities around the world to accumulate Ecuadorian human talent, funding projects like Yachay Tech, and all the investments in science and technology are ways to move towards a production matrix that is based on knowledge production (SENPLADES Planificacion, 2012). As it can be seen, the change of the Ecuadorian production matrix is a process that involves the development of human talent through higher education (award scholarships to study in universities around the world, and the creation of a local STEM university) and investments in science and technology, in addition to the diversification of production, the establishment of strategic industries, and a selective import substitution.

Science and technology (S&T) activities are a driver of economic growth (OECD, 2017). Claims regarding the supply of STEM professionals as a vital element for the economy of a country are addressed in several nations (Freeman, Marginson & Tytler, 2016). In the case of Ecuador, the importance of STEM fields has been a clear message sent by the CR government to the population. A way to notice this is the importance that is given to STEM subjects when people are applying for a governmental scholarship to study abroad using the *Programa de Becas Convocatoria Abierta* (Open Convocation Scholarship Program). The SENESCYT establishes that there are study areas that are funded and others that are not. The purpose of this is to contribute to the transformation of the Ecuadorian production matrix. The areas of knowledge that are prioritized are education, arts, natural sciences, math, statistics, information and communication technologies, engineering, industry and construction, agriculture, forestry, fishing, veterinary, health and welfare. On the other hand, we find the areas that are not funded such as social sciences, business administration, marketing, finance, accounting, project administration, entrepreneurial law, interior design, graphic design, fashion design, human resources, medical specialties related to aesthetics,

jewellery, gastronomy, psychology and tourism (Becas SENESCYT, n.d.-b). It can be seen that the majority of fields of study that are funded are related to STEM. This shows the governmental determination of recruiting, training and retaining people in those fields as a vital part in the change of the production matrix. However, there are areas that are being excluded from funding, and this could leave people without studying or forcing them to choose other areas that are not the ones they like. With respect to this, if the CR government is talking about meritocracy, an alternative could be to fund the studies of those who are outstanding students, and can get admission at world-class universities around the world.

Human talent is a key concept that is frequently used by Correa's government when referring to the transformation of the production matrix. An example of this are Correa's words during a *sabatina*, which are presented here:

There is not any university in Latin America among the best 100 universities of the world. That is one of the big problems of our America. I hope that with this project [Yachay Tech] in the short term Ecuador will be able to have one of its universities among the best 100 universities of the world. This is vital for development comrades, more important than bridges, than highways. If an earthquake hits us, it will destroy the bridge, but it will not destroy human talent and with human talent we can rebuild everything again. Are you aware of that? Human talent cannot be stolen by others nor destroyed. It is the key to development plus science and technology that has to do with human talent. Human talent generates science and technology and that human talent that knows how to apply that science and technology. (SECOM Ecuador, 2015, 33:52)

We can notice that Correa's words are relevant in relation to the exhortation to study STEM subjects when he links Yachay Tech, the creation of human talent as a key to development, and the generation of S&T by human talent.

Correa rejects the idea of human capital, and prefers the use of human talent as it was mentioned in Chapter 2 (2.4b). In relation to human capital, a concept that was proposed by Gary Becker (1964), Baron and Armstrong (2007, p. 5-10) express that this kind of capital are the intangible resources that workers give to their employers, and it is not owned by the owners of the organization, but secured by the employment condition. According to them, human capital theory considers people as assets and highlights that investments in workers will bring important returns. Authors such as Boudreau and Ramstad (2007, p. 4) mention that human capital can have several names such as "people", "labour", "intellectual capital", "human resources" or "talent", but what is increasingly recognized as critical to competitive advantage and strategic success are the resources that employees have and the ways these resources are organised. The importance of human talent seems important in Ecuadorian government policy since Correa created the Coordinator Ministry of Knowledge and Human Talent on April 8, 2011 (Ministerio Coordinador de Conocimiento y Talento Humano, n.d.-c) which motto is "Coordinate and strengthen the fair and solidary Knowledge Society." (Ministerio Coordinador de Conocimiento y Talento Humano, n.d.-b).

Part of the Ecuadorian government discourse to persuade young people to choose STEM subjects that would help to develop the economy of Ecuador is related to the creation of new HE courses in the country. The need to have new undergraduate courses that will help to change the Ecuadorian production matrix was a message that was repeated by top ranking authorities during Correa's government. During an interview (El Tiempo, 2012), the then president of the SENESCYT, René Ramírez Gallegos mentioned in relation to this,

As a part of the process of commodification of HE, there was a separation of the universities with the needs of the country. We want to change that. Most of the majors that were offered were linked to business administration, when the country needs for its productive transformation, for instance, more engineering majors, research in renewable energies and petrochemistry.

In line with what was mentioned by Ramírez, the then president of the CEAACES, Guillaume Long, said that there was the need of having more engineers and technical majors in the country, which is identified in the Constitution and the National Plan for Good Living as a strategic area for the country's development (HispanTV, 2013). Correa mentioned that in the country of the past there were universities that offered several professionalizing majors that were not needed which had titles such as engineering in cosmiatry. He added that there was an excess in the demand to study business administration in Ecuador when there is lack of mining engineers and geologists (Presidencia de la República del Ecuador, n.d.-a). This idea of discouraging the study of traditional majors and persuading young people to choose new HE courses can be evidenced in Correa's words during the Citizens' Outreach program number 141 where at 1:33:08 he stated that there was a need to have university in terms of country and not electoral interests (Enlace Ciudadano, 2009). In this regard, he said,

How is it possible that in this country there are 60,000 lawyers and around 40 law faculties and we have to continue giving 400 million dollars per year to subsidize future unemployed [people]? Until when! Meanwhile, we do not have geologists to develop mining. We have more faculties, more architects per inhabitant than the US where people do have money to build their houses.... I always set this example, how many faculties of commerce, or marketing does this country have? We will soon have more marketers than consumers in this country and everything is named engineering. That is how mediocrity is. Engineering in this, engineering in that.... Afterwards,

people complain that the diploma is useless. How is it going to be useful if it does not represent the training, if there are professions and occupations where the market, the system is saturated and then we demand the government to get us a job!

The message in Correa's words seemed to be discouragement of the choice of HE courses such as business administration and law that were very popular among young people but had too many graduates and a big economic cost for the country. A powerful reason not to choose the traditional HE courses in the country was that the future professionals could be unemployed if they chose those subjects while there was plenty of opportunity to work in new careers in Ecuador.

Government discourse also focused on themes such as academic quality and free-of-charge higher education, which are included in this literature review despite they are not subject choice factors. They are considered here since they were frequently mentioned during the CR government. In Chapter 2, Correa's words were presented to illustrate the importance given to these two factors in his government plan. His words were in relation to having education of excellent quality and absolutely free for everyone who cannot afford it. Regarding excellent quality, the government's messages on the STEM university in the current study mention its world-class nature, and consider it as the most important project in the history of Ecuador (Ecuador's political, science and knowledge transformations, 2014). The quality of HEIs is a factor that is considered in the literature of university choice (Hemsley-Brown & Oplatka, 2015). In this respect, a study carried out in Scotland revealed that academic reputation of the university influenced undergraduate student choice, and was one of the top factors mentioned by them to select a university (Briggs, 2006). This is in line with Ahmad and Buchanan's (2015) findings in the context of their study in Malaysia. As it will be shown later in this thesis, government policy did not have that much influence on

sparkling interest in the subject of a sizable group of interviewees, but it did influence the choice of university, mainly because of academic quality and free-of-charge HE.

3.2a What research says about the influence of government messages on the choice of STEM undergraduate subjects

Governments have used a variety of mechanisms to persuade students to choose a career field. This includes, for instance, communicating market signals and raising awareness about career prospects (Akroyd & Lavin, 1991; Law & Arthur, 2003). Similarly, governments have provided funding for scholarships, and for encouraging summer programmes and internships that serve as a channel for career counselling (Crisp & Nora, 2012). In relation to STEM, government messages on motivating students to choose STEM undergraduate programmes have been documented in research. For instance, STEM admissions increased in Russia from 21.6% to 23.4% between 2009 and 2010, partly because of government policy discourse about innovation, the need for engineers, and cuts in the amount of non-STEM places supported by the government such as pedagogics, social sciences and humanities (Smolentseva, 2016, p. 254). Henriksen, Jensen and Sjaastad (2015) studied first-year students from STEM higher education disciplines in Norway to describe the role of out-of-school experiences and targeted recruitment efforts in the election to study a STEM program. Regarding targeted recruitment efforts, they found that the HEIs websites were considered as far more motivational than campaign websites from government offices, professional organizations, etc. They mentioned the case of Utdanning.no, the official website established by the Ministry of Education of Norway to give information about career options and higher education. Forty per cent of the participants had visited the website, and 7% of these considered it inspirational. In the case of the biological laboratory and pharmacy respondents, 19% of the website visitors found it inspirational for their educational choice to a great extent. Regarding the university website, Simoes and Soares (2010) found that it was

considered by the respondents among the top three sources of information when applying to a Portuguese university ('former/current students' and 'teachers' were the other sources). In these studies, the university website was a top source of information in the decision-making process. This is particularly important to take into consideration in the Ecuadorian case since the Arts and STEM University in the current study were created by the government and the information that is displayed on their institutional websites aligns with the government narrative.

In order to address the problem related to the tendency of young students in some countries not choosing STEM education (OECD, 2008), the Swedish government put into action a campaign which was studied by Andree and Hansson (2013). They explored the extent to which the Broad Line campaign, a STEM recruitment project in Sweden communicated messages to increase the number of young students that choose the natural science programme in upper-secondary school. The data analysed from the campaign, which had marketing principles and had a relationship with identity issues, consisted of films on the Internet and television commercials and written information describing the campaign. The findings reveal that the government messages communicated in the campaign focus on relative cost, utility value and attainment value rather than the interest and enjoyment value of science (opportunities offered by the natural science program to develop personal characteristics such as self-realization). What is missing here is a study on how effective the campaign was, especially the messages on the interest and enjoyment value of science. In relation to this, the influence of particle physicist Brian Cox in the UK has apparently augmented the number of physics applications to the University of Manchester. According to The University of Manchester (n.d.), the 'Brian Cox effect' has increased by 52% the university physics applications and the number of students taking A-Level physics has augmented by 20%. Nevertheless, we have to consider Smith and Gorard's (2011) suggestion

in terms of an excess of STEM graduates in the UK, the case of Russia where half the workforce with HE qualifications did not work in their field of study (Smolentseva, 2016, p. 259) or the case of the US where two-thirds of STEM degree holders work in non-STEM occupations (Maltese, Potvin, Lung & Hochbein, 2016, p.126). Therefore, augmenting the number of people that choose physics (or any STEM subject) is not enough if there are not sufficient job opportunities for those who get a HE qualification in the aforementioned fields.

According to the OECD (2008), over 1993-2003, there was a decline in the number of students choosing S&T fields in tertiary education among its countries. The exception is Finland since it does not suffer from a general shortage of STEM workforce and its participation in STEM fields is much higher than the majority of western countries (Dobson, 2016, p. 234). However, Smith and Gorard (2011) questioned the claim in relation to a shortage of scientists in the UK. In their paper that considered patterns of attainment and participation in STEM fields, they noticed that the majority of science graduates in the UK go to initial jobs that are not directly related to their studies suggesting that at this point, there is an excess of STEM graduates. Based on data obtained from the annual graduate destination survey that is collected by the HESA (Higher Education Statistical Agency), their analysis indicates that,

In general, less than half of all graduates who report an occupation are in employment directly related to their degree. Even though this is only the first destination survey after six months, it is astonishing in light of claims of science graduate shortages that so few new graduates go into related employment. Of the rest, just under a quarter of newly qualified engineers report every year that they are working in what are considered to be non-graduate jobs, including unskilled and routine employment, such as being cashiers and waiters. Around ten per cent are in general management and a further ten per cent are classified as 'other'. (p. 171)

In spite of the claims of scarcity of STEM professionals, the information above shows that getting an employment in STEM fields in the UK is not guaranteed for a high percentage of STEM graduates. They even suggested that the incentives could be leading the wrong kinds of students in science with wastage and lack of efficiency in the supply of STEM graduates. In the Ecuadorian case, the campaign on the importance of STEM for the development of the country could be leading students who are not actually interested in the mentioned fields to choose those majors. In this regard, we have to think about those students who might be studying STEM majors just because they were led by the governmental messages that it deals with the careers of the Ecuadorian future, even when they were not motivated to study STEM. Also, taking into consideration the effects of lack of enjoyment of their professions and dropping out has to be considered in the plans of transforming the production matrix. On the other hand, there could also be the case of those students who were not totally convinced of their choice of study, but with the years, ended loving their major and profession.

3.3. Comparison of higher education government policy in Ecuador and other countries

This section considers the case of two countries (Saudi Arabia and Singapore) that were selected for discussion since their national policies are focused on attempting to move to a knowledge-based economy, which is also the case of Ecuador. A comparison between these countries and Ecuador is useful to reflect on the extent to which Ecuador is a particular case for this study.

Earlier in Chapter 1 (section 1.2) I mentioned the existence of a shared government policy in several countries around the world regarding investing and increasing the number of young people taking STEM subjects (Freeman, Marginson & Tytler, 2016), which is what the Ecuadorian government has been doing during the last decade. There exists a significant

higher allocation of resources in STEM education in Ecuador in relation to what used to be the case before 2007, that is combined with governmental messages to encourage undergraduate enrolment in STEM courses in the discursive context of the transformation of the Ecuadorian production matrix.

Government policy in Ecuador, as other nations, is motivated by economic imperatives. From an economic development perspective, the CR government is attempting to transform the country's production matrix, which for the Ecuadorian context means to move from an oil-dependent and extractivist economy to an economy that is based on the production of knowledge (Buen Vivir TV, 2014, 8:10). Saudi Arabia shares a similar policy and is trying to move from an economy that relies on oil to one that relies on the production of knowledge. Saudi Arabia, which is heavily dependent on oil and petroleum-related industries such as petrochemicals and petroleum refining, has had attempts to diversify its economy and become an international leader in science and technology (Khorsheed, 2015). Khorsheed notes that higher education institutions have focused only on teaching while academic research has lacked momentum, which is a similarity to what was happening in Ecuador before Correa's government. Differences and similarities with the Ecuadorian government policy appear in Saudi Arabia's Vision 2030 document (Kingdom of Saudi Arabia, 2016). Among the similarities with the CR government policy is that the Saudi government plans to support its national industries in terms of advertising and exporting their products. Regarding human capital, the King Salman Program for Human Capital Development has similarities with the Ecuadorian policy since the selection of individuals will be done according to merit. In the year 2030, Saudi Arabia aims to have at least five of its universities among the top 200 universities in the world rankings, which is a similarity with the Ecuadorian plans of having Yachay Tech among the top 100 universities around the world. Unlike Ecuador, Saudi Arabia plans to manufacture half of its military needs to create

more jobs and keep more resources in the country and wants to privatise some government services. In relation to privatising government services, the Saudi government intends to pave the way for investors and the private sector to acquire and run services such as education and health care that are currently in charge of the public sector. This policy is in clear opposition of the *Buen Vivir* philosophy that considers that the government should provide free-of-charge education and health care.

In the case of Singapore, this country has a national examination for tertiary education and government policy favours the sciences and technologies over the humanities and the social sciences (Marginson, 2011), which are similarities to policy in Ecuador. The *Buen Vivir* model of higher education is different from that of Confucian states such as Singapore since there is a tendency of the CR government to adopt policies that go in the opposite direction of neoliberalism. The majority of Confucian states use the standard neo-liberal forms of modernization according to Mok (2009, as cited in Marginson, 2011). In this respect, higher education systems in Confucian states are transformed as quasi-markets and universities are remodelled as quasi-firms while maintaining government control. In terms of limitations, Singapore (as in other Confucian education nations such as Japan, Korea, China, Hong Kong China, Taiwan and Vietnam) presents disadvantages in terms of social equity in tertiary education participation. Meanwhile, in Ecuador there is a social inclusion discourse that has at its core the education policy and expansion in HE access for vulnerable populations that evidenced more access to HE of Indigenous and Afro-descendant people, with increases of 8 and 11.4 percentage points (respectively) regarding the attendance gross rate of these historically excluded populations between 2006 and 2013 (Logros SNNA, n.d.). Marginson notes that the Confucian combination of steep university hierarchy, the concentration of poorer families in low status institutions, intensive selection and one-off examination hell generates social equity problems. Regarding the “one-chance”

examination, it is criticised by Marginson as a powerful instrument for the reproduction of elites and the maintenance of a hierarchy of higher education institutions. Another limitation mentioned by Marginson regarding the Singaporean Model is the insistence that research must have a visible utility and a potential profitmaking application that tends to inhibit the academically controlled research program which is the best potential source of long term innovations.

Another area of similarity between government policy in Ecuador and what is happening in other countries around the world is the expansion in the rate of HE participation (see Figure 2.1 and Table 2.2). Marginson (2016) notes that the world is rapidly becoming more educated at higher education level and there are more and more people going into tertiary education. He presents evidence in relation to the worldwide Gross Tertiary Enrolment Ratio (GTER) increase between 1972 and 2012 from 10% to 32%, which is now rising 1% per year. An example of this trend was observed between 1991 and 2007 in South and East Asia where there was a massive growth of tertiary students, which constitutes the platform for the evolution of modern societies and knowledge economies in several countries (Marginson, 2011). Within this worldwide expansion in the rate of HE participation, there has been a global turn to STEM that is evident in government policy in several countries in relation to leading school science and mathematics, higher education and research in STEM fields. During the period 2011 to 2015, tertiary education STEM participation was highest in European countries such as Finland, Germany, United Kingdom, and Sweden (Freeman, Marginson & Tytler, 2019).

The creation of Yachay Tech and the other three emblematic universities of the CR government evidence that policy in Ecuador is similar to that of other countries in relation to the attempt to create 'world-leading' HEIs as new foundations. In this regard, Marginson

(2011) mentions that one of the interdependent elements on which the Confucian Model rests is the accelerated public investment in research and “world-class” universities. Research is strongly supported by the state, which is a characteristic of Confucian systems. In addition, Marginson (2012) notes that until now there has been no other way to the world-class university as time-effective as the Post-Confucian model and it is recognised that this model will be influential in the future, for instance, working as models for non-Confucian nations, which do not have the same political and cultural elements as Confucian nations, to obtain world-class universities by using a combination of US and Post-Confucian systems.

3.4 Motivations for the choice of STEM undergraduate courses

The second research question in the present study is about the motivations that undergraduate students enrolled on STEM degree programmes report for selecting their course. In this regard, this section will address literature on motivation and motivational factors that influence the choice of HE courses.

Making choices is addressed in decision theory. Peterson (2009) defines decision theory as “the theory of rational decision making” (p. 1), and mentions that decision theory is interdisciplinary since there is a contribution of philosophers, psychologists, economists, statisticians and computer scientists. In the current study, we are assuming that decisions are rational. In the process of making choices, he adds that the decision maker chooses an action from a number of alternatives. Schick (1997, p. 11) offers a definition of making a choice as “to make up our mind, to settle some issue we face: to choose is to come to want to take this or that option we have.” He emphasises that what you are choosing must be an option, and you must be free, and adds that some choices have reasons. In this regards, he mentions that in the classical theory of reasons, a reason is a two-part mental state made up by beliefs and desires.

The stages of decision-making according to Janis and Mann (1977) are five: appraising the challenge, surveying alternatives, weighing alternatives, deliberating about commitment, and adhering despite negative feedback (p. 172). They go further and mention that intense conflicts can arise when a person has to make an important decision such as the choice of a HE major. In this respect, Janis and Mann (1977) speak of “decisional conflicts” as

simultaneous opposing tendencies within the individual to accept and reject a given course of action. The most prominent symptoms of such conflicts are hesitation, vacillation, feelings of uncertainty, and signs of acute emotional stress whenever the decision comes within the focus of attention. (p. 46)

Regarding the stages of decision-making, adhering despite negative feedback is a point that has to be considered when individuals are choosing a HE course. They may be faced to the opposition of family members, friends or other people and this generates a conflict within them.

With respect to the term motivation, it is used in this study as understanding of the “why” of human behaviour (Deci & Ryan, 2000). The term is derived from Latin *movēre*, to move (Morris, 1981). Schunk, Meece and Pintrich (2014) provided a general definition of motivation as “the process whereby goal-directed activities are instigated and sustained.” (p. 5). According to Pintrich and Schunk (2002), motivation is a process rather than a product. People do not observe motivation directly, but rather they infer it from behaviours such as effort, choice of tasks, persistence, and verbal expressions. Rolls (2014, p. 40-41) mentions that motivation makes a person work to obtain a reward (a stimulus or event that the person works to obtain) or escape from or avoid a punisher (what the person works to avoid or escape from such as a painful stimulus). He mentions that motivation may be considered a

state in which the person is working for a goal. In the literature on motivation, a common term that appears is motive, and authors such as Jung (1978) define it as “the causes or reasons that underlie a given behaviour.” (p. 4). Motivation involves goals that provide impetus for and direction to do something. However, Jung (1978, p. 76) notes that situational constraints that have to do with financial or personal factors, rather than motivational factors, may determine the choice of career. With respect to this, each person has their choice only from the alternatives that s/he thinks are available.

Motivation can be intrinsic or extrinsic. Concerning this matter, Pintrich and Schunk (2002) say that,

Intrinsic motivation refers to motivation to engage in an activity for its own sake. People who are intrinsically motivated work on tasks because they find them enjoyable. Task participation is its own reward and does not depend on explicit rewards or other external constraints. In contrast, extrinsic motivation is motivation to engage in an activity as a means to an end. Individuals who are extrinsically motivated work on tasks because they believe that participation will result in desirable outcomes such as a reward, teacher praise, or avoidance of punishment.” (p. 245).

Regarding external rewards, an element that needs consideration is instrumental motivation. Hampden-Thompson and Bennett’s (2013) study mentions this kind of motivation, and in that context they referred to it as a pupil being encouraged to study science because of external rewards such as getting a good job in a science career.

Deci (1975) mentions that “intrinsic motivation is innate” (p. 65) and adds that intrinsically motivated behaviours are those which people engage in to feel self-determining and competent. Expanding on the relationship between extrinsic and intrinsic motivation, the author says that there is a negative relationship between intrinsic motivation and the amount

of rewards. In relation to this, external rewards can motivate a person extrinsically but at the same time they reduce the person's intrinsic motivation. Also, if a human being has to do an activity in which s/he has no intrinsic interest, that person will have to be motivated extrinsically (p. 207-209, 228). There is a difference between intrinsic motivation and interest. In this regard, Schunk, Meece, & Pintrich (2014) mention that interest is not a kind of motivation but an influence on motivation, and that students who are interested in learning about something should show motivated behaviours (choice of the activity, effort, persistence, and achievement).

One of the first things that must be pointed out is that students' post-secondary choices are not linear, but the result of the interaction of several interests. Rather than being the result of one decision, students negotiate and construct their choices continuously. Concerning this matter, Holmegaard's (2015) paper on a qualitative study among 38 upper secondary school students in Denmark raised some concerns for STEM education since the improvement of pupils' interests only in science may not lead to augment admission in STEM programmes since there are other interests that also intervene. The results in this Scandinavian context suggest that choosing what to study is far from being something about student preferences and the exclusive accountability of the pupil in getting information, and it confirmed how HE choices have to do with the regulation of social structures that are taken and put into action by the pupils. Various cultural and social processes play a role in the students' decisions. Interest in academic content is not the only element that is considered to make a choice but other factors are analysed such as interest in the study culture, interest in a recognized HEI, studies in an attractive city, staying close to relatives and friends, getting an attractive job, balancing work and personal life among other things. In this study, the economic factor is not mentioned since Danish higher education is free of fees and students have monthly grants from the government. In the case of the emblematic universities of the

CR government, there is a similarity since education is free of charge. However, we have to consider the cost of transportation, clothing, food or accommodation that are not part of free-of-charge education.

In the choice of STEM majors, high school students are influenced by several motivational factors to make this decision such as getting a high-paid job, helping others, own inspiration, confidence in the subject, interest in the subject, monetary issues, significant persons and experiences, taking science and math courses in high school, gender, socioeconomic status, geographical region, and attainment which have been documented in the research literature on students' choices of STEM subjects. In the following subsections, these motivational factors will be explored.

3.4a Getting a high-paid job

The motivation to get good remuneration after graduating is one of the important factors for the choice of a HE course. Regarding financial motivation, Al-Fattal (2010) carried out a study to understand student choice of university and marketing strategies in Syrian private higher education, and among the findings, the most important issue regarding motivation to pursue HE was the economic future prospect, meaning that education at a university gives the opportunity for getting a good job that would provide a better life. Extrinsic motivation was identified by Maharaj, Blair and Kee (2016) in their mixed methods study as an important factor why undergraduate students at the Department of Mechanical and Manufacturing Engineering at a Caribbean university wanted to get their degree: they were extrinsically motivated to attend university once enrolled because of more chances of career success in the future.

Regarding gender differences in this motivational factor, Konrad et al. (2000) meta-analysis evidenced that males show greater interest in high-salary jobs than females. This

finding is in line with that in Malgwi, Howe and Burnaby's (2005) study in which males were significantly more influenced by the major's potential for the level of compensation in the field. In the same line, Kolmos, Mejlgaard, Haase and Holgaard (2013) found that men in Denmark tended to be moved by financial factors when they were selecting a career in engineering.

3.4b Helping others

This study borrows the concept of helping others from the work of Skatova and Ferguson (2014). These authors claim that students select university degrees for four reasons, being one of them the opportunity to help others. Literature in this regard also mentions social good motivation, which has to do with reasons to become an engineer that are rooted in the desire that, as a professional, the person will be able to contribute to society (Kolmos et al., 2013). Social good motivation or helping others is considered by some students when choosing their STEM undergraduate courses. In this regard, Cerinsek et al. (2013) noticed in their study that women preferred (more than men) inter-personal career priorities like helping others, contributing to society and the protection of environment. Holmegaard, Madsen and Ulriksen (2014) also found that most of the women in their study chose an STEM major such as biomedicine or biotechnology to help others and improve human life. Regarding this last point, social good motivation is part of the Ecuadorian government policy discourse in relation to Good Living. There are government efforts to emphasise social good motivation among the citizens, especially among public servants. An example of this can be seen in the case of brain surgeries that would cost between 6000 and 20000 USD, and are free of charge in public hospitals ("*En hospital Guayaquil se*", 2013). The idea of civil servants in the CR discourse is conceived as a way to help others.

3.4c Own inspiration and significant persons' influence

Sjaastad (2012) did research on sources of inspiration in the choice of science courses in HE and found that there were responses where no person was reported by the participants as their inspiration for their choice of study. Inspiration did not come from other people, but from the student (own inspiration) is defined in this study as the students' self-inspiration to choose what they wanted without any external influences. In this respect, Maltese, Potvin, Lung and Hochbein (2016, p.112) reported that college students mentioned that no one in particular had been the primary influence on their choice of STEM (34%), followed by those who mentioned their parents (27%) or teachers (14%). Although own inspiration appeared as the most important category in this study, significant persons also seem to be influential in the choice of a HE course.

Drawing on the work of Ball and Vincent (1998) in relation to 'hot' and 'cold' knowledge, Archer, Hutchings and Ross (2003) argued that information that is available to youngsters about post-16 educational choices can be considered 'hot' knowledge (learned through the 'grapevine') or 'cold' knowledge (formal or official knowledge). For the case of this study, hot knowledge would be the comments of significant persons while cold knowledge would be the information given by the Ecuadorian government on STEM subjects.

As mentioned above, people may have an influence on the students who decide to base their choice on STEM areas. In this regard, a significant person, as it was defined by Sjaastad (2012) in his study in Norway, is "a person who either through direct interaction (a definer) or by example (a model) provides information which influences the individual's conception of self or the individual's conception of an object (the object in his study was STEM education)." (p. 5). He developed this definition from Woelfel and Haller's (1972)

concept. Sjaastad mentioned parents (and even grandparents), teachers, and to a minor degree, celebrities as significant persons who inspire and model youngsters' attitudes toward STEM. Parents who are working in STEM fields help model their children's attitudes towards it, while teachers show how these areas of knowledge can bring fulfilment in students' lives and by motivating, encouraging or giving them a positive experience and helping them discover their abilities. In relation to parents, it is recognised that in many countries they are considered as key in leading their children to STEM study and work (Freeman, Marginson & Tytler, 2016). In terms of support from other people, Aschbacher, Li, and Roth (2010) found that pupils who participated in science and found good support among different communities were more likely to strengthen their science identities and be persistent in their science, engineering or medicine (SEM) aspirations than students with less support.

In the case of parents, Sjaastad's results showed that some of them persuade, and in some cases, a single conversation was enough while in other cases, parents had to repeat their wishes to see their children in STEM fields. In relation to this, Alwedinani's (2016) study on gender and subject choice in higher education in Saudi Arabia mentions cases where fathers and mothers refused to allow their daughters to choose the major that they wanted. On the other hand, there was the case of parents who put pressure on their offspring, for instance, telling them what they expected of them or pushing them in their educational choice. The qualitative and quantitative analyses of this study determined that interpersonal relationships (with people who are close to the youngsters and know them personally) are important factors when motivating students to choose STEM fields and a recommendation is given to augment the recruitment of pupils in STEM fields by aiming at the people who are close to the students. This is important to bear in mind at the moment of analysing the messages of

the Ecuadorian government that could have reached the university students through a person that is close to them.

Some of the findings mentioned above are in accordance with the results of Cerinsek, Hribar, Glodez, Dolinsek's (2013) study, who found that key persons such as mothers and good teachers in Slovenia influenced girls' decision of studying STEM subjects considerably more than in the case of boys. Nevertheless, Sjaastad (2012) found that there are differences in the role of fathers and mothers in the decision-making process of Norwegian female students. While fathers were mentioned by the respondents (female and male) six times than mothers, mothers were important to the female respondents since they were described as having motivated through conversations or personal support. Fathers were seen as models since they displayed engagement in STEM jobs. The considerable difference in responses was connected to the great gender difference reported in Norway regarding the predominance of men in STEM labour. Knowing that these significant persons can influence women's decisions to study STEM majors is important for people who are trying to attract more girls to these fields that are dominated, in general, by more male students as it will be seen in lines below that mention gender issues in STEM.

Hampden-Thompson and Bennett (2013) found that students whose parents had more years of schooling and higher occupational status were more likely to mention that they liked science, had a future orientation, and motivation to study science. They mentioned that pupils who had parents working in a science field reported higher levels of future orientation, enjoyment, and motivation towards science than pupils who did not.

Kolmos, Mejlgaard, Haase and Holgaard (2013) explored the motivational factors in the choice of study, with the particular aim of comparing the reasons female and male students had to select a career in engineering. In their analyses, which were based on a survey

among engineering students who had just commenced their studies in Denmark, they found that women were considerably more influenced by mentors than men, showing that men tend to be moved by intrinsic and financial factors and by the importance that the engineering profession has within society. In relation to this, Connor (2001) mentioned in her study the strong role that tutors had in supporting and helping the students make decisions about their university options. Different from what Sjaastad (2012) found regarding the important role of parents in the choice of study, their influence in this study was low across all the programmes and was the least important.

Regarding peer effects, a study of undergraduate students in Russia suggested that friends and study partners affect the individual specialization choice of students, being those friends who are study partners and those with similar academic achievement, the ones who have the strongest effect (Poldin, Valeeva & Yudkevich, 2015).

The effect of career counselling on the choice of tertiary education majors has been addressed in previous research. A study in Cyprus by Menon Eliophotou (2010) to examine the role of career counsellors in high school focusing on their effect on students' career choice revealed that students consider counselling to be of little importance in the decision-making process before entry in higher education. Among the problems identified by the counsellors in that study, lack of time for large number of pupils was mentioned. Connor (2001) carried out a study in the UK on the decision-making process of young people from lower SES about whether or not to participate in HE, and found that in general, the potential entrants felt that financial matters were not addressed by career advisers. Henriksen, Jensen and Sjaastad (2015) found that school counsellors were rated low by the students as sources of inspiration for the choice of a STEM major. In all these studies, career counselling did not have a significant effect on the choice of STEM majors. Perhaps ways to improve this could be working together with some of the significant persons mentioned earlier. Personalizing the

process of career counselling with the people who know the students personally may have a positive effect on the way students could be perceiving the job of counsellors.

3.4d Confidence in the subject

Confidence in the subject is an important motivational factor for STEM subject choice. The literature indicates that students' choice of major mainly depends on their confidence that they will succeed in that major (Eccles, 1987). Moakler and Kim (2014) found that students were more likely to choose STEM majors when they had strong confidence in terms of mathematics and academic areas. Confidence is associated with attitudes, feelings, and perceptions in terms of students' academic abilities (Lent, Brown, & Gore, 1997). Regarding academic abilities, namely math ability, higher ability in this subject increases the probability of choosing STEM fields and decreases the probability of choosing humanities in university (Humburg, 2017).

Regarding studies in relation to gender and confidence in the subject, Eccles (1984) reported that girls are as good at math as boys during their formative years. However, they do not expect to do as well in the future nor are they as likely to go on in mathematics as are males. In this respect, Moakler and Kim (2014) found that women indicated lower mathematics confidence than did men.

Self-belief constructs, which have to do with people's self-perceptions of competence, also have a relationship with the selection of STEM fields, and they have been studied by some researchers. Parker et al. (2014) did research on self-efficacy and self-concept, two self-beliefs that were juxtaposed in their Australian study. Among other things, they found that self-efficacy and self-concept were independent and powerful predictors of tertiary entrance ranks at the end of secondary school. They also realized that math self-efficacy significantly predicted university entry but math self-concept did not. However, math self-concept was a

significant predictor of choosing STEM university majors, but it was not the case for math self-efficacy. In relation to this, the results of Taskinen, Schütte and Prenzel's (2013) study strongly affirmed the assumption that classes which are exposed to a wide range of science activities showed higher self-concepts and science competencies. Nevertheless, we again have to consider that the choice of studying STEM subjects is a complex process. Rather than being linear, we will have a process that has multiple directions. Predicting STEM choice at universities on the basis of math self-concept could not be enough if there are other factors that could influence the decision-making process. For instance, students who have a high math self-concept and who are the breadwinners in their family may consider working instead of going to university in case of facing financial problems.

3.4e Interest in the subject

The term interest refers to patterns of selection among alternatives. These patterns do not appear to be a result of external pressures, and appear to be the result of characteristics of the person who is choosing and from the attributes of the alternatives. When someone has an interest in something it means that, other things being the same, s/he is apt to favour it over other alternatives (Ball, 1977). Interest in the subject is an important motivational factor in the choice of STEM subjects. Previous research has revealed that interest in the subject is the most influential factor for incoming freshmen of both genders. (Kim, Markham & Cangelosi, 2002; Malgwi, Howe & Burnaby, 2005; Strasser, Ozgur & Schroeder, 2002). Some authors such as Skatova and Ferguson (2014) use the name intrinsic motivation as another way to refer to interest in the subject, and they mention in their study that people choose university degrees for four reasons, being one of them interest in the subject.

Kolmos et al (2013) found that besides social good motivation, which was followed by financial motivation, one of the most important motivational factors for choosing STEM

subjects is intrinsic motivation. Interest in doing something is a factor that may help people to choose a determined activity. In the case of STEM subjects, Cerinsek et al. (2013) found that it was a meaningful factor that influenced the decision of studying STEM, in particular for the case of women. In relation to gender and intrinsic motivation, Ferissizidis et al. (2010) found that women reported greater intrinsic motivation and men presented greater extrinsic motivation.

Musu-Gillette et al. (2015) found that interest in science and math in secondary school can have impact in the long term on the selection of a college major. Holmegaard (2015) mentioned that to attract more pupils to study science, there must be consideration for the active engagement of learners in creating their own education to help them make personal sense. Another way to attract students to study STEM is by combining different subjects that may be attractive to the choosers. In this respect, Maringe (2006, p. 476-477) found that some participants in his study were showing interest in combinations of subjects (for instance, science and media studies in order to become a science journalist).

Interest in science can be present among children. In a study carried out in the UK among 10/11-year-old children in order to understand the processes that underlie the formation of young students' inclinations and their interest in science, Archer et al. (2010) mentioned that among the groups of pupils, some "made reference to peers who were 'known' as interested in pursuing science, suggesting that science is already operating here as a marked identity." (p. 631). In terms of age when interest in the subject is sparked, a study in the US by Maltese and Tai (2010) found that the majority of their participants (65%) reported that their interest in science had begun before middle school (before participants were 10-11 years old). What is not addressed in Maltese and Tai's study is whether the participants who reported their interest in science since childhood were motivated by government's messages to be interested in their subjects.

Mathematics affection is another factor that can be considered within interest in the subject. In relation to this, love for mathematics was a significant predictor of STEM major selection across all ethnic groups and genders (You, 2013). Musu-Gillette, Wigfield, Harring and Eccles (2015) showed in their study that value for mathematics is associated to students' choice of a college major. They also mentioned that, individually, the long-term trajectory of pupils' self-concept of ability (SCA) in mathematics, which is an individual's belief about how good s/he is at doing things in a specific domain (Eccles-Parsons et al., 1983, as cited in Musu-Gillette et al., 2015), was also linked to the selection of a college major.

A study of 9th-grade students in Germany carried out by Taskinen, Schütte and Prenzel (2013) on adolescents' motivation to choose a science-related career aimed to investigate the school's role in maintaining, instilling and nurturing students' interest in science-related careers. In their study, pupils were more interested in science when there were more activities offered by the school such as science field trips, extracurricular science activities, or science clubs. Interest in science was increased when the science teachers used it to help pupils understand real-life applications.

There can be significant experiences that can play a role influencing the decision to pursue a STEM degree. Cerinsek *et al.* (2013) found that out-of-school experiences such as science television programmes and channels that were popular had a notable influence, especially on the educational choice process of male students. They also mentioned that playing computer games had significantly more influence on males' decision to study STEM than in female's decision. Henriksen, Jensen and Sjaastad (2015) found that computer games inspired STEM students to choose their major, mainly the computer science students. Their results revealed that young people notably value web pages where the HEIs provide their information material. Out-of-school experiences (popular science and fiction or drama with a science component) were considered by the respondents as more inspirational than targeted

recruitment efforts in the process of choosing a STEM field. Popular science in the form of TV programmes (Discovery Channel, National Geographic and Norwegian science programmes) was considered as a great source of inspiration. Visits to museums and science centres had a lower rating. Leisure activities related to nature were also frequently mentioned. As regards the targeted recruitment efforts, visits to or from a HEI and education expositions had a somewhat higher rating.

Holmegaard, Madsen and Ulriksen (2014) found that students' experiences with science in high school and whether they felt that the topics made sense to them had an influence on their interest in science and their desire to pursue an STEM field at the tertiary level. Bennett, Lubben and Hampden-Thompson's (2013) study revealed that work experience and extra-curricular career provision also had a notable influence on the chemistry/physics uptake. The strategies to take students to the world of work or bring the world of work to their schools was very important. In this respect, visits to universities and industries, being part of engineering projects, participate in science weeks, organize engineering and medical societies with speakers invited for lunch meetings and being part of career days at school are activities that influence the uptake. The student interviews confirmed that these extra-curricular career promotion events had an influence on pupils' ideas about their future career. Regarding this last point, it is important to ensure that the students are getting not only one, but several sources of information on career promotion since there could be the risk that the students choose the wrong HE course because of having enough elements to decide.

Hampden-Thompson and Bennett's (2013) study had the aims to explore, on the one hand, the relations between teaching and learning activities and student engagement, and on the other hand, student and school factors and student engagement. In their study, they used the Programme for International Student Assessment (PISA) 2006 UK data. Across the

measures of student engagement, there was higher engagement by students who reported that applications in science, hands-on activities and interaction were present in *all lessons* compared with pupils who mentioned that the aforementioned activities *never or hardly happened, happened in some lessons, or happened in most lessons*. Students in schools where there was no shortage of science teachers had higher levels of engagement in science than pupils in schools where there were high levels of shortage. They also found that the greater the frequency of student investigations within the schoolroom, the lower the enjoyment of science among pupils.

We have to be aware of the fact that interest in STEM disciplines during elementary or secondary school will not necessarily mean that the student will be inclined to enter an STEM field at the university level. Research has been done to know why some pupils who are interested in science refrain from choosing a STEM study programme. Concerning this matter, Holmegaard, Madsen and Ulriksen (2014) examined students' choice to continue studying or not STEM after concluding upper-secondary school in Denmark. They found the particular case of students who had a STEM subject as a favourite subject at high school, but who became non-STEM choosers at the university level, mainly because they considered that constructing a desirable identity within their studies would be difficult. In this regard, Lyons (2006) found that there are factors that demotivate students in science classes such as transmissive pedagogy, decontextualized content, and unnecessary difficulty of school science.

3.4f Financial problems

Existing studies suggest that financial concerns have an important role in the choice of study at HE. Forsyth and Furlong (2000) included finance among some potential barriers of disadvantaged young people to accessing HE. Callender and Jackson (2008) found that

money issues limit lower class students' choice of university more than pupils from higher SES.

3.4g Science and math course taking in high school in STEM aspirations

Providing science and math courses to students before going to university could be a way to give them more chances to have aspirations to become STEM students. Myers, Starobin, Chen, Baul and Kollasch (2015) identified in their study that pupils who had completed more science were 1.75 times more likely to want to pursue STEM majors than the pupils that completed few science courses. For the case of math courses, those students who had completed more courses were 1.56 times more likely to have STEM aspirations than those who completed few math courses. These results show that completing more science courses and completing more math courses are associated with being more likely to pursue STEM majors, but the study does not mention whether this was because those students who like science also like maths. You (2013) found that advanced mathematics course-taking during high school years influenced STEM major choices and this influence was different across ethnicity and gender.

A study carried out in the United States by Lee (2015) mentioned that much attention has been given to math and science-related learning environments on pupils' STEM major choices while the TE (technology and engineering) component in STEM has been marginalized. Using multilevel structural equation modelling (ML-SEM), she found that the frequent use of video or computer games had a strong linkage to students' STEM major choices in 4-year postsecondary institutions, after math achievement scores and demographic characteristics were taken into consideration. However, frequent use of computers had no significant relation with pupils' STEM choice. The findings regarding use of video or computer games and its association with STEM major choice must be considered carefully

since having more teenagers doing the abovementioned activities does not mean that there will be more people selecting STEM. In relation to the Ecuadorian context, several UEM (*Unidades Educativas del Milenio* or Millennium Educational Units) have been built during the CR government. They incorporate modern elements of information technology in the learning process, and technology is used as a way to potentiate education from childhood (Ministerio de Educación, n.d.-c). The principle of inclusion is at the core of these institutions which is evidenced in the location criteria. In this respect, Ministerio de Educación (n.d.-d) mentions that the places where the UEMs are located have been chosen based on taking care of historically excluded sectors and level of poverty, lack of educational services, and low scores in national tests such as the *Pruebas SER* (SER tests).

3.4h School influence and the choice of STEM

There are factors that discourage students to learn science. Concerning this matter, Lyons (2006) explored the narratives of Swedish, English and Australian high school students on learning science to examine the experiences of school science that three studies from the aforementioned countries reported. In this review of the literature, he documented factors that demotivate students in science classes such as transmissive pedagogy, decontextualized content, and unnecessary difficulty of school science.

There are other factors that motivate students to learn sciences. In a study carried out in England to understand the kinds of activities that engage high school students with science and motivate them to its further study, DeWitt and Osborne (2008) found that some in-class activities were more likely to motivate learners to like science classes. Based on the participants' experiences in the Science Across the World (SAW) project, the results show that activities that engaged them the most were those that included manual work, collaboration with other students, the opportunity to work autonomously, have self-directed

learning, discover things on their own, and activities that extended beyond a single lesson. These findings show that activities that promote a degree of independent learning and student empowerment were valued by the participants in this study.

Regarding hands-on activities, laboratory experiments and the practical applications of STEM subjects was mentioned by Cerinsek et al (2013) as a significant influence for choosing STEM majors. In line with this, Osborne and Collins (2000) carried out a study in England with the aim of documenting the range of views that students and their parents had about the science curriculum at school, the interesting aspects that they found, and their views on its future content. One of their findings was that ‘without exception, pupils expressed a greater interest in work that included opportunities for experimentation and investigation (p. 36)’.

3.5 Influence of students’ background characteristics in the choice of undergraduate STEM programmes

The third research question in the present study is whether the motivations reported by STEM undergraduates vary in terms of demographic and academic characteristics (i.e. by gender, SES, geographical region, and attainment) In this regard, this section will address literature on background and academic characteristics in the choice of STEM undergraduate courses. This section focuses on gender, socioeconomic status, geographical region, and attainment since they are reported by Tripney et al. (2010) in their systematic review of the UK literature as factors that have been considered to influence STEM subject choices of young people (aged 14-19). These factors are also discussed in the literature on broadening participation of underrepresented groups in STEM fields. In this respect, the literature includes research on gender (Ceci, Williams & Barnett, 2009; Myers et al., 2015; Shauman & Xie, 1996; Smith & Gorard, 2011;), SES (Chen, 2009; Codioli-Mcmaster, 2017; Lee, 2015;

van de Werfhorst, De Graaf & Kraaykamp, 2001; You, 2013), geographical region (Tripney et al., 2010), and attainment (Schultz et al., 2011; Tripney et al., 2010; van de Werfhorst, Sullivan and Cheung, 2003). Additionally, Roberts and De Oliveira (2016, p.224) mention that a flourishing STEM system is vital for economic development and in order to address any lack of interest in studying STEM, or shortage of graduates, scientists and engineers, it is important to first understand the main encumbrances in relation to study and employment. In this regard, the literature has identified variables such as socioeconomic background and gender as key issues.

The idea of social justice that is transmitted in the messages from the Ecuadorian government are relevant for underrepresented groups as it will be seen in subsequent lines. The idea of social justice is basic to the standpoint of those on the left who believe that government has to play a main role in promoting it (Giddens, 1998). In the context of this study, social justice follows Giddens' description of a leftist perspective. I will define social justice taking into consideration the idea provided by the CR government in its National Plan for Good Living 2009-2013 (SENPLADES, 2009), in which it is considered as the cornerstone of citizens' freedom. Wright's (2006) vision of social justice is valid to better understand the definition in the context of the current Ecuadorian government when he mentions that "in a just society, all people would have broadly equal access to the necessary material and social means to live flourishing lives. (p. 96)". The National Plan for Good Living expands Wright's idea and mentions that all the citizens in a fair society have the same opportunities to access material, social and cultural elements that are necessary to have a decent life that allow them to reach self-realization (the fulfilment of one's own potential), and establish the pillars for the mutual recognition as equal citizens. The idea of equal citizens in Good Living acknowledges that social justice is for all the human groups that are present in the four natural regions of Ecuador. Social justice for the CR government can be

seen as an attempt to include groups of people that have been historically excluded from Ecuadorian HE such as low-SES communities, people deprived of their liberty, Indigenous or Afro-descendant people (SNNA, n.d.-a). As seen in the previous chapter, it is also about three ideas that are at the core of the betterment of the Ecuadorian HES: meritocracy, equal opportunities for all the citizens, and transparency.

The following subsections will discuss the literature on how gender, SES, geographical region, and attainment influence STEM subject choice.

3.5a Gender

In general, there is a perceived masculinity within the STEM disciplines meaning that these fields of study are associated with the presence of more male than female entrants. The influence of the surrounding society and culture on participation in STEM majors may be a barrier to participate in HE among women, who are considered as an underrepresented group in STEM fields by some researchers (van de Werfhorst, Sullivan & Cheung, 2003; Ceci, Williams & Barnett, 2009; You, 2013; Lee, 2015; Weinrib & Jones, 2016). In relation to this, researchers such as Smith and Gorard (2011) would mention that the “long-standing stereotype of ‘science’ being a difficult subject studied by traditional age, middle-class, high-attaining men remains.” (p. 172). Chen (2009) mentions that the percentage of those who entered STEM fields in her study was higher among male students. Nevertheless, there are sciences where women are well represented. In relation to this, Shauman and Xie (1996) found that women scientists have a good representation in life sciences, but are underrepresented in other areas such as the physical sciences and engineering. In Russia, women are severely underrepresented in STEM fields especially in computer science, engineering and metallurgy, although they are stronger in biological sciences (Smolentseva, 2016). Nowadays there are initiatives around the world to redress women’s

underrepresentation in STEM. For instance, increasing female participation in science is pursued to achieve gender equality and secure human capital for S&T fields since the Japanese working-age population is decreasing (Ishikawa, Moehle & Fujii, 2016).

Eagerness to go into STEM was revealed by more male than female students (Myers et al., 2015). Similar findings were obtained by Hampden-Thompson and Bennett (2013) who reported that males had higher levels of engagement (motivation, enjoyment, and orientation) in science than females. Consistent with this study, Nott and Wellington (1999) found that among 11-16 year-old English students, girls were less likely than boys to find science investigations interesting.

Lee (2015) found that among the demographic characteristics of her study, women were underrepresented considerably in choosing STEM majors when compared to men. Similar findings were obtained by You (2013) who mentioned that across all ethnic groups in her study, 74.1% of male students were more inclined to choose STEM majors when compared to 25.9% of female students. Since mathematics competency was mentioned as a strong predictor for White female pupils' STEM major choice (You, 2013), augmenting math competency of girls may help to attract more female students to STEM fields.

Bieri Buschor, Berweger, Keck Frei and Kappler (2014) determined in their qualitative analysis that learning experiences, parental support, and role models were crucial in the female students' choice of studies. A suggestion to reduce the gap between the number of men and women in STEM majors by augmenting the amount of female STEM teachers in elementary and high school can be considered as an alternative in order to have more female role models.

Gender equity is mentioned in the Constitution of Ecuador (*Constitución de la República del Ecuador 2008*, 2008) and is also in the Ley Orgánica de Educación Superior,

LOES (2010), which is the Higher Education Organic Law. The LOES even mentions the equality of opportunity principle which is mentioned in article 71. This principle has to do with making sure that all the actors of the Higher Education System (HES) have the same possibilities regarding access, retention, mobility and graduation, without discrimination related to gender, religion, sexual orientation, ethnic group, culture, political view, SES or disability. The last lines of this article give special attention to migrants. In both documents, there is a difference between *igualdad* (equality) and *paridad* (parity). In the case of parity, there should be the same amount of women and men in an institution or a process. These concepts evidence the efforts of the government to help more women have a space in society and in higher education. This in turn is connected to the concept of social justice.

3.5b SES

SES has several definitions that include a reference to social status such as position or rank, and economic indexes such as wealth and education (Schunk, Pintrich, & Meece, 2010). The influence of SES on education is another factor that influences the choice of STEM subjects. Hampden-Thompson and Bennett (2013) found that SES is positively associated with student engagement and that there is a positive association between attending a private school and pupils' enjoyment of science and orientation towards science in the future. Lee (2015) found that students from lower SES backgrounds had less probabilities to enter STEM majors when compared with their classmates from a higher SES background, which is in line with Chen's (2009) findings. In this respect, students in France are deterred from choice of STEM fields due to socioeconomic background (Roberts & De Oliveira, 2016, p. 231).

Codioli-Mcmaster (2017) found that when SES increases, it is more likely that young women will choose STEM instead of other well-paid subjects. You (2013) described in her study that students who had attended lower SES educational institutions were often more

disadvantaged than other pupils and were less inclined to take advanced mathematic courses. Regarding this last point, we have to keep in mind the cases of people who were poor but became successful professionals, and that low SES is not a cause of low motivation – although they are associated, the factors that usually accompany low SES are the ones that influence achievement and motivation (Schunk, Pintrich, & Meece, 2010). Returning to You's study, she also described how African American and Hispanic pupils took fewer math courses in high school. However, she determined that those African American and Hispanic students that had taken advanced math courses were as inclined as White pupils to choose STEM majors. Regarding this particular finding, the CR government has put a lot of effort to give equitable educational opportunities across the country to people from different ethnic groups, especially the groups that were historically excluded in Ecuador, such as Afro descendants and Indigenous groups (SNNA, n.d.-a). Concerning this matter, in 2006, 9.5% of the total of Indigenous people, and 14.1% of the total of Afro descendants attended university. In 2013, those percentages had augmented to 17.5% and 25.5%, respectively. In relation to this, Horta and Lisboa Filho (2016, p. 269) mention the adoption of racial quotas in Brazilian HE, a trend that started in 2004 when the University of Brasilia adopted the policy of reserving 20% of HE places for individuals of Indigenous or African origin without the need of taking a university entrance examination. Unlike the Ecuadorian case where a national examination is required for Afro-descendants and Indigenous people, the Brazilian case does not require this examination. This inclusion of groups that have been traditionally neglected in higher education may be beneficial to reduce the SES gaps within a country, but there should be consideration in terms of quality assurance not only at the HE level, but also the years of education between childhood and teenage.

According to Roksa, Grodsky, Arum, and Gamoran in their study on changes in higher education and social stratification in the United States, findings regarding SES showed

that parental education had a strong influence on HE access across cohorts. In relation to this, those students whose parents had college degrees or graduate credentials had more access to HE (including more prestigious HEIs) than those students whose parents ended their education after secondary school. Furthermore, there are advantages associated with highly educated parents across the years (Shavit, Arum, & Gamoran, 2007, Chapter 7, p. 179). Van de Werfhorst, De Graaf and Kraaykamp (2001) studied parental effects on the field of study of participants of the 1992 and 1998 Dutch Family Surveys and found an association regarding intergenerational resemblance in terms of fields of study that in general seemed to be strong between the educational fields of fathers and their children, and mentioned that children's preference for study fields is partially established in the structure of culture and economic class.

3.5c Geographical region

Geographical region is mentioned by Tripney et al. (2010) as one factor that influence the choice of STEM subjects of young people. In their systematic review of the UK literature on factors influencing young people's STEM subject choices, they mention one study (Sharp et al., 1996) that investigated the effect of geographical region on students' choice of science subjects and mathematics. Tripney et al. rated this study as low/medium overall weight of evidence. This study found that for some STEM subjects, schools and/or colleges located in the East Midlands and South West showed higher take-up than similar schools or colleges in other places. For physics, this applied only to comprehensive and secondary modern schools while for biology, this only applied to colleges.

3.5d Attainment

Prior research suggests that a motivational factor that directly influences the choice of a STEM major is math attainment (Crisp, Nora & Taggart, 2009; Wang, 2013). In relation to

ability, Tripney et al. (2010, p. 9) mention that young people whose levels of prior attainment are higher (than those with lower levels of prior attainment) are more likely to continue their studies in subjects such as science and/or mathematics. Attainment is a factor that has been studied with respect to the uptake of STEM subjects at HE. Schultz et al. (2011) mentioned the US government effort to promote diversity among the science community for more than 40 years. However, the persistent disparity in educational attainment of students from various ethnic groups has limited the abovementioned effort.

Differences in the level of academic rigour at high school also play a role in the transition from high school to HE. In relation to this, Ivancheva (2013) mentions that students that come from public high schools in Venezuela do not have the same position and level when they enter HE as those students from private high schools, which is recognized by officials in the Ministry and UBV tutors who mainly send their children to private secondary schools and traditional HEIs. Regarding school effects playing a role in the uptake of STEM majors, Chen (2009) found higher percentages of students entering STEM fields among those who had strong academic preparation than their counterparts who did not.

A study by van de Werfhorst, Sullivan and Cheung (2003), using longitudinal data from the 1958 British birth cohort found that children who had attained good grades in humanities had the tendency to select arts in university, and were likely to avoid subjects such as science and engineering. On the other hand, high levels of attainment in science O levels and CSEs were associated with engineering and pure sciences choice at degree level. Also, people who were good at sciences at age 16+ often selected pure sciences and engineering.

Student empowerment is mentioned by Bennett et al. (2013), who analysed four high-uptake schools that were compared with 4 low-uptake schools. Their aim was to identify

individual and school-related factors that have an influence on students' post-compulsory uptake of physics and/or chemistry in England. They noticed that the schools that required higher grades in the GCSE (General Certificate of Secondary Education) science examinations were the higher uptake schools in three of the four pairs of institutions. Student empowerment (such as student groups organizing medical and engineering societies, workshops by different engineers and scientists, etc.) encouraged engagement with scientific work influencing the uptake of chemistry and/or physics. Also, diversity in the school curriculum to offer choices for pupils with different abilities for science was beneficial for the uptake of the two subjects.

Finally, engagement in a subject is associated with attainment in that subject. In this regard, within New Zealand, as in nearly all other countries, pupils with higher engagement in science or maths have higher achievement in general in the aforementioned two subjects than those with lower engagement (McKinley, Gan, Bunting, & Jones, 2016, p. 207).

3.6 Conclusion

This chapter has explored the factors that influence the decision-making process to select STEM undergraduate courses around different countries. At some points, it has also mentioned why some students did not choose STEM. In relation to this group of non-STEM choosers who are not included in this study, their case could be addressed in further research to know why they did not choose STEM majors, and have a better understanding of what is happening in the Ecuadorian context. The choice of study is not a linear, but a multidirectional process which may have several factors that shape the decision to choose or not a STEM major. In the specific case of the influence of governmental messages in the choice of STEM subjects, this chapter showed that government initiatives to increase the number of young people taking STEM subjects can be effective. Beyond the government's

message influence, there are other motivational factors that were explored in this literature review such as getting a good job, helping others, own inspiration, confidence in the subject, interest in the subject and monetary problems which are important in this study since they were the top six motivations reported by survey respondents. Finally, the influence of gender, SES, geographical region, and attainment are important factors that are considered to influence the choice of STEM subjects.

Chapter 4: Methodology

4.1 Introduction

This study aims to explore how the government policy on HE influence the choice of undergraduate programme in Ecuador. This study employs a mixed method approach. Data collection was carried out through online surveys and interviews that were directed to undergraduate students in their first two years at two Ecuadorian public universities (hereafter, STEM University and Arts University). This chapter aims to provide an explanation of the research strategy that has been adopted and the process of data collection in order to address the research questions in this study. The chapter will start with the scope of the study where the three research questions in this research are presented (4.2), and then it will present the rationale for using mixed methods research design (4.3). The next sections describe the participants and sampling (4.4), and the two instruments that were used in the study (4.5) before discussing the ethical considerations of this research (4.6). Afterwards, the chapter will address the main study data analysis (4.7) before reaching the conclusion in 4.8.

4.2 Scope of the study

Ecuador is an interesting case for this study since there was an innovation process in higher education taking place at the moment of this research. This study explored the three research questions that are presented below:

RQ1. To what extent has the current Ecuadorian government's message about the importance of Science, Technology, Engineering and Mathematics (STEM) subjects influenced the subject choices of students currently enrolled in higher education in Ecuador?

RQ2. What motivations do undergraduate students enrolled on STEM degree programmes report for selecting their course?

RQ3. Do the motivations reported by STEM undergraduates vary in terms of background characteristics (i.e. by gender, socio-economic status, geographical region, and attainment)?

The variables in the third research question relate to the typology of political dispositions that will be presented in Chapter 5 and the six motivational factors that will be explored in Chapter 6 since gender, SES, geographical region, and attainment are considered in previous studies as factors that influence STEM subject choices of young people aged 14-19 (Tripney et al., 2010). Additionally, the third research question focuses on these four demographic and academic characteristics since they are discussed in the literature on broadening participation of underrepresented groups in STEM fields. In relation to this, research on gender (Ceci, Williams & Barnett, 2009; Myers et al., 2015; Shauman & Xie, 1996; Smith & Gorard, 2011;), SES (Chen, 2009; Codioli-Mcmaster, 2017; Lee, 2015; van de Werfhorst, De Graaf & Kraaykamp, 2001; You, 2013), geographical region (Tripney et al., 2010), and attainment (Schultz et al., 2011; Tripney et al., 2010; van de Werfhorst, Sullivan and Cheung, 2003) have been introduced earlier in the literature review.

Ethnicity and disability were initially considered as two demographic variables in the third research question since they are also reported by Tripney et al. (2010) as factors that influence choice of STEM subjects among young people. These variables were excluded from the analysis because of the low number of students in some of their categories, which could have raised ethical issues in relation to identification of participants (five students reported a disability, seven students were Indigenous, three were Afro Ecuadorians, and three were White as it can be seen in Table 4.1). Moreover, the frequencies of students in some ethnic groups would not have been appropriate for statistical analysis such as the use of chi-square since the assumption of this statistical test is that '80 per cent of all the cells in a cross-tabulation contain 5 or more cases.' (Cohen, Manion & Morrison, 2007, p. 592). Attainment was included as a variable in the third research question since it is important in the literature

on STEM subject choice as it was mentioned earlier, and it was raised by the thesis advisory panel member during this research.

The definitions of the four variables in the third research question are presented in subsequent lines. Gender is defined as ‘the varied and complex arrangements between men and women, encompassing the organization of reproduction, the sexual divisions of labour and cultural definitions of femininity and masculinity.’ (Bradley, 2013). The survey question to obtain information on students’ gender asked them to select whether they were male or female. This question did not include options such as Other or Prefer not to say, which was an involuntary omission while writing the survey on Qualtrics.

SES is defined in this study as social stratification (Payne, 2000). In this regard, Payne mentions:

the concept of social stratification as a particular form of social division emphasises the idea that individuals are distributed among the levels or layers of a social hierarchy because of their economic relations. These layers or ‘social strata’ are real social groupings, forged together through both their economic relations and their associated social relations and interactions; groupings that are able to reproduce themselves over time. (p. 21-22).

Payne adds that social stratification is a typical social division that is different from others in that it is firmly based in economic relations. Three social classes are considered in his book: the advantaged classes, the intermediate classes, and the subordinate classes. SES in this research considered these three categories using different names from those proposed by Payne: upper class, middle class, and lower class, respectively. The information to classify the participants according to their social class was based on students’ self-identification. The data revealed that there were not any upper class participants at the two universities in this study (see Table 4.1).

A geographical region in this study uses National Geographic Society's (2011) definition of region as:

an area of land that has common features. These features can be natural, such as climate or landscape. They can also be artificial, such as language or religion.

Language, government, or religion can define a region, as can forests, wildlife, or climate... Regions, large or small, are the basic units of geography...

For the purpose of this research, the abovementioned features are natural such as climate or landscape. For example, National Geographic Society (2011) mentions that the Amazon River region in South America is the area that surrounds the Amazon River, which runs through Brazil, Bolivia, Ecuador, and Peru. The Amazon region is characterized by 'warm temperatures, heavy rainfall, a large diversity of plant and animal species, and little human impact on the environment.' With respect to the natural regions in this research, Ecuador is divided into four geographical regions: *Costa* (Coast), *Sierra* (Highlands), *Región Amazónica* (Amazon region), and *Islas Galápagos*. In order to determine the participants' geographical region, the information on the city or province where they lived was used to classify them into one of the four geographical regions (participants from the Galapagos Islands and the Amazon region did not appear in the sample as presented in Table 4.1).

Attainment in this study was defined as the participants' final scores in the ENES. This national exam is required to enter public HE in Ecuador. There were two groups for the analysis of attainment: middle achievers were those students who scored 600-900 points, and high achievers were those students who obtained 901-1000 points. STEM students were the majority in the high achievers group (42 out of the 44 high achievers were STEM students) while arts students were the majority in the middle achievers group (58 out of 66 students were arts students in this group). This difference is due to the higher scores required to study

at the STEM University where students need more than 900 points in the ENES. There were exceptions for eight STEM students who scored between 801 and 900 points.

This study makes use of qualitative and quantitative research methods to address the abovementioned questions. The two instruments that were employed during the pilot and main study were surveys and interviews. The surveys came before the interviews and they were online. Sending out the surveys at the beginning allowed me to get information from the participants that would lead to emerging topics for further exploration during the interview sessions.

This study embraces an interpretivist ontological and epistemological orientation that is the opposite to a realist standpoint that assumes the existence of a single reality that is independent of the observer (Yin, 2014, p. 17). According to Schwandt (2007, p. 160), interpretivism or the interpretivist tradition represents approaches to the study of social life that give a central place to *Verstehen* as a human sciences method, that assume that the meaning of actions is inherent in the action, and the task of the researcher is to discover its meaning. The epistemological debates often have on one side the positivists or realists, and on the other side, the constructivists or interpretivists. The former emphasises the specific reality of social phenomena, and the latter place the emphasis on human perception and interpretation (Della Porta & Keating, 2008, p. 7).

In terms of methodology in the field of social sciences, interpretive research has the aim of understanding human nature and the diversity of cultures and societies, and the motivations of human behaviour in the context of a cultural perspective. In this kind of research, explanation comes from interpreting the motives human have for their actions (Della Porta & Keating, 2008, p. 26-27). The interpretation in the current study is about the motives that undergraduates had for choosing their majors.

4.3 Rationale for using a mixed methods research design

The research strategy that is being employed in this study in order to address the research questions fell into the category of mixed methods research. By a research strategy, Bryman (2016) means “a general orientation to the conduct of social research.” (p.32). With respect to this, he explains that, contrary to quantitative research, qualitative research can be construed as a research strategy that usually has a focus on words rather than quantifying the collection and analysis of data. Its approach is inductive to the relation between research and theory, emphasizing the generation of theories. It rejects the natural scientific model norms and practices, in particular of positivism, giving preference to how participants interpret their social world.

The core assumption of mixed methods research is that the combination of qualitative and quantitative approaches provides a more complete understanding of a research problem than either approach alone. (Creswell, 2009, p. 203; Creswell, 2014, p. 4). Creswell (2009, p. 203) provides two more advantages of mixed methods: on the one hand, it uses the strengths of both quantitative and qualitative research, and on the other hand, the use of both qualitative or quantitative approaches is adequate to address the complexity of the problems addressed by social science researchers. Their combination of methods provides an expanded understanding of problems found in research.

This study made use of the sequential explanatory strategy mentioned by Creswell (2009, p. 211) which is a strategy for mixed methods design that is characterized by quantitative data collection and analysis in a first phase of research followed by qualitative data collection and analysis during a second phase that builds on the initial quantitative results (see Figure 4.1). Typically, weight is given to the quantitative data, and data mixing is

done when the initial quantitative results informs the secondary qualitative data collection. In this strategy, although both forms of data are separate they have a connection.

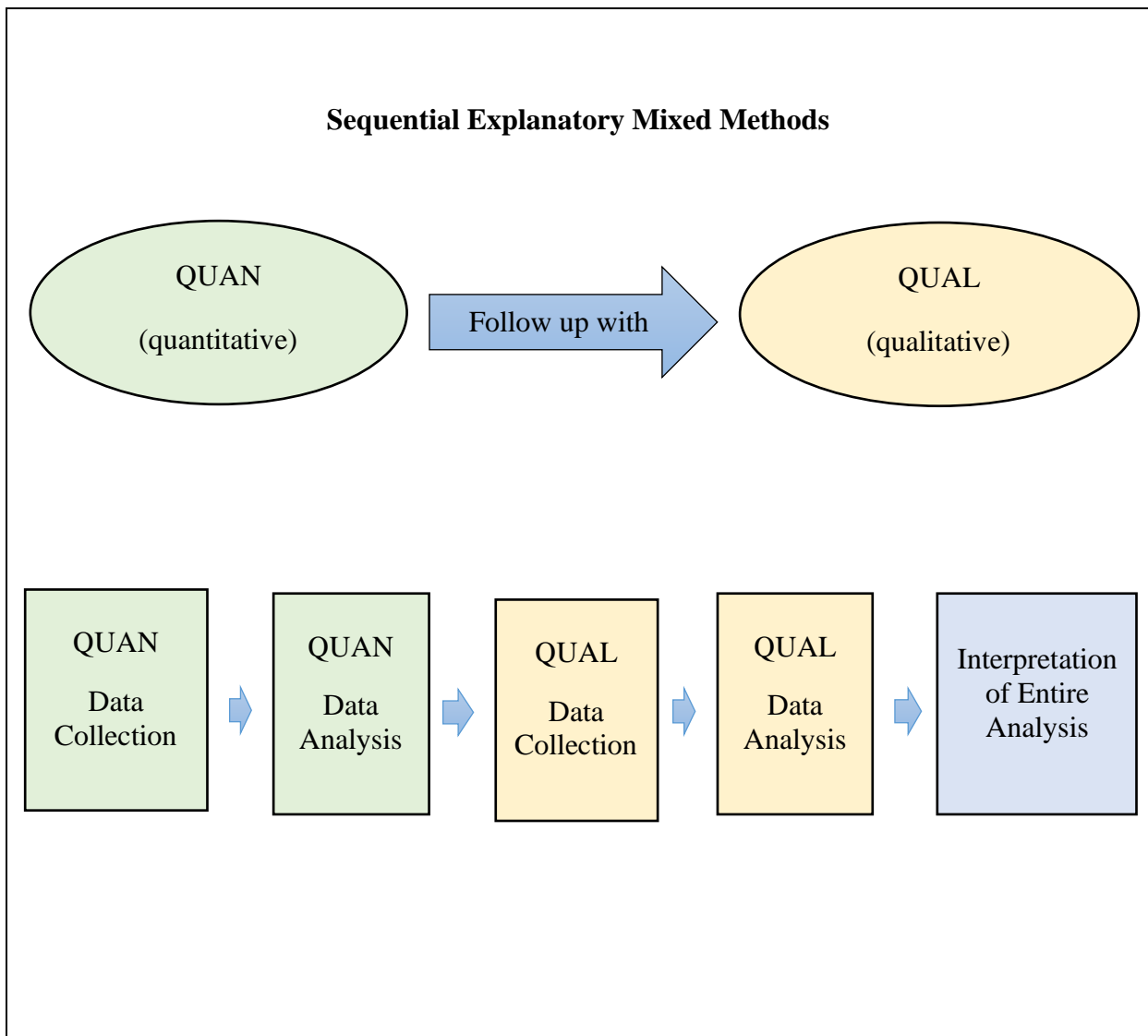


Figure 4. 1. Sequential Explanatory Design used in the current study

SOURCE: Adapted from Creswell (2009, p. 209) and Creswell (2014, p. 220)

A limitation of this strategy is the extended period of data collection since the two instruments are not applied at the same time, being even more difficult if the two stages of data collection have the same priority. One of its main strengths is that the design has a straightforward nature, being easy to implement since the steps are in clear and separate stages, making it easy to be described and reported.

4.4 Participants and sampling

The participants in this study were first-year undergraduate students at two public Ecuadorian universities who produced written and oral data from the online surveys and interviews, respectively. A total of 128 students participated in the main study survey (56 from the STEM University and 72 from the Arts University). The number of participants are presented in Table 4.1 by institution, geographical region, ethnicity, gender, SES, and disability. As mentioned above, the low number of participants in relation to some ethnicity and disability categories was one of the reasons to leave these variables out of the analysis in this research. Table 4.2 shows how different ethnic groups were distributed at both HEIs. The population of students at both institutions were mainly *Mestizos* (89.9% and 94.1% at the Arts and STEM University, respectively). These two percentages are higher than that of the *Mestizos* in the general population of Ecuador in 2010, which was 71.9% as it was mentioned in Chapter 2.

Table 4. 1. Survey and interview participants by geographical region, ethnicity, gender, SES and disability

Background characteristics		Survey Participants		Interview participants	
		Arts University	STEM University	Arts University	STEM University
Geographical region	Amazon region	0	0	0	0
	Coast	45	14	13	6
	Highlands	13	37	6	17
	Galapagos	0	0	0	0
	Total	58	51	19	23
Ethnicity	Afro- Ecuadorian	3	0	1	0
	White	2	1	0	0
	Indigenous	4	3	1	1
	Mestizo	49	47	18	22
	Montubio	0	0	0	0
	Other	0	0	0	0
	Total	58	51	20	23
Gender	Male	46	32	10	10
	Female	25	25	10	13
	Total	71	57	20	23
SES	Lower class	28	30	7	13
	Middle class	32	21	12	10
	Upper class	0	0	0	0
	Total	60	51	19	23
Disability	Yes	4	1	0	0
	No	55	50	19	23
	Total	59	51	19	23

Table 4. 2. Number of participants by ethnic group at each university and its comparison with the total student population

	Arts University			STEM University		
	Survey participants (n=58)	Interview participants (n=20)	Student population (n=1030)	Survey participants (n=51)	Interview participants (n=23)	Student population (n=830)
Afro-Ecuadorian	5.2%	5.0%	3.7%	0.0%	0.0%	0.8%
White	3.4%	0.0%	1.8%	2.0%	0.0%	1.8%
Indigenous	6.9%	5.0%	0.5%	5.9%	4.4%	2.8%
Mestizo	81.0%	90.0%	89.9%	92.2%	95.6%	94.1%
Montubio	3.4%	0.0%	2.3%	0.0%	0.0%	0.5%
Other	0.0%	0.0%	1.8%	0.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

A purposive or targeted sample was used during the pilot study and the main study. Shank (2006, as cited in Shank and Brown, 2007, p. 46) mentions that the members of this sample are chosen because of particular characteristics. The particular characteristic that I wanted was students' newness (students who had just started their undergraduate studies). The plan at both universities was to recruit fresher students (first-year students) for the main study, and second-year students for the pilot study. The reason for sparing the first-year participants for the main study was that they were the youngest pupils at both universities and they could have better memories on the decision-making process while they were selecting their HE courses. Since the choice of HE course had already occurred, it was important to have first year participants in the main study so they could have more opportunities to recall the events that led them to choose their current major.

Purposeful samples are more common in qualitative research, where there often is no attempt to use the results obtained from the sample to generalize. As Shank and Brown (2007) put it,

In qualitative research, purposive samples are quite common and are often the desired mode of sampling. These types of samples are often target samples. That is, specific participants are chosen because of their expertise, their insights, or their access to information. (p. 127)

However, Shank and Brown warn about a limitation when using this sampling procedure. Since this sample was treated as its own mini-population, there was a limit in relation to the things that could be generalised to the whole population.

As mentioned above, the pilot study considered second-year students (from 3rd and 4th semester at both universities). On the one hand, I could not choose the students from the first and second semester since they were reserved for the main study. On the other hand, I did not choose students from higher semesters since they could have problems recalling the process of choosing their HE courses, an aspect that Yin (2009) lists in the limitations of using interviews. Having different participants for the pilot study and the main study was in line with the considerations in questionnaire design provided by Cohen, Manion and Morrison (2011) that recommend to “pilot the questionnaire, using a group of respondents who are drawn from the possible sample but who will not receive the final, refined version.” (p. 403).

Earlier in the literature review, it was mentioned that the CR government created 4 emblematic universities which started their activities in 2014 (two for STEM fields, one for arts and the last one for education). From these HEIs, the focus was on the two STEM universities for the sampling of this study. The idea of doing research at the STEM university located in the Ecuadorian Amazon region did not come just because of the need of getting STEM undergraduates for this study, but also because I was attracted by the university’s location in the Amazon jungle, which has a biological reserve to be used as a natural laboratory by students and researchers (Ministerio de Cultura y Patrimonio, n.d.). This last

idea grabbed my attention since I have been interested in plants and the natural world since I was a child. I thought it would be a good idea to know the motivations for choosing STEM majors at that Amazonian university, a HEI that intends to train researchers that are committed to the environment in majors that have to do with genetic research, biodiversity, water sciences and life sciences. In the end, I decided to choose the STEM university in the Highlands since that institution had been advertised by the CR government as its most important project to change the production matrix of the country, and it was getting more attention from the government than the other three emblematic universities.

Elaborating on the two universities where the sampling was carried out, the description provided by the Coordinator Ministry of Knowledge and Human Talent of Ecuador (Ministerio Coordinador de Conocimiento y Talento Humano, n.d.-a) states that the STEM University is located in the province of Imbabura, while the Arts University is in the province of Guayas. In relation to these places, the STEM University is in the Highlands while the Arts University is located in the Coast, two very different regions in terms of the people who live there. The abovementioned ministry also provides details of the fields of study of each university: the STEM University offers life sciences, nanoscience, renewable energies, and ICTs, and the Arts University has HE courses related to cinema and audiovisual arts, intercultural literary arts, musical arts, movement and theatrical arts, and applied and visual arts. The STEM University was chosen for this research because it was ideal to study the influence of the government messages on the choice of STEM subjects since former President Correa had repeatedly advertised this institution and its new HE courses in the country as his most important project in order to change the production matrix of the country.

During the early stages of this research, the possibility of having only one university (the STEM University) was considered. The inclusion of the Arts University, which is one of the emblematic universities created by the CR government, was taken into consideration as a

comparison group. Taking into account that university students in the arts can be considered as a contrasting category to science and maths (Nosek, Banaji & Greenwald, 2002), this study focused on one STEM oriented university and one Arts oriented university to compare and contrast the influence of government messages on the major choice of students from both institutions. Although two HEIs were included in the current study, the total number of participants was low.

There were other universities that were considered to get STEM participants which were in the cities of Guayaquil and Portoviejo. In the case of Guayaquil, the institution was the university where I obtained my master degree. In the case of Portoviejo, the HEI was the place where I work. In the latter case, I desisted from this alternative because of possible conflicts of interest, something that is mentioned during the process of getting the University of York's ethical approval to start data collection. This last idea led me to choose institutions where I was not known.

4.5 Instruments

The two instruments that were used in this study were online surveys and interviews. Training on specific research issues was considered before and after preparing the instruments. In relation to this, I attended a training course (Introduction to Qualitative Interviewing) at the University of Surrey before starting the pilot study. Additionally, I booked a training course (Introduction to Data Analysis 1 & 2) at the University of Manchester which took place before starting the main study data analysis. In relation to interview data analysis, I attended an Introduction to NVivo training course at the University of York. Additionally, I watched NVivo by QSR videos on YouTube to better understand the use of this software.

Both instruments will be explored separately in the following lines.

4.5a Surveys

The survey was piloted before obtaining the final version that was used during the main study at both HEIs and which is included in Appendix A. Qualtrics software was used during the pilot study and main study to send out the emails that had a link to the survey in Spanish, which is the official language of Ecuador. The pilot study was carried out to aid item development and to better the reliability and validity of the instrument. During the pilot study, pupils from 3rd and 4th semester at both universities received an email with a link to the survey in order to get feedback on any unclear point and make the necessary modifications to the questionnaire. Piloting a questionnaire has several functions such as checking the clarity of the questionnaire, gaining feedback on the validity of the questionnaire and the purposes of the study to eliminate ambiguities or problems in wording, identifying redundant or irrelevant items, omissions, and items that were not completed or misunderstood (Cohen, Manion and Morrison 2011, p. 402). All of these functions were considered during the pilot study of the current research.

After getting ethical approval from the University of York to carry out the pilot study, the first emails were sent to the Arts and STEM universities in Ecuador on June 2016. Members of both HEIs replied via email, but I did not get any messages indicating approval to send out the online survey to their students from 3rd and 4th level. During the second attempt, I requested help from one of my friends who worked at my institution, and who knew some people from SENESCYT and the STEM university. The STEM University requested some documents such as the research proposal and the ethical approval from the University of York, but after that, there were no replies. I had decided to go back to Ecuador to establish face-to-face communication since online communication was not working. Before this, my primary academic supervisor emailed authorities from the STEM university in advance. The letter is provided in Appendix E.

Regarding this letter, my supervisor emailed it on October 5th, 2016 to people that I had contacted in previous emails. Since she did not receive any replies, she sent another email on October 17th, and that very day, she got an email from the Vice-chancellor for Research and Innovation who requested the completion of an IRB (Institutional Review Board) form in order to know the kind of risks that could affect the participants. After completing the form and mentioning that the study would have minimal risk, my supervisor and I got IRB approval to carry out the pilot study. The Vice-chancellor mentioned that besides having IRB approval to do research at the institution, a collaborator from the STEM University and his written consent to participate was needed. I got the local collaborator and his written consent via email after some days. I visited the STEM university where I met my collaborator, who helped me get the emails of 370 students from 3rd and 4th level.

I also emailed the Head of the Research and Postgraduate Studies Department at the Arts University, and I got a favourable reply that very day. On subsequent days, I sent him the online survey and the ethical approval of the University of York for the analysis on behalf of the Academic Vice-Rectorate and the Student Welfare Department. After some emails, I got approval to send out the survey. I requested some help from the institution in order to let the students know that the study had the permission and support of the authorities at the Arts university. In relation to this, before I sent out the link to the survey to the 276 students from the two levels, the Head of the Research and Postgraduate Studies sent them an invitation to complete the online survey. As regards the STEM University, I did not request this help.

Once all the 646 students' emails were organized on Qualtrics, the surveys were sent out on November 14th, 2016. I scheduled three reminder messages to unfinished respondents that were sent on November 25 (Friday), November 27 (Sunday), and December 5 (Monday). Sending the reminder emails on Friday, Sunday and Monday had a reason. The local collaborator at the STEM university mentioned that before sending out the surveys, it was

important to decide when it was more strategic to send them: at the beginning of the week or at the end. This was taken into account to send the first email and subsequent reminders on days that were at the beginning and at the end of the week. The survey was closed on December 12, 2016.

The surveys started from the total of 646 students who received the email were 217, and of this group, 155 students did not have any answers while the other 62 students completed the questionnaire (9.6% of the total of emails sent out). Of these 62 respondents, 29 participants out of 276 students at the Arts University completed the survey (4.5%) while at the STEM University, this amount was 33 participants out of 370 students (5.1%). With respect to response rate, for internet surveys it is usually lower than for paper-based surveys, as is the completion rate of all the survey (Reips, 2002a, as cited in Cohen, Manion and Morrison, 2011, p. 286). Witmer *et al.* (1999: 147, as cited in Cohen, Manion and Morrison, 2011, p. 286) reported that for paper-based surveys, the response rate could be as high as 50% and as low as 20%, and for an online survey, it could be as low as 10% or lower than this percentage. As it was mentioned earlier, the response rate at both HEIs was 9.6%, which is in line with what was described by Witmer *et al.*

The changes that were made as a result of the pilot study will be explained in subsequent lines. To start, the beginning of the survey that was about general information on the participants had to be modified, and here two majors were included (music production and sound production) that were not mentioned on the Arts University website, but some of the students had mentioned during the pilot study. With this, the original number of 11 majors that were in the drop-down list for both HEIs, augmented to 13 during the main study survey.

Then, in part one of the survey, which was about the influence of the messages on the importance of students' major in the choice of study, the following question was added for the main study survey: Was there a message from the Ecuadorian government during its television or radio programs that influenced your decision to choose your current major? Please explain. (The programs that are considered in this question are the Citizens' Outreach programs (*sabatinas*), speeches to the nation by the President or Vice-president of Ecuador, *Buen Vivir TV* or *Ama la vida TV* programs, etc.). I did this because there was another question that got this information in the form of a Likert scale, and I felt that using an open-ended question would give me the information that I felt was lacking in this question. In this respect, closed questions such as rating scales, dichotomous and multiple choice questions "do not enable respondents to add any remarks, qualifications and explanations to the categories, and there is a risk that the categories might not be exhaustive and that there might be bias in them (Oppenheim, 1992, p. 115, as cited in Cohen, Manion and Morrison, 2011, p. 382)"

In the second part of the survey that was about motivations for the choice of study, two questions were added at the beginning of it: How old were you when you decided that you were going to study at university? and How old were you when you decided to study your current major? These two questions were ordered from general (age when participants decided to study at university) to specific (age when participants decided to study their current major) following the funnel approach described earlier in this chapter. The question about hobbies during high school was also modified and included a box for doing sports. The question about sources of inspiration had one more choice added during the main study: Inspiration did not come from other people, but from I. With respect to this last question, it was interesting to see that several respondents during the pilot study were mentioning that the inspiration came from themselves and not from others. If we consider that, in general, human

beings are not isolated from others and their ideas, this statement should be taken with care. The possibility of influences from other people that remain at the unconscious level of the participants should be considered.

The third part of the survey which was about background and motivation to choose a major did not have any changes in its six questions. The fourth and last part of the survey which was about demographic information had changes. First, the boxes for participant's name and date were eliminated. This was done since the report generated by Qualtrics provided information about the participants' emails and the date the respondents had completed the survey. The identification of respondents' email was important for the recruitment of participants for the interviews. Second, the boxes that provided information for participants' city and province were merged. Finally, the box for comments and suggestions to improve the survey was not included.

Regarding support at both HEIs, it was very important for me during my stay in Ecuador, and I was well-received. The process of getting permission to start the pilot study at the universities in Ecuador started with online communication difficulties, and ended up with the satisfaction of learning from difficult times. The support and persistence demonstrated by me and my academic supervisor was very important during the third attempt of getting approval to send out the surveys at both institutions where I did not know anybody. The academic supervisors' help in relation to the letter that she wrote, which was presented earlier in this chapter, was definitely vital to change the course of the situation and start getting positive results. If I had to start a new research project and get permission for data collection at a new university, I would definitely recommend starting with face-to-face communication instead of emailing people who do not know me. Additionally, I would recommend to start contacting the research department at the institution. In the case of the current study, the people that were emailed at the beginning were not from the research department and were

more related to the administration team of the university. The key person that gave permission to collect data was the head of the research department at the STEM University. All in all, this pilot study was an enriching experience that shaped my spirit and renewed my motivation for the main study.

The main study survey took place in 2017, and started on February 7th for the case of the STEM University, and February 11th for the case of the Arts University. The participants were first-year students (levelling and first semester) at both universities. An email with a link to the survey (see Appendix A) was sent out to a total of 431 students at the Arts University and 208 students at the STEM university. After the first email was sent at both universities, there were 10 reminders to unfinished respondents. In relation to this, Qualtrics did not allow more than 10 reminders. The surveys were closed on April 20th, 2017. The students who participated were 72 at the Arts University and 57 at the STEM University. The response rate to the main survey was 20.2%. The questionnaire was emailed to 639 students and 129 provided answers, but one was excluded from the analysis since the participant had only completed three items (institution, semester, and Q1). This percentage was higher than the response rate to the pilot survey, which was 9.6%.

In terms of the bias analysis, I only obtained information from both institutions on gender and the geographical region of the respondents (see Table 4.3). I received information on disability and ethnicity from both universities but these variables were excluded from this study as I mention in this chapter. Regarding gender, the percentages of the sample and that of the STEM University were similar. This was not the case for the Arts University where the difference was higher (more than ten percent points for males and females). In the case of geographical region, the percentage in the sample was almost the same for coastlanders and highlanders, but there were big differences in the populations at each university where we can

see that the STEM University had a significant majority of highlanders and the Arts University had much more coastlanders.

Table 4. 3

Comparison between percentage of respondents in the sample and at each institution

Background and academic characteristics		Sample	Arts University	STEM University
Gender	Male (n=61)	59.2%	71.9%	57.0%
	Female (n=42)	40.8%	28.1%	43.0%
SES	Lower class (n=50)	54.3%	-	-
	Middle class (n=42)	45.7%	-	-
Geographical region	Coast (n=45)	48.9%	85.1%	17.8%
	Highlands (n=47)	51.1%	13.8%	80.1%
Achievement	High attainers (n=40)	43.5%	-	-
	Middle attainers (n=52)	56.5%	-	-

The survey final version that was used during the main study had 45 questions that included 17 open-ended and 28 closed-ended questions. The closed-ended questions included five kinds of questions described by Cohen, Manion and Morrison (2011): dichotomous, rating scales (5-point Likert scales), multiple choice (single answer and multiple answer mode), ratio data (that deal with continues variables that have a true zero, and the respondent

provides the numerical answer that fits his or her case, e.g. How old were you when you decided to study your current major?), contingency questions, filters and branches (which depend on the answers to earlier questions, for instance: 'If No is selected, then skip to 3. Background characteristics and...'). These kinds of question act as filters for subsequent questions, in which the later questions are dependent (contingent) on the earlier ones, and are branches of former questions).

The participants at the Arts and STEM University received the same survey during the pilot study and the main study, and were asked to mention the factors that contributed to motivate them to study STEM or Arts oriented majors. At both universities, I sent the link to the survey to all the students from the first year (main study) and second year (pilot study). There were four sections to the survey: Influence of messages on the importance of major on the choice of study, motivations for the choice of study, background characteristics and the motivation to choose a major, and demographic information

The survey was prepared bearing in mind the funnel approach. This approach starts with general questions to introduce the topic, then it moves into specific questions, and ends with general, easy questions (like demographics). The approach lets participants warm up starting with general questions, work into specific questions, and warm down at the end of the survey. In doing so, the survey turns into a smooth process, which lowers drop-out rates, and may even help increase the quality of answers that are received (Smith, n.d., p. 5-6).

The survey questions were prepared including all the majors that were offered on the websites at the two universities in this study. There were four sections in the survey. The first section (questions 1-7) were related to the first research question, and the questions were prepared taking into account the means of communication that the Ecuadorian government uses to deliver messages on the transformation of the production matrix and the role of the emblematic universities in this change. All of the TV or radio programs that were included in

the survey were from the government (*sabatinas*, *Buen Vivir TV*, and *Ama la Vida TV*). The second section was about the motivations in the choice of major, and was related to the second research question. This section considered the concept of significant persons since they are considered sources of inspiration in young people's choice of science in HE (Sjaastad, 2012). Some of the significant persons mentioned in Sjaastad's article and included in the online survey were fathers, mothers, friends, teachers, siblings, relatives, and counsellors. Chachashvili-Bolotin, Milner-Bolotin and Lissitsa's (2016) article was also used to include questions such as people who encouraged the uptake of tertiary studies, and students' background information such as father and mother's level of education (for the case of the third research question). The third section was prepared taking into account the final score in the ENES examination, and problems regarding money, gender, and disability issues. Finally, the fourth section included demographic information such as occupation or job title of fathers and mothers, SES, ethnic group, gender, whether the person had a disability or not, and monthly family income (total). The questions on the background and academic characteristics of the participants were necessary since they are variables that influence the choice of STEM subjects (Tripney et al., 2010).

4.5b Interviews

Unlike the surveys, the interviews were not piloted with students from the two HEIs, but with 6 participants that were a combination of my family members and former students at a university in the city of Portoviejo. All the respondents who completed the main study survey (and some who only completed a few questions) were emailed to recruit participants for the interviews. The interview schedule was prepared by first exploring the survey data analysis. Thus, I had to link the wording of the interview questions to the pilot study survey findings. As regards to the main study findings, I could not use its findings to prepare the interview schedule since the online survey was still open during the time he needed to get the

final version of the schedule. A first draft was sent to my primary academic supervisor and clear feedback was given on it. Regarding this, there was the need to redraft it since there was repetition of survey questions, and the presence of closed questions with scales and fixed response choices that had to be eliminated from the schedule. Also, there were issues in terms of lack of subtlety in the questions that had to be corrected (for instance, asking directly if a participant had a disability and whether it affected HE choices).

With this feedback in mind, a second draft was prepared and there were new comments. There was a need to focus more on quantitative rather than qualitative data findings to develop the questions. The trends in the quantitative analysis had to be the main focus for the wording of the interview questions. In addition, the number of thirteen questions had to be reduced (the final version had eleven questions). With fewer questions, I would have more time for some semi structured discussion if interesting things appeared during the interview (for instance, the Common Core Curriculum, which is a time at the STEM University when the students are receiving four semesters of common subjects before they choose their HE course in 5th semester). In terms of leading questions, there was some work to be done with respect to phrasing. The phrasing also took into consideration giving less information in the question. Finally, I was encouraged to identify each interview question with one research question by putting 1, 2 or 3 at the end of each one of them.

The third and final draft focused on using the funnel approach used to word the survey questions (going from the general to the personal) and some little changes in terms of wording. After the final version was obtained, there was the need to test the questions with my family members and my former university students. During the process, cognitive interviewing was put into action (make sure that the interviewees could make sense and answer the questions). The pilot interviewees were six people (three family members and

three students from a private university in Portoviejo where I had previously worked), and each of these took in average around 50 minutes to complete the session.

The main study interviews were onsite for the case of the STEM University, and took place between April and May 2017 (see Figure 4.2). In the case of the Arts University, the interviews were via Skype and took place between July and August 2017 when I was back in the UK. The participants were students from the levelling semester and first semester at both HEIs who had already taken the online survey and decided to be interviewed individually after reading and signing the informed consent form that is presented in Appendix C. There were 23 and 20 interviewees at the STEM and Arts University, respectively, who answered the questions that are found in Appendix B.

Interviews have limitations. Yin (2009, p. 108-115) warns that interviews should always be considered as verbal reports, and we should be wary that when reporting about the events and how they happened, the respondents could have common problems of poor recall, bias, and poor or inaccurate articulation. His suggestion is to corroborate data from interviews with information from different sources, and discusses the use of triangulation.

As an interviewer I kept in mind what I had learned during data collection for my master thesis in relation to avoid expressing my own perceptions on the topics of the interview. As regards to interviewing, Cohen, Manion and Morrison (2011, p. 425) say, 'Avoid giving your own view or opinion; be neutral.' Additionally, I kept in mind not to reveal my political preference so the interviewees did not feel constrained by it. Cohen, Manion and Morrison (2011, p. 421) mention in this respect, 'During the interview the biases and values of the interviewer should not be revealed, and the interviewer should avoid being judgemental'. I also considered Arksey and Knight's (1999, p. 53) recommendation in relation to avoid giving signs of approval or disapproval of answers received and avoid answering the question for the participant. I was just limited to asking the questions in my

interview schedule and listening to the responses provided. Sometimes there were impromptu questions as a result of something interesting that appeared during the responses (for example, the common core curriculum at the STEM University).

Regarding the impact of the presence of a camera on interviewees' candour, there was an interesting finding when I triangulated the data from the online surveys and the online interviews (Skype interviews). There were active rejecters that used strong words against the government during the online surveys, but did not show this behaviour during the Skype interviews. This could be partly explained since the online survey respondents were anonymous while the interviewees had to identify themselves via email and during the interview. In this regard, Cohen, Manion & Morrison (2011, p. 411) mention among the advantages of the questionnaire when it is compared to interviews that it tends to be more reliable because it is anonymous, and it encourages greater honesty. Furthermore, the Arts interviewees expressed their consent to be video recorded on Skype. With respect to this last point, 'A videotape might yield more accurate data but might be even more constraining (than an audiotape recorder), with its connotation of surveillance.' as Cohen, Manion & Morrison (2011, p. 424) note. The idea of being under surveillance could have influenced active rejecters' responses during the videoconference and adopt a more passive attitude in relation to expressing their ideas about the government. Additionally, some Arts students had their videoconference at the Arts University and this could have influenced their responses.

4.6 Ethical considerations

Before starting the pilot study, ethical approval from the Education Ethics Committee (EEC) at the University of York (UoY) was needed. From the Educational Research Group (ERG) meetings in charge of the head of the UoY Department of Education, I understood that I could not start data collection without this approval (the Ethical Issues Audit Form in

Appendix D also addresses this point at the beginning of it. Obtaining ethical approval was a joint responsibility of my academic supervisor and me, and this meant that the academic supervisor was no longer a guide and an approver, but one of the applicants. Both would obtain approval from my Thesis Advisory Panel (TAP) member and one member of the EEC.

The Ethical Issues Audit Form provided information on the topic, the place where the study was going to be conducted, the methods for data collection, the process of participant recruitment, a declaration that the time that I was asking to my participants was reasonable and it was within acceptable levels in terms of the disruption to their normal activities. Additionally, this form mentioned that the topics would not cause distress or anxiety among the participants, the research would not involve deception, it would not involve the participation of participants under 16 years of age or the inclusion of high risk or vulnerable groups. The form addressed the incentives that I would give to the participants after completing the survey and interview. I gave knowledge vouchers to attend a talk on how to use autodidacticism to learn English without leaving Ecuador and prepare for the IELTS or the TOEFL. In the case of the interviews I considered 10 USD plus a cup of coffee and crackers/cookies to be served during the interview for each participant. The document mentioned that the participants would have the option to be informed via email about the findings of the study. I mentioned that I would have an Informed Consent Form (ICF) for the participants to sign, and provided an attachment of the ICF. I mentioned that I would inform the participants in advance about what their involvement in the study would entail and the purpose of it, the possibility of getting information that had to be passed to relevant external bodies for moral or legal reasons. In relation to this last point, I did not have to pass this kind of information to the abovementioned bodies. I also addressed how long I would store students' data after their participation, and how I would keep this information, who would have access to it, and the way I was going to protect participants' identities during the

research process. The possibility of using their data in public presentations or future analyses was also mentioned, as well as having a chance to decline that use. Names and contact details of two persons to direct questions, concerns or complaints were provided (I provided the name and email of my academic supervisor and the email of the EEC). Since there were interviews in this study, I also informed the participants that they would be given an opportunity to comment on their written record of the interview session. The right of participants to withdraw from the study during data collection with a deadline by which they would be able to do this was also included in the document. I mentioned that I was not going to access data from a non-publicly available source such as pupil data in possession of a local authority or school).

Possible conflicts of interests were not reported in the Ethical Issues Audit Form. Although the organisation that is funding my scholarship is the SENESCYT, I did not have any direct personal involvement in it, and there were not any conflicts of interests reported. In terms of the two universities in the current study, I had no relationship with members of both institutions before starting the pilot study. I decided to look for institutions where I did not know any member to avoid conflicts of interest. The University of York's Ethical Issues Audit Form (see Appendix D) that I had to complete before starting data collection addressed conflicts of interest. Concerning this matter, 3.5.2. of the University of York's Code of Practice on Research Integrity (2014) mentions that,

In relation to research or research-related activity, a conflict of interest can be understood as a situation in which a researcher's interest in pursuing unbiased findings is potentially or actually compromised by his/her other interests, or the interests of others involved – whether financial, institutional, academic, political, personal or otherwise.

Not having friends in the HEIs that were going to take part of this study had a limitation, and it was the time that it took to start data collection for the pilot study. In Figure 4.2, the reader can see that it took almost four months to get permission at the Arts and STEM University to start the pilot study (things were easier during the main study since I had already made some contacts within the two institutions that helped me with my research).

After submitting the Ethical Issues Audit Form and the Informed Consent Form, the ethical approval process did not take a long time since the participants were not vulnerable groups. In relation to this last point, the University of York website mentions:

Where research involves vulnerable groups (e.g. children, prisoners, those suffering mental or physical illness), particular care should be taken to safeguard their welfare and interests; and additional safeguards such as Disclosure and Barring Service (formerly CRB) checks should be implemented as appropriate (Code of practice and principles for good ethical governance, 2014).

All the participants were at least 16 years old, and had to sign participant consent forms before taking part in the study. Also, email informed consents were obtained from the two Ecuadorian universities, and their authorities were assured that the information would be confidential. A letter of permission explaining my status as a PhD student at The University of York was prepared by my first academic supervisor, and used to introduce me to the students and the staff at both HEIs.

Those participants in each institution who completed the survey were asked whether they wanted to voluntarily provide further information during the interview sessions. The interviews lasted in average between 40 and 60 minutes, and took place inside the university (excepting the case for the arts students in which the use of Skype was necessary since I was back in the United Kingdom). The participants' interviews were audiorecorded, and they

were transcribed and coded. All the instruments gave the respondents the opportunity to give their comments or suggestions on issues that were not mentioned.

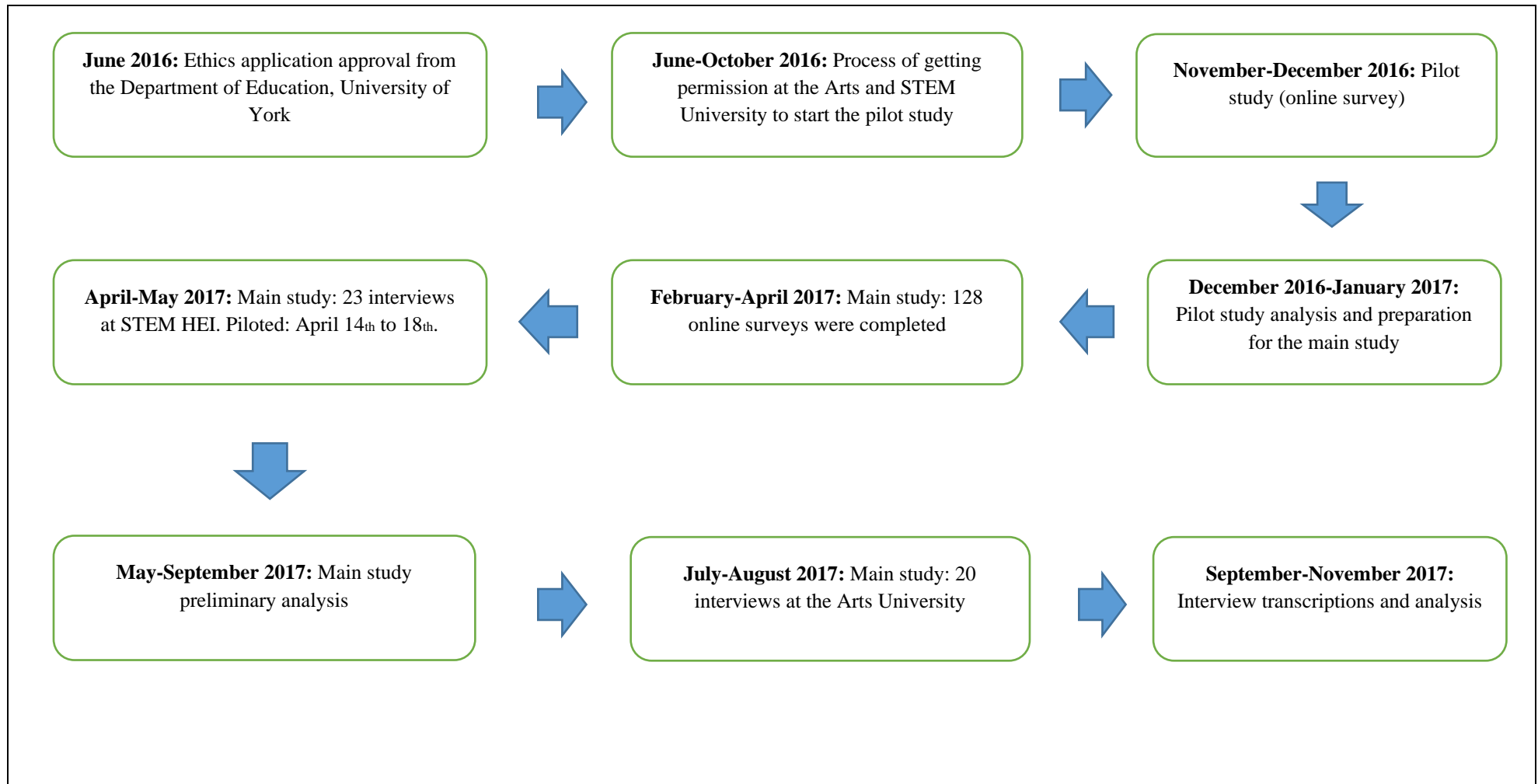


Figure 4. 2. Data collection and analysis process during the pilot and main study

4.7 Main study data analysis

The main study data analysis has two sections: survey data and interview data analysis. A description of what was done in relation to data analysis will be presented in subsequent lines.

4.7a Survey data analysis

The purpose of this analysis was to inform what should be considered during the next stage (interview analysis). I employed descriptive statistics during the survey data analysis. At some points there is qualitative analysis since there were open-ended questions. The data for this analysis was downloaded from Qualtrics as SPSS files (one for each university) and merged into a single SPSS file so the data could be easier to analyse. The data in this merged file had variables that allowed me to identify both institutions such as students' email, whether they were from the Arts or STEM University, and their HE course. The analysis that was done using SPSS was related to descriptive statistics such as obtaining frequencies and crosstabulations between variables.

4.7b Interview data analysis

For the case of interview data analysis, the raw data of all the 43 interviews (20 and 23 interviews at the Arts and STEM university, respectively) were transcribed by me and once this information was ready it was analysed using NVivo Data Analysis Software.

I did not find any interviewees with disabilities at both universities, which was disappointing since disability was one of the key variables that was considered at the beginning of this study. In this respect, students with disability at the STEM University were 1% of the population (830 students) according to information that was provided to me via email by administration staff working at that institution.

Regarding ethnicity, self-identification of ethnic group is the way how the Arts and STEM University determined the ethnicity of the students. The majority of the interviewees were *Mestizos* (18 and 22 participants at the Arts and STEM University, respectively). With respect to minority groups such as Indigenous and Afro Ecuadorians, there were participants from these two groups at the Arts University and only one participant from the former group at the STEM University. There were not any participants from the *Montubio* and White groups. The low number of participants in some ethnic group categories was particularly difficult since this was also a key variable in this study. The low number of participants in some ethnic categories was one of the reasons to leave ethnicity out of the analysis of this thesis since it could raise ethical issues in relation to identification of participants. The other reason for eliminating ethnicity from this research was that the low amount of participants in some categories would not be suitable for statistical analysis.

In terms of geographical region, there were only participants from the Coast and the Highlands (20 and 23 interviewees, respectively) in the current study. In terms of SES, there were 5 participants from the lower class, 15 from the lower-middle class, 21 from the middle class and one from the upper-middle class. My primary academic supervisor and I discussed the idea of just having three categories for SES instead of having five. In this regard, there was the case of two siblings who were studying at the Arts University and one mentioned that their family was from the lower class, while the other sibling mentioned the lower-middle class. The idea of merging the lower class with the lower-middle class and the middle class with the upper-middle class was a solution for the abovementioned case. Additionally, I also got more participants within the merged categories for data analysis. Regarding gender, number of female interviewees were slightly higher than the number of males (23 compared to 20).

During supervision meetings the possibility of paying to get the transcriptions done was discussed. I considered this idea since the process of transcribing would take valuable time that I could use to work on other chapters of the thesis. The people that were considered to help me with the transcriptions were my former students from English classes back in Ecuador. Another group of candidates were EFL teachers that were my colleagues in Ecuador. The last person and the candidate of my preference was one of his sisters who also teaches English. In the end, I decided to transcribe since I considered the advice of a PhD student who told me that the time when a researcher is transcribing gives the chance to organise ideas and have a deeper understanding of the data. One thing that she recommended based on her experience during her PhD thesis was to transcribe in Spanish and once this was done, I should only translate the things that were going to be in my thesis. I translated all the transcriptions directly into English in spite of knowing that doing this would mean that at some times I would have to use extra time to go to online Spanish-English dictionaries to check the correct translation of words. While I was already transcribing, a PhD student shared information about wreally.com and Transcribe (audio transcription software). I did not use the software since I was almost done with the transcription process. The process of transcribing 43 interviews was a big challenge for me. At the end of this process I had completed a 60,000-word document. On average, every interview was completed in one day.

During the interviews, I reminded the students that they had to focus on past events since they were answering the questions based on their current life. I also noticed that this was happening while I was piloting my interview schedule with my brother who had graduated from high school in 1998. During that pilot interview, I told my brother not to think in terms of 2017, but in the years around 1998 when he was making his decision to study his HE course. I realised that he was answering several questions using the present as reference and this also happened with some of the interviewees during the main study.

Conversations during supervision meetings led to the need of training on interview data analysis. Before starting the aforementioned analysis, I attended a training course on the use of NVivo at the University of York which took place on September 2017. I also attended another NVivo training course at the same university during January 2018. I encountered a limitation while I attended both training courses since I did not have all my transcriptions ready by the time these events took place. It would have been better to have all the transcriptions ready to use them during the sessions to make learning more meaningful. Once the transcriptions were ready, I used YouTube tutorials to better understand the use of NVivo and help to make sense of qualitative data. In this respect, I watched some videos that were published by the qualitative research software developer QSR International, namely the NVivo how-to videos on exploring NVivo for Mac.

4.8 Conclusion

This chapter has explored the scope of this study, the rationale for using mixed methods process of data collection during the pilot and main study using online interviews and interviews, the participants and the sampling process, ethical considerations, and the main study analysis.

Two difficulties in relation to eliciting information about subject choice were present in this study. First, the analysis of the choice of undergraduate programme is retrospective. This has a limitation: when reporting about the events and how they happened, interviewees could have common problems of poor recall (Yin, 2009). Shepherd and Zacharakis (1999) warn about the use of post-hoc methodologies that may bias the results and mention that people are poor at introspection and have problems with recall and post-hoc rationalization biases. In relation to this, an alternative for future studies could be collect data when students

are in their last year of high school and once they are in their first year at university. In doing so, the aspiration and the actual choice could be documented in research.

A second difficulty was the existence of some codes that emerged from the data that were related to access to HE in general and university choice rather than subject choice, which is the focus of this study. In this respect, future studies on subject choice could be improved by raising awareness among young researchers and their participants that university choice factors are different from subject choice factors. Including factors that just belong to subject choice and excluding those that are related to university choice and HE access in general could improve future research on subject choice. However, having university choice and HE access factors included in the data of the current study was useful to show how government messages had influenced the choice of institution of some participants.

The interview schedule was designed to explore the relative importance of different factors that influenced the choice of major. One thing that would be different to better understand how government's message influence subject choice would be to have one question where participants can rank the influence of government's messages and motivational factors beyond the government, which would include the use of percentages for each one of the motivational factors mentioned above.

Regarding challenges of political research, classifying some students into the typology of political dispositions that will be presented in the next chapter is one of the challenges presented in this study. With respect to this, Alejandro (theatrical creation, interviewee, passive rejecter) mentioned that he was not interested in politics and he did not pay a lot of attention to these kinds of messages. Until that moment he could be considered an apolitical student in the typology. However, Alejandro's apolitical position could be challenged when he said in Q29 of the survey, 'For the moment, relatively satisfied since

there are subjects that are related to the policy of the current government which study looks more like a kind of indoctrination.’ His case was not isolated and there were other students that were expressing government rejection during the online surveys but did not show that rejection during the interviews. A possible explanation for this could be that online surveys were completed without my presence while interviews were face-to-face and the students gave their consent to be audiorecorded. Future studies could use online surveys as a way to help students to open up regarding their political views.

Chapter 5: The extent to which the Ecuadorian government's message about the importance of STEM subjects influenced undergraduates' subject choice

5.1 Introduction

Chapter 5 presents key findings from the online survey and the interviews during the main study in relation to the first research question: to what extent has the current Ecuadorian government's message about the importance of science, technology, engineering, and mathematics (STEM) subjects influenced the subject choices of students currently enrolled in higher education in Ecuador? The overarching research question in this analysis is: how does government policy on higher education in Ecuador influence undergraduates' choice of STEM subjects? This chapter demonstrates that the Ecuadorian government's messages about the importance of STEM subjects influenced a significant minority of respondents since almost half of the STEM students (45.0%) reported that the government was influential in their subject choice. In this respect, 21.4% of the participants in the sample were STEM students who reported that the government's message had been influential in their choice of HE course compared to 26.2% of STEM students who reported no influence. The percentage of participants who were positively influenced by the government's message at both universities was quite high (38.9%). From those who mentioned an influence, STEM students were more likely than arts students to report that government messages had influenced their decision. This suggests that government assertions on the importance of STEM subjects to the change of the production matrix in Ecuador has had some influence on current students. Additionally, a sizable group of interviewees (39.5%) mentioned that their interest in the subject was decided at quite a young age and government did not have much influence sparking this interest. However, the government's messages seemed to have some influence on the participants' choice of university.

The remainder of this chapter is divided into three sections: the influence of the government's message on the participants' HE course choice (5.2), an analysis of the participants' positions concerning the influence of government in their choice of HE course (5.3), and the conclusion (5.4). In 5.2, the typology of four political dispositions that emerged from the data will be discussed about the government's influence on participants' choice of major: positively influenced students, active rejecters, passive rejecters, and apolitical students. These positions will be analysed concerning the choice of HE course and institution in 5.3 before concluding the chapter.

5.2 The influence of the government's message on the participants' choice of HE course

The results from Q7 in the survey¹ showed that a majority of the respondents (61.1%) were not influenced by the government's messages in terms of their choice of HE course (see Figure 5.1). Nevertheless, the minority of students who reported that they were influenced by the government's message in relation to their HE choice was 38.9%, which could be considered a sizable group.

¹ Was there any message from the Ecuadorian government during its television or radio programmes that influenced your decision to choose your current major? Please explain. The programmes considered in this question are the citizens' outreach programmes or *sabatinas*, speeches to the nation by the president or vice president of Ecuador, *Buen Vivir TV*, or *Ama la Vida TV* programmes, and others.

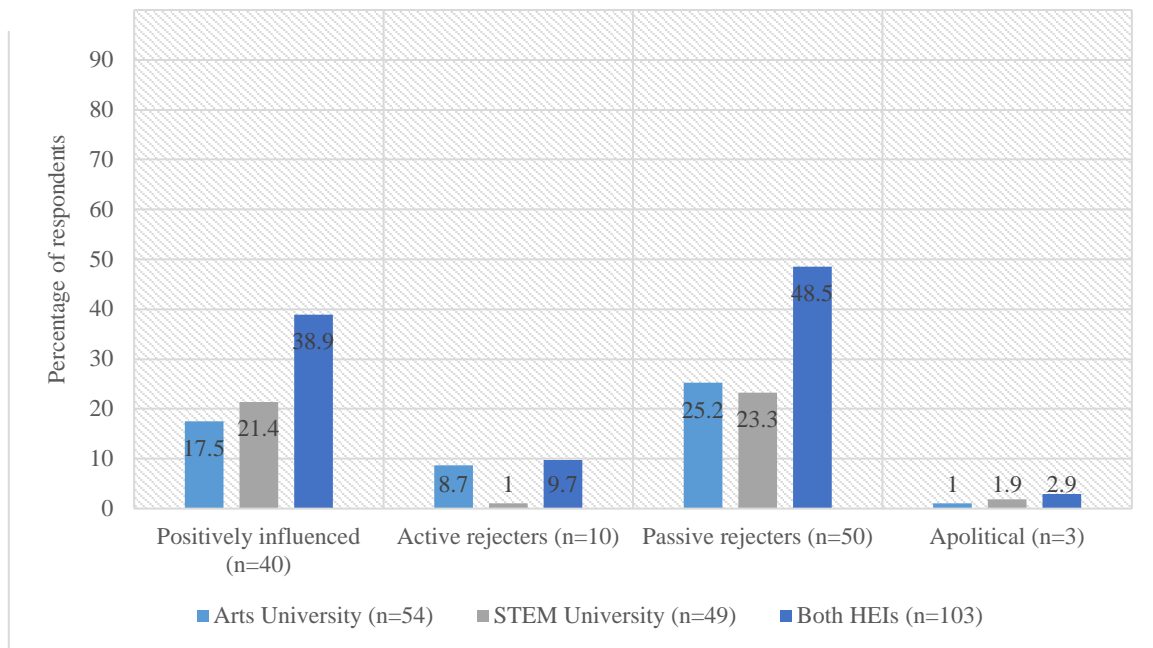


Figure 5. 1. The typology of political dispositions concerning the influence of the government’s message on participants’ subject choice (data obtained from Q7 in the survey).

Upon closer examination of the open-ended responses in Q7, a typology of political dispositions concerning the influence of the government’s messages emerged from the data, which can be observed in Figure 5.1. This typology mainly emerged from the survey data in question 7, but interview data was also used to determine the political disposition of some participants. The four distinct positions in this typology were:

- a. Positively influenced students (i.e. those participants who reported that the government influenced them in their choice of major). The percentage of survey participants in this category was 38.9%.
- b. Active rejecters (i.e. those participants who reported as being aware of the government’s message but actively rejected the idea that they were influenced by it). The percentage of survey participants in this category was 9.7%.

- c. Passive rejecters (i.e. those participants who reported they were aware of the government's message but passively claimed it did not influence their choice of major). The percentage of survey participants in this category was the highest of the four groups in the typology (48.5%).
- d. Apolitical (i.e. those participants who reported that the government did not influence their choice of major and said that they are not interested in politics). The percentage of survey participants in this category was the lowest of the four groups (2.9%).

The data presented in Figure 5.1 suggests that there was a significant minority of STEM students that were influenced by the Ecuadorian government in relation to the choice of STEM undergraduate courses. This is evident since the positively influenced is a sizable group that is almost two fifths of the respondents, and there are more STEM students who say that they are positively influenced which aligns with the government narrative. It is important to mention that the government message has really reached this group but maybe it has not been as successful as they would have hoped. Additionally, the participants' responses suggest the government's message seemed to strengthen an existing preference for STEM and arts HE courses, and that their choice of subject was made years before they started their application to university. The students' responses suggest that they had limited agency with respect to their choice of major, which could be explained in part by the link between HE course and obtaining a certain amount of points in the ENES, which questions the extent to which the choice of subject is a free choice in the Ecuadorian HE system. Participants tended to consider the government's influence in terms of university choice rather than subject choice. This unexpected consideration of government influence could be explained in part by the financial benefits (free-of-charge HE and student grants) that students were going to obtain at the STEM University and Arts University. Another possible explanation could be

the idea of the academic quality of the two institutions (especially the STEM University) that was advertised by Correa and his government: the lecturers' academic profiles, the quality of education, or good comments about the HEIs seemed to attract students.

In the next section, the four groups in the typology of political dispositions in terms of the participants' choice of HE courses will be analysed.

5.3 Analysis of the participants' positions concerning the influence of government on their choice of HE course

As mentioned earlier, a typology of four different political dispositions emerged from the survey and interview data about the influence of the government's messages on participants' choice of HE courses. The four groups of students were positively influenced, active rejecters, passive rejecters, and apolitical. Across the groups, some participants provided a percentage of the government's influence on their choice of study. This percentage was an estimate of the government's influence concerning other factors that were present in the process of choosing their HE courses, which will be explored in Chapters 6 and 7.

Table 5.1 presents the motivational factors for university choice reported by the participants, and it can be seen that some factors related to the Ecuadorian government's messages emerged from the data such as academic quality (including perceived quality of instruction), new HE courses in Ecuador, and free-of-charge HE. Regardless of the participants' political disposition, academic quality was the motivational factor that emerged in all four groups. Free-of-charge HE appeared in all the groups, except the apolitical group, while new HE courses in Ecuador was a shared factor among positively influenced students and passive rejecters (see Table 5.2).

Table 5. 1. Participants’ motivation to study at the Arts/STEM universities (survey data, n=108)

Motivational factors	Percent
Interest in the subject	20.4
Perceived quality of instruction	20.4
New HE courses in Ecuador	14.8
Academic quality	9.3
Free-of-charge HE	9.3
The only Ecuadorian HEI specialised in the arts	4.6
The support that art is receiving from the government	4.6
Opportunity to change Ecuador	2.8
Research that is done at the university	1.9
Mission and vision of the university	1.9
University is a new project	1.9
Government’s messages	1.9
Ideas associated with innovation	0.9
Helping others	0.9
No more options in Guayaquil	0.9
Student grants	0.9
HE courses offered at the university	0.9
The decision was made at the last minute	0.9
On-campus accommodation	0.9
Total	100.0

Table 5.2 presents a summary of the motivational factors concerning the choice of HE courses and university and the groups in the typology of political dispositions. The motivational factors presented in this table will be explored in more detail in the next section.

Table 5. 2. Motivational factors for the choice of HE courses and university concerning students’ political dispositions

Typology	Motivational factors	
	Choice of HE courses	Choice of university
Positively influenced students	New HE courses in Ecuador, job opportunities, and government policy to support national art	Academic quality, financial benefits (free-of-charge HE and student grants), and constant advertising of the university on Correa’s behalf
Active rejecters		Academic quality, financial benefits (free-of-charge HE), government policy to support the arts, university location (only for arts students), and HE course was not easily available at other universities
Passive rejecters	Interest in the subject, new HE courses in Ecuador, and personal decision	Academic quality, financial benefits (free-of-charge HE and student grants), good comments about the university, and the only Ecuadorian university that specialises in the arts
Apolitical students		Academic quality, on-campus mobility

5.3a Positively influenced students

As mentioned earlier, 38.9% of the survey participants reported that the government influenced their choice of major (see Figure 5.1). Positively influenced students reported that they were motivated by government messages about academic quality, financial benefits (free-of-charge HE and student grants), new HE courses in Ecuador, and job opportunities. Government policy to support the arts seemed to be a factor that encouraged arts students and gave them the confidence to choose their HE courses.

During the current study, Ecuadorian HE policy was focused primarily on STEM rather than arts subjects, and this can be seen when Correa mentions that the STEM University in this study was ‘the most important project [of his government] and I honestly consider that it is the most important project in the history of the country; there is the future: human talent, science and technology’ (SECOM Ecuador, 2014, 2:19:14). Considering this, here we could pose a question on how the government’s message also influenced participants in the arts, and a possible explanation could be the advertisement of the Arts University by Correa. One example of this is when he inaugurated this institution in 2014 and said, ‘We have invested to date more than one thousand million dollars in the creation of four new cutting-edge, world class universities: University of the Arts (UArtes), UNAE (National University of Education), Yachay City of Knowledge, and IKIAM’ (Telerama, somos más, 2014). It can be seen that Correa advertised the four universities created in his government as excellent universities, which was one of the motivating factors reported by some participants in their choice of study (although this motivational factor is related to the choice of institution rather than subject choice).

The motivational factors that emerged from open-ended questions in the surveys and interviews were not only related to the focus of this study, which is subject choice, but also to

university choice. In the following paragraphs is an analysis of the most important factors that emerged about the choice of HE courses and university.

Choice of major

The group of positively influenced students mentioned that they were motivated by the idea of new HE courses in Ecuador. These HE courses are only found at the Arts University and STEM University, although they can be found in other countries. Table 5.3 shows that six HE courses in Ecuador were only found at the two HEIs mentioned above: two at the Arts University and four at the STEM University (Geoportal SNIESE, n.d.-b).

Table 5. 3. HE courses available at the Arts and STEM University

Institution	HE courses only available at the Arts and STEM University	HE courses available at the Arts and STEM University and other Ecuadorian HEIs (including the number of institutions that offer the same subject)
Arts University	Literature	Cinematography (two HEIs)
	Theatrical creation	Dance (two HEIs)
		Musical arts (three HEIs)
		Music production (two HEIs)
		Visual arts (four HEIs)
STEM University	Biomedicine	Biology (eight HEIs)
	Nanotechnology	Chemistry (three HEIs)
	Petrochemistry	Geology (three HEIs)
	Polymers	Information technology (ten HEIs)
		Mathematics (five HEIs)
	Physics (four HEIs)	

New HE courses in Ecuador was a motivational factor that emerged from the survey (see Table 5.1) and interview data and is related to the Ecuadorian government's messages. Messages in relation to new HE courses in Ecuador were repeated by top ranking authorities during the CR government, which discouraged the choice of some traditional HE courses, such as business administration, law, marketing, and architecture, and fostered the idea of having new and necessary subjects that would help change the Ecuadorian production matrix (Ayala, 2012; Enlace Ciudadano, 2009; HispanTV, 2013; Presidencia de la República del Ecuador, n.d.-a). The responses of some positively influenced interviewees in terms of new HE courses matched the government discourse. For instance, Esther (biomedical engineering) was attracted by the messages about new majors in the country, such as biomedicine or nanotechnology, and knowing that they are not traditional majors, there would be new opportunities to work. She added, 'They were very influential because of the new HE courses that they offered instead of the traditional one that I was thinking about, which was medicine.' Kerly (physics) spoke about her motivation to choose her subject in relation to a message during a sabatina about 'not choosing the traditional majors such as medicine and law, but majors related to science that will help the country to develop', which is a message that matches the government discourse on the transformation of the production matrix. Survey respondents such as Erika (biomedical engineering) were motivated by 'the possibility of changing things and choosing HE courses that had never existed in the country.' These responses show how the government seemed to partly persuade some students in their choice of HE course.

The motivation in terms of job opportunities seemed to facilitate the decision-making process of some positively influenced students at both universities. In this regard, Marisa (scenic art, Q7 survey) said, 'I do not remember the programme, but they advertised the new universities, and honestly, I was very motivated since they explained that despite being an

arts major, we could get a job.’ Micaela (cinematography, interviewee) was motivated by the creation of better conditions to get a job in the field of arts. She mentioned that ‘this government passed laws to benefit artists. All of these things motivate you since you think of a better future for artists, such as getting jobs more easily.’ Juliana (science of information and technology, Q7 survey) replied,

The citizen outreach programmes provide a lot of information about the jobs that are underexploited and that need to be developed. Also, the information is very promising with respect to the sources of employment that would be generated and the development of a subject that I completely like.

The idea of ‘HE courses of the future’ can be classified within the job opportunity messages. In this respect, Correa’s messages seemed to influence the subject choice of students like Nadia (cinematography, survey) who said,

Once I heard Mr President talk about the HE courses of the future during a sabatina and he mentioned my HE course that was about to start, cinema, I learned that it was possible to achieve my life’s dream and I decided to direct my life towards that dream.

A theme that emerged among the arts students was the support that national art and artists have from the government. In this regard, Leonardo (cinematography, interviewee) was motivated by Correa’s messages about the importance of promoting education and showing the social problems of the country through the arts. Micaela (interviewee) heard that the university was created to have film, music, literature, dance, or theatre produced in Ecuador and now there are Ecuadorian films that have space at movie theatres because it is mandatory to show them according to Ecuadorian law. Micaela thinks this is good because she will be motivated to produce films that will have a place at Ecuadorian movie theatres.

Her answer suggests that she felt more confident in her major choice since the government created better conditions for future professionals in the field of arts. Linked to what Micaela mentioned about the space that is given to Ecuadorian movies in the local market is the government policy to promote the consumption of national products through the Primero Ecuador (Ecuador First) campaign. Concerning this, Jose (music production, interviewee) heard that consuming national art products is encouraged and supported by the government, and he acknowledged that the government supports national products. He said, ‘We have to consume national products in the first place. We have to consume our art, culture, or music. This motivated me to some degree.’ He also mentioned that people who wanted to study music in the past had to go to Argentina or Europe due to the lack of opportunities to choose an arts HE course in Ecuador. Byron (music production, interviewee) dropped his STEM major when he was in his last semesters, and started a new one, this time at the Arts University. Government policy in terms of supporting the arts seemed to revive his intrinsic motivation for his current major. He said:

I feel 100% sure. I was studying information systems engineering and I got to the 7th semester and the major had ten semesters. I quit that major and now I am in the first semester at the Arts University. I did not feel good studying the other major. I attended classes with a feeling of unhappiness while now I feel happy at the Arts University because it is what I like and what I have always wanted. I am 27-years-old, and when I graduated from high school, I wanted to study music production or something about music. The culture here in Ecuador considers a musician to be a lazy person, that studying music is a waste of time or you are not going to earn a living. This is true since it is difficult to earn a living with music. I wanted to study music, and there were two universities here in Guayaquil where they offered majors related to it: the Catholic university, which had a major that I did not want, and the UEES

which is very expensive. I did not see any possibilities at these HEIs, and I finally chose information systems engineering at the Salesiana, which was near my house.

Byron got the major that he wanted and had the opportunity to have free-of-charge HE, which is something that he did not have at UEES.

In relation to the choice of HE courses of positively influenced participants, we see that the government's messages seemed to persuade students in terms of three themes that emerged from the data: new HE courses in Ecuador, job opportunities, and government policy to support national art. These will be explored in the next section on themes related to the choice of university of positively influenced students.

Choice of university

Students' motivation for their choice of university concerning academic quality (including perceived quality of instruction) was the most important theme that emerged in Table 5.1. Regarding messages of academic quality, which the Ecuadorian government advertised, Maily (chemistry, Q7 survey) reported,

I was not motivated by my HE course, but by the university, since I noticed how we have an HEI with well-prepared lecturers since the majority of them have PhDs, [the university has] well-equipped laboratories, and students that get more than 900 points in the ENES.

Maily mentioned academic quality, and she also reported more motivation for her university choice than HE course choice. Another student that was motivated to place more importance on the choice of university rather than the HE course was Kevin (nanotechnology engineering, interviewee), who said, 'The messages during several sabbatinas not in terms of my major, but the university in general, motivated me to come here.' Kevin and Maily's

words suggest that government messages influenced institution choice more than subject choice among some students. Nevertheless, the opposite must be considered, such as in the case of students like Jose (physics, interviewee) whose interest for his subject was the main motivation in his choice of study.

Academic quality seemed to be an important motivational factor among other students such as Lizbeth (biomedical engineering, interviewee), who was motivated by the new university of experimental technology where she ‘would have the opportunity to have studies of a high level and study with the best [lecturers].’ The government messages about the quality of the STEM University also motivated Lady (biomedical engineering, interviewee), who reported that the government influenced her choice since the university was said to be innovative, technological, and it had support [from the government] and prestige.

Government messages concerning financial benefits at both institutions influenced the choice of university of some of the participants who said their motivation was based on free-of-charge HE and economic support (student grants). Daniela (nanotechnology engineering, interviewee) commented that the government’s influence was considerable since there were advertisements for the university, the majority of them on TV, ‘specifically about majors such as nanotechnology in a public university that could be studied by students who do not have much money.’ Micaela (cinematography, interviewee) recognised that the government had a partial influence on her choice. ‘If the government had not created the university and its free-of-charge conditions, it would have been more difficult for me [to attend a HEI],’ she added. The government’s messages about student grants motivated Lady (biomedical engineering, interviewee) to study at the STEM University. She also said that HE is free of charge and she did not have to worry much about funding.

Correa's constant advertising of the universities was another theme that emerged from the data. Belen (polymer engineering, interviewee) reported the effect of the messages on her choice: 'since President Correa was always talking about the university, this generated curiosity and I started researching the institution on its website, and I noticed that it was very different.' She said, 'President Correa's messages about the relationships of the STEM University with international organisations grabbed my attention.' Belen seemed to be attracted by the fact that the university was advertised as an HEI with international relationships. There were other participants like Lizbeth (biomedical engineering, interviewee) and Naomi (software engineering, interviewee) who reported that the messages had a lot of influence on them since Correa was constantly talking about the STEM University during the *sabatinas*. This last point is in opposition to what was mentioned by some interviewees regarding the lack of advertisement for this university. Perhaps those participants who reported a lack of advertisement were not followers of the *sabatinas* or did not have exposure to the means of communication that shared the government's messages about the emblematic universities and their majors. It could be that these participants needed other means of communication, such as social media, to see the government's message.

As seen above, three themes emerged from the data in relation to the positively influenced participants' choice of university: academic quality, financial benefits, and Correa's constant advertising of the universities. In the next section, I will explore the group of active rejecters.

5.3b Active rejecters

The overwhelming presence of Correa during the citizen outreach programmes, which were organised for Saturdays since 20th January 2007, is visible when we review the Ecuadorian government statistics. According to *Presidencia de la República del Ecuador* (n.d.-b), out of a

total of 523 citizen outreach programmes that took place during Correa's administration (508 in Ecuador and 15 in other countries), he gave a speech to the nation in 456 of these programmes that were broadcast on TV and radio. The rest were given by Vice President Jorge Glas or Vice President Lenin Moreno (37 and 30 programmes, respectively); 498 programmes were live while 25 were pre-recorded and were carried out in 157 cantons of Ecuador (only 64 cantons were not visited by Correa or his vice presidents). Despite the number of *sabatinas* Correa used to talk about HE and the emblematic universities, the majority of participants in the current study reported that they were not influenced by the government's message. This finding was evidenced in Q7 of the survey (see Figure 5.1) where the majority of respondents (61.1%) reported no influence from the government in relation to their choice of HE course.

Among the three groups of non-influenced students that are shown in Figure 5.1, we find the active rejecters, participants who reported they were aware of the government's message but actively rejected the idea that it influenced them. The responses from the active rejecters matched the discourse of people who are *anticorreístas* (i.e. against Correa's government). An example of this kind of participant is Jemina (musical arts, interviewee), who said, 'I was not motivated by the government's messages,' and added, 'I am not a *correísta*.' She expressed that she does not like the Arts University because of that. The majority of active rejecters were participants from the Arts University (8.7% in comparison with 1% at the STEM University). Regarding these percentages, the inclusion of the Arts University in this study as a comparison group was very useful to detect this kind of participants (active rejecters) in the typology of political dispositions. Without the Arts University, the typology would have lost many of the respondents of the active rejecter group, and perhaps the typology would have had just three groups instead of four.

Respondents from the Arts University seemed to be more critical than STEM students about government policy. A possible explanation for this apparent dissatisfaction could be that the arts students have more exposure to oppositional discourse since the Arts University is located in the home city of an important political party that opposes the government. Additionally, the campaign for the 2017 presidential election took place when the data was collected, and this could have had an influence on the number of active rejecters at the Arts University since this electoral season was very competitive with an opposition that was trying to defeat the government and Correa, who had been the president of Ecuador for almost a decade. Another thing to consider is that the STEM University is located in the countryside where students have on-campus accommodation, and the closest city is 20 kilometres from the university; this could have kept them more isolated from the opposition's discourse.

Choice of major

The survey responses to Q7 regarding the existence of the government's messages during its television or radio programmes that influenced participants' decision of HE course revealed that there were participants that did not accept being influenced by government and they even challenged what the government was doing. In some cases, active rejecters' comments included words of rejection in relation to the government. An example of this is a response provided by Katherine (literature, Q7 survey), who said, 'Nobody helped me to select my HE course. I chose it because I have talent, not because of the junk TV that is broadcast by the government.' Another example of government rejection is evidenced in Yonis' (musical arts, Q7 survey) words. He said, 'Really I am not his follower...and today I see his sabatinas are a waste of money, perhaps in some TV programmes there are important aspects, but nothing else.' Angel (scenic arts, Q7 survey) also used rejection words, 'Nothing at all, I hate sabatinas. I think they are a great waste of time.' Gaby (literature, Q7 survey) commented, 'No messages. Good Living is a distorted circus of the government.' These students used

strong words to reject the government. Nevertheless, there were other participants in this group that expressed their rejection of the government without using strong words. For instance, Jemina (who mentioned that she was not a *correísta*) said that her choice of HE course was not influenced by the government, but her interest in the subject. In this respect, she said, ‘I have always had an inclination for the arts, and I agree with the creation of the Arts University because it gives the citizens many opportunities to enjoy this benefit.’ Vélez (sound production, Q7 survey) reported, ‘I do not consume audio-visual products from the government.’

Some participants did not like *sabatinas* because they were used to attack other people. This was the case for Eddy (sound art, Q7 survey) who said, ‘Nothing at all [he means that there were not any government messages that influenced his choice of HE course]. Those programmes are not useful for that, but to attack and insult other people.’ Mayleen (visual arts, Q7 survey) provided this answer,

To be honest, I did not like a lot of those programmes, not because they are bad or something like that; many of them taught good things and educated people. The messages of the president or vice president did not generate rejection, but their *sabatinas* or citizen outreach programmes disappointed me.... I would not like that they [the children in my family] see the president of our nation insulting [others] during a *sabatina*, and people encouraging that behaviour.

During the interviews, Mayleen mentioned that she did not have much motivation in relation to being influenced by the government’s message. She studied at a *colegio del milenio* (high schools created during Correa’s government), and they were her worst years. However, she also had positive experiences at that educational institution such as learning theatre, participating in plays, and she had the opportunity to sing.

It can be noted from what has been presented in this section that active rejecters not only deny the government's influence on their choice of HE course but also show a strong rejection of the government. In the following section, the active rejecters' choice of university will be analysed.

Choice of university

The survey responses in Q10 (what motivated you to study at the Arts/STEM University?) revealed the active rejecters' different motivational factors for the choice of university. As in the case of positively influenced students, active rejecters reported that they were motivated by academic quality, financial benefits, and government policy to support the arts.

Regarding academic quality, Domenica (physics, Q10 survey) said, 'The STEM University is the best university of the country with the best lecturers and the vision of people from around the world.' Her interview responses for Q2 (can you tell me what motivated you to study at the Arts/STEM University?) revealed that academic quality was a factor that motivated her choice of institution.

There were not any [government] messages. I think that if you follow what the government or your family say, it is like a lack of personality. I was critical in terms of the advertisement of the government, and before coming here, I did research about the STEM University, and I even came to the university to see how things worked...I did research, and I saw the kind of lecturers at the STEM University, all of them were PhDs. This last idea motivated me more than the government's messages.

Domenica added, 'The only good advertisement that I remember is that the people that gained access to the STEM University were the best in the country. If you gather the best students with excellent lecturers, you are creating a good project.' Domenica's responses focused on academic quality in relation to studying at an excellent university with excellent

lecturers who had PhDs and having classmates who were high achievers in the ENES. Eddy (music production, survey) was also attracted by the idea of academic quality and said, 'I also heard that this university had education of a different level.' Jemina (interviewee) said about academic quality, 'The second reason for choosing the Arts University was that I had good references about the institution. The comments were that the Arts University was good at music.' Jimmy (literature, interviewee) replied, 'Also, I did some research on the lecturers and the content that was taught, and I learned that the best lecturers were at the Arts University.'

Financial benefits, such as free-of-charge HE, was another factor that motivated some active rejecters. Jemina (interviewee) mentioned, 'To begin, it is a free-of-charge HEI. Since my undergraduate degree has not been registered [on the SENESCYT website], I do not pay the semester at the Arts University.' Jemina previously studied at another Ecuadorian university. People who already have an undergraduate qualification registered on the SENESCYT website have to pay tuition fees if they want to study a second HE course at a public university. She added, 'I liked this since education at the Catholic university is expensive. This was a big factor that did not let me study music before.' Mayleen reported, 'I was motivated by the existence of a degree for the major that I wanted to study, that it was owned by the state (free of charge) and that it was in my city, but above all, that it was free of charge.'

As in the case of positively influenced students, the government policy to support the arts also motivated some active rejecters such as Scarlett who said, 'The promotion of respect towards these careers.' Jimmy commented, 'The novelty of aiming at an arts career as a profession that is recognised [given respect] by the government.'

University location within the city was another reason for the choice of study among some respondents. This motivational factor was only reported at the Arts University. Gaby (literature, survey respondent) reported her motivation to study at the Arts University due to ‘the existence of my HE course without having to leave the city or country.’ Jimmy (literature, interviewee) said in relation to university location, ‘I was motivated by many things. One was the location since I live in the city centre; I live eight blocks away from the Arts University.’

Other active rejecters were motivated to study at their HEI because their HE course was not easily available at other universities. Angel (scenic arts) said, ‘It was the only public university where I could study scenic arts’, while Miguel (cinematography) said, ‘There are no more options in Guayaquil.’

As seen above, active rejecters reported that the government did not influence their choice of HE course, and their rejection of the government is visible in their responses. Concerning the choice of university, active rejecters shared motivational factors that were reported by positively influenced students such as academic quality, financial benefits (free-of-charge HE), and the government policy to support the arts. Other motivational factors that were not mentioned by positively influenced students appeared such as university location (only for the case of arts students), and HE courses were not easily available at other HEIs.

The next section will present the findings for the largest group of the typology of political dispositions.

5.3c Passive rejecters

Passive rejecters reported that they were aware of the government’s message but passively claimed it did not influence their choice of HE course. The percentage of participants in this category was the highest among the four groups in the typology of political dispositions

(48.5%). In the following sections, passive rejecters will be analysed in terms of their choice of HE course and university.

Choice of major

The participants' interest in the subject, which is one of the motivational factors that will be explored in Chapter 6, was more powerful than the influence of the government's messages for some passive rejecters. Jose (physics, interviewee) reported, 'During the sabatinas, I heard good comments from Rafael Correa about the STEM University and this was a motivating factor. However, this was not as motivating as my interest in physics.' Henry (music production, Q7 survey) said in this regard, 'Nothing influenced me. I had the desire to study music production before the creation of this university.' Gustavo's (sound art, Q7 survey) response also suggested that his decision to study a HE course was made years before the Arts University was created. He reported, 'No messages influenced my decision. It was only a coincidence since I was getting training as a musician.' Alison, (chemistry, Q7 survey) replied, 'I think that each person chooses their major taking into consideration their likes and passions. For my part, nothing relating to the (government's message) influenced me when I made my decision.' Dario (music production, Q7 survey) said,

To be honest, I have not been interested in listening to those programmes. My desire to study music production started when I was a child...because I am an artist and I did not have the money to record a professional song, so I decided to study and give opportunities to others.

Participants such as Elias (dance, Q7 survey) denied the government's influence in his choice and spoke about his interest in the subject and the problems regarding the arts. He reported, 'Nothing [regarding the government's influence]. Dance is a dream that many people

consider as something that leads you to nothing, but in spite of that, one fights to get what one wants.’

As in the case of the positively influenced students, new HE courses in the country was a factor that emerged from the passive rejecters’ data. Andrea (chemical sciences and engineering, Q10 survey) was motivated by ‘the new majors that are available and because it is an emblematic university.’ Tania (life sciences and biotechnology, Q10 survey) also reported that she was motivated by the new HE courses. Sisa (biomedical engineering, Q10 survey) said, ‘The most important thing that encouraged me to study at the STEM University was its HE courses since they are new in this country.’ Other students, such as Franz (information and technology science, Q7 survey), seemed to consider the government’s message of choosing non-traditional majors, which was mentioned in section 5.3a by positively influenced participants. Franz said in this respect, ‘Any of them. My choice was since I wanted to do something different, look beyond the line. The line where there are thousands of engineers in Ecuador that are satisfied without looking for something else.’

Some passive rejecters mentioned that their choice was personal and not influenced by the government’s messages. Josue (biology, Q7 survey) said in this respect, ‘Nothing at all. It was a personal decision.’ Bryan (physical sciences and engineering, Q7 survey) agreed with Josue, saying, ‘No, it was my personal decision.’ Niqimaila (literature, Q7 survey) replied,

No, the decision is personal. You do not have to choose a major because the government tells you. Your choice should be based on your dreams and objectives. Depending on that, you have to know how to contribute to your fatherland with your profession.

Other participants felt there were no external influences on their choice of HE course. For instance, Kevin C. (sciences of information and technology, Q7 survey) replied, ‘Nothing nor anyone had an influence on my decision to study here.’

As noted above, passive rejecters reported no government influence when selecting their HE course. Instead, they reported factors such as interest in the subject, new HE courses in the country, and personal decisions as reasons why they chose their subjects. The next section will explore passive rejecters’ choice of university.

Choice of university

Regarding their choice of university, passive rejecters reported motivational factors such as academic quality, financial benefits (free-of-charge HE and student grants), good comments about the university, and that the Arts University is the only Ecuadorian HEI that specialises in the arts.

The quality of HEIs is a factor that is considered in the literature of university choice (Hemsley-Brown & Oplatka, 2015). One of the messages of the Ecuadorian government has been the need for academic excellence in its universities. The creation of the emblematic universities, such as the STEM University and the Arts University, was a government attempt to provide academic excellence in HE. Regarding academic quality, passive rejecters such as John (biology, interviewee) said, ‘I was not motivated by the government. What motivated me was the news about the creation of a university of quality and research that was different from the rest of the HEIs.’ Axelzoller (scenic arts, Q10 survey) was motivated by ‘the level of education’. Academic quality also motivated Josue (biology, interviewee), who said, ‘I was motivated by the sabatinas from the president of Ecuador and his messages that recommended this university, and that it would be one of the best in Latin America.’ Although he was a passive rejecter, here we see that the government’s message seemed to

motivate his choice of university.

Within the academic quality messages, some students focused on the quality of the lecturers. Alejandro (theatrical creation, interviewee) reported no influence from the government and said he was motivated by the idea of quality. He commented, ‘Also, the Arts University has a quality factor that other universities in the field of art do not.’ During the survey (Q10), Alejandro mentioned that the reason for studying at his HEI was ‘that it was the only university of arts in the country that has public access and has a number of renowned lecturers.’ Franz (science of information and technology, Q10 survey) was motivated by ‘the possibility of having lecturers with great recognition that would open my path to more opportunities around the world.’ Andy (mathematics/nanotechnology, Q10 survey) was motivated by ‘the quality of studies that is offered at the STEM University since it has international lecturers.’ As in the case of Andy, Alison (chemistry, survey Q10) also mentioned international lecturers. She said ‘it was a flagship university with cutting-edge technology, and above all, that lecturers come from different parts of the world. Therefore, I consider this education to be of an excellent standard.’ John (biology, Q10 survey) mentioned ‘the quality of education and the quality of its lecturers.’ Another student that was motivated by the quality of the lecturers was Gustavo (sound art, Q10 survey) who said, ‘I was motivated by the teachers and by the recognised lecturers in several administrative and musical areas.’

Andy (mathematics/nanotechnology engineering, interviewee) reported no influence from the government and mentioned that he saw some videos about the STEM University on YouTube and there he could see advertisements from the government that he had not seen on TV. Those messages referred to ‘the STEM University as a centre for the formation of the best university students in Ecuador, a place that was going to solve many problems in Ecuadorian society, and the plans to be a model for Latin America.’ Andy added, ‘I also saw

sabatinas where Rafael Correa said that the STEM University was an achievement of our society, and even mentioned that it is the most important project of his government.’ Andy mentioned that the government’s messages were not so influential, and the only thing that he liked was when Correa expressed the degree of importance of the project to his government. Andy even thought, ‘If this is the most important project, I have to be part of it!’ Although Andy mentioned no influence, this last quote looks like the government was quite influential in his decision to study at the STEM University. Quotes like this show that some students were aware of the importance of the STEM University in Correa’s plan.

Financial benefits (such as free-of-charge HE and student grants) were another motivational factor in passive rejecters’ choice of institution. Regarding free HE, Alejandro (theatrical creation, interviewee) reported,

I was not influenced by the government’s messages. My motivation to go to the Arts University was because I do not have enough economic resources, and it is a public university (free of charge), and this was something that attracted me.

Students like Niqimaila (literature, Q10 survey) were motivated by a combination of free-of-charge HE and having a good quality education. She said, ‘Take advantage of free of charge and quality higher education.’ Elias (dance, Q10 survey) said about finance,

I am poor and knowing that the UEES had arts (dance) was disappointing since it is very expensive. It was then when I made a big effort to get a score that let me choose the Arts University, which is the university that would let me achieve my dream.

Regarding student grants, Edison (mathematics, interviewee) said, ‘I was not directly motivated by the government. The economic support that I receive at the STEM University is what directly motivated me.’

Comments from other people about the university motivated some of the participants regarding their choice of institution. Sisa (biomedicine, interviewee) said, 'I was not motivated by the government's messages. I was motivated by the project and some videos in which I found the comments of students who were already studying at the STEM University.' Josue (biology, interviewee) said, 'I was not motivated by the government. It was more about asking my classmates and doing research on the STEM University.' Andy (mathematics/nanotechnology, interviewee) said,

I was not motivated by the government. The person who motivated me was my brother who told me about the STEM University project. I think that this is one of the main problems that the STEM University has, and they should advertise the university more so young people know about it and can be more motivated to study here.

Some passive rejecters in the arts expressed their motivation to study at their institution since it was the only one in Ecuador that specialised in the arts. Roura (cinematography, Q10 survey) said, 'It is the only arts university in Ecuador. It is not the same to study an arts HE course at common universities than studying at one that is specialised in the arts.' Dario (music production, Q10 survey) was motivated to study at the Arts University 'since it is a university created specifically for the world of art.'

As shown in this section, passive rejecters reported their motivational factors in choosing their HE course were interest in the subject, new HE courses in Ecuador, and personal decisions. In contrast, they reported their motivation for the choice of university in relation to academic quality, financial benefits (free-of-charge HE and student grants), good comments about the university, and being the only Ecuadorian HEI that is specialised in the arts.

The following section will explore the apolitical students, which is the last group in

the typology of political dispositions presented in this chapter.

5.3d Apolitical participants

These participants reported that the government did not influence their choice of HE course, and they are not interested in politics. The percentage of survey participants in this category was the lowest of the four groups (2.9%).

Choice of major

Apolitical students reported their lack of interest in politics and said that the government had not influenced their choice of HE course. Jose (mathematics, Q7 survey), one of the students in this group, said, 'No, in general, I do not watch sabatinas, and I am not very interested in politics.' Mabel (mathematics, interviewee) said, 'I do not like following politics.' Mabel added, 'I do not think that the government motivated me regarding my choice of HE course despite how the university was a government proposal and the STEM University is receiving government support.' Juan (music production, survey) did not want to engage in politics across all the survey questions. In Q7 (survey), he replied, 'I do not remember.' He did not use language that could identify him as pro- or anti-government.

Choice of university

Academic quality was a motivational factor reported by the apolitical group. In this regard, Mabel (mathematics, Q10 survey) mentioned her motivation to study at the STEM University because of 'the professionals that were teaching at those universities.' During the interview, Mabel reported, 'I saw advertisements on social media and the sabatinas of Mr President. They talked about the lecturers from other countries, the opportunities that you could get and do something for Ecuador.' Mabel mentioned that the STEM University website has information about the lecturers and their CVs, and she had checked this before coming to the

university. Juan (music production, Q10 survey) reported his motivation to study at the Arts University because of ‘the variety of lecturers presented [at the Arts University]’.

On-campus mobility was mentioned as a motivational factor by Jose (mathematics, Q10 survey) since ‘on-campus mobility is a great advantage. Where I live, the public universities are hours away from my house, and I did not like travelling back and forth without considering the time that is spent.’ The fact that the STEM University has on-campus accommodation and free-of-charge buses that connect the university with the town, which is not far away, are advantages that other universities do not have.

As seen above, apolitical students presented disengagement with politics. As in the case of active rejecters, apolitical students did not report motivational factors about their choice of HE course as it is seen in Table 5.2. In terms of choice of university, academic quality (in relation to lecturers) and on-campus mobility were the motivational factors that were reported by this group.

5.4 Conclusion

The evidence in this chapter shows that the STEM participants who reported that they were influenced by the government’s message was a significant minority, suggesting that the Ecuadorian government initiative to persuade young people to choose STEM undergraduate courses has been successful. A typology of political dispositions about the government’s message emerged from the survey and interview data. The four groups in the typology differed in their engagement with government policy, number of participants, and choice of HE course and university. Regarding the choice of HE course and university, some similarities among the groups in the typology were observed, such as academic quality, which was the motivational factor shared by all the groups.

A degree of scepticism regarding the students' narratives of their political dispositions might be considered. For instance, apolitical students may have a political preference, but they may not want to mention their engagement in politics to other people, especially if they are in front of strangers. In the case of positively influenced students, we have to be aware that they may be reporting an influence from the government on their choice of HE course because they may be supporters of Correa's government. The opposite could be the case with active rejecters who may deny government influence since they actively oppose the government. Additionally, care in relation to the issue of correlation and causation should be considered since it is possible that the reason there is a high proportion of STEM students reporting that they are influenced by the government message is because it aligns with their decisions and it does not mean that the government caused the choice of HE course.

This chapter provided evidence that there was a significant minority of respondents that were influenced by the Ecuadorian government in relation to the choice of STEM undergraduate courses. The next chapter will explore other motivational factors reported as influential to HE course and university choice. In this respect, the interview data suggests that the participants mentioned more motivational factors about the choice of university than the choice of HE course (the latter is the focus of this study). Future HE research on subject choice should consider ways to better isolate themes that are related to HE course choice from those that are related to the choice of university.

Chapter 6: Motivations reported by the participants for selecting their HE course

6.1 Introduction

Chapter 6 presents key findings from the survey and interviews in relation to the second research question - What motivations do undergraduate students enrolled on STEM degree programmes report for selecting their course? The overarching research question in this analysis is: How do government messages on higher education in Ecuador influence undergraduates' choice of STEM subjects? The previous chapter explored the extent to which government messages influenced the participants' subject choice while this chapter will explore influences on choice of HE course beyond the government. The findings in this chapter suggested that the top six motivational factors reported by the survey respondents were: get a high-paid job, start working to contribute to society, own inspiration (inspiration did not come from other people, but from the student), confidence in the subject, interest in the subject, and monetary issues.

This chapter begins with participants' motivations for selecting their HE courses (6.2) where I will introduce the findings in relation to the second research question before analysing each of the 6 motivational factors in 6.3. In this regard, the 6 factors will be presented as follows: get a high-paid job (6.3a), start working to contribute to society (6.3b), inspiration did not come from other people, but from the student (6.3c), confidence in the subject (6.3d) interest in the subject (6.3e), and monetary issues (6.3f). I focused on these 6 themes because they were the most mentioned in relation to subject choice by the survey respondents. Other themes that also had many mentions during the interviews and that are related to government policy (such as academic quality, free-of-charge HE, and student grants) have been included in spite that they are university choice factors. The inclusion of these factors partly helps to understand why the students chose the Arts and STEM

University (and not other HEIs), and how the Ecuadorian government policy influenced this decision even in those students who reported that they were not influenced by the government in relation to their choice of HE course. Finally, the conclusion will be presented in 6.4.

6.2 Participants' motivations for their choice of HE course

The term motivation is used in this study as understanding of the “why” of human behaviour (Deci and Ryan, 2000). This chapter will focus on the top six motivations that participants reported for selecting their HE course, which are presented in Table 6.1. The percentages in relation to the motivational factors in Table 6.1 come from different questions in the survey: get a high-paid job, and start working to contribute to society emerged from Q12 (what things would you like to do regarding your career once you graduate?); inspiration did not come from other people, but from the student was obtained from Q16 (have any of the following inspired you to study your arts or STEM major?); confidence in the subject relied on data from Q26 (how confident are you about your choice of major?); interest in the subject was obtained from Q27 (what you most like about your field of study is...); and monetary issues used information in Q33 (do you consider monetary issues have been a problem to study what you wanted at the university level?). Later, interview data were used to provide explanations in relation to these percentages.

Table 6. 1. Motivational factors influencing HE course choice (survey data)

Motivational factors	Percentage of participants
Get a high-paid job (n=44)	47.3%
Start working to contribute to society (n=68)	73.1%
Inspiration did not come from other people, but from the student (n=46)	69.7%
Confidence in the subject (n=85)	74.6%
Interest in the subject (n=77)	72.0%
Monetary issues (n=52)	46.8%

The findings in Table 6.1 show that four of these motivational factors (confidence in the subject, start working to contribute to society, interest in the subject, and inspiration did not come from other people, but from the student) were reported by the majority of survey respondents (74.6%, 73.1, 72.0% and 69.7%, respectively), which evidences that these factors were very important for the students in their choice of HE course.

Table 6.2 shows differences among the Arts and STEM institutions in relation to percentages for the six motivational factors. The STEM students had a higher percentage than arts students only for the case of get a high-paid job. This could be explained in part since the arts students had more discouragement of significant persons in relation to their choice of HE course and their future earnings.

Table 6.3 presents the six motivational factors cross-tabulated with the typology of political dispositions in relation to government's message presented in Chapter 5. Positively influenced students presented the highest percentages in confidence in the subject and own inspiration, while the lowest percentages were found in the factors get a high-paid job and monetary issues. These findings suggest that confidence in the subject and own inspiration

are important for positively influenced students when they select their HE course. Active rejecters presented higher percentages for the factors own inspiration, interest in the subject, and monetary issues than for the other factors (monetary issues presented the highest percentage in this political group). These results suggest that intrinsic motivation is important for active rejecters in the choice of HE course. Passive rejecters seemed to be motivated by getting a high-paid job since this percentage was higher than those of the rest of factors, which suggests that students in this political group consider earnings upon graduation as important in their choice of HE subject. Lastly, apolitical students presented the highest percentage in the factor start working to contribute to society, which suggests that helping others is important for students in this group when choosing their HE course. Nevertheless, this has to be taken with care since this last group only had 3 participants.

Table 6. 2. Cross-tabulations of motivational factors and institutions

Institution	Get a high-paid job (n=44)	Start working to contribute to society (n=68)	Inspiration did not come from other people, but from the student (n=46)	Confidence in the subject (n=85)	Interest in the subject (n=77)	Monetary issues (n=52)
Arts University	47.7%	54.4%	60.9%	56.5%	61.0%	61.5%
STEM University	52.3%	45.6%	39.1%	43.5%	39.0%	38.5%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Table 6. 3. Typology of political dispositions crosstabulated with subject choice motivational factors

Typology of political dispositions	Subject choice motivational factors					
	Get a high-paid job (n=44)	Start working to contribute to society (n=68)	Inspiration did not come from others, but from the student (n=46)	Confidence in the subject (n=85)	Interest in the subject (n=77)	Monetary issues (n=52)
Positively influenced students	22.9%	35.7%	36.8%	38.0%	35.3%	31.0%
Active rejecters	8.6%	8.9%	13.2%	8.5%	11.8%	16.7%
Passive rejecters	65.7%	51.8%	50.0%	50.7%	51.5%	50.0%
Apolitical students	2.9%	3.6%	0.0%	2.8%	1.5%	2.4%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

6.3 Analysis of motivations for the choice of HE course

As previously noted, this section explores the top six motivational factors in relation to choice of HE course as they were self-reported by the survey respondents: get a high-paid job (6.3a), start working to contribute to society (6.3b), inspiration did not come from other people, but from the student (6.3c), confidence in the subject (6.3d) interest in the subject (6.3e), and monetary issues (6.3f). In the next subsections, I will explore each of these factors in terms of the Arts and STEM institution, and the typology of political dispositions in relation to government's message presented in Chapter 5.

6.3a Get a high-paid job

Getting a high-paid job is defined in this study as obtaining high earnings after students conclude their undergraduate studies. Regarding this motivational factor, Konrad et al. (2000) meta-analysis evidenced that males show greater interest in high-salary jobs than females. This motivational factor was mentioned by 47.3% of the survey respondents as one of the reasons for the choice of HE course (see Table 6.1).

Get a high-paid job was the only motivational factor where the percentage was higher for the STEM students than the Arts students as it is seen in Table 6.2 (52.3% against 47.7%). This could suggest that STEM students are more motivated than Arts students to get a high salary upon graduation. Partly, this can be explained by discouragement in relation to future earnings that arts students received from significant persons. In this regard, parents not always were sources of inspiration and in some cases they discouraged the choice of HE course, being a common denominator among arts students. Arts students faced more opposition from their parents in their choice of HE course than STEM students, mainly because of remuneration problems after graduating. The comments of Nadia (cinematography, interviewee) and Jose (music production, interviewee) are presented here

as an evidence of parents' opposition who said that their HE choice will not feed or give them money in the future:

There are a lot of students that do not know what to study and they have talent for arts. They do not choose arts because their parents do not support them. Some parents think that arts will not feed you or give you prestige. People with old-fashioned ideas see art students as insane or dirty people because of the way they dress. I know the case of a friend who wanted to study visual arts but he had the opposition of his parents and they did not allow him to study this major. In the end, this creates unhappy professionals and reduces the productivity of national goods. I think that you should study what you like regardless of what your parents say. Other professions have more importance than arts. Arts has its importance and it is also a profession. (Nadia)

I am 80% sure (of my choice of HE course) because there was insecurity of my parents who told me not to study music since it would not give me money or I wouldn't be able to live from it. This is the way I chose and I will continue until the end. (Jose)

Regarding how this motivational factor relates to the typology of political dispositions, positively influenced students presented a low percentage (22.9%) in this factor as it is seen in Table 6.3, which suggests that the students in this political group were not so interested as other groups in the typology to get high earnings in the future. In contrast, passive rejecters were the group with the highest percentage, which was quite high (65.7%). This may suggest that passive rejecters are more motivated than other groups in the typology by the idea of getting a high-paid job.

6.3b Start working to contribute to society

I borrowed this concept from the work of Skatova and Ferguson (2014). These authors claim that students select university degrees for four reasons, being one of them the opportunity to help others. For example, when the suffering of close relatives coming from illnesses fuels the motivation to pursue a career in medicine. This factor was reported by 73.1% of the survey respondents as it can be seen in Table 6.1. This motivational factor is related to government messages about *Buen Vivir* that promote the idea of helping others in the community.

Start working to contribute to society presented a higher percentage among Arts students than those in STEM (54.4% against 45.6% as it can be seen in Table 6.2). This may suggest that Arts students are more motivated than STEM students to choose their HE course because of the idea of helping others. However, this should be taken with care given the small number of participants in the sample.

Regarding how start working to contribute to society relates to the typology of political dispositions, apolitical students seemed to be more motivated to help others than participants in the other political groups, as it is seen in Table 6.3. Nevertheless, this should be taken with care since there were only three students in the apolitical group.

Interview data help to better understand why some students were motivated by this factor. Having a close relative suffering from a disease and finding a cure was a motivation among biomedical engineering students such as Lizbeth and Lady. Lizbeth reported how health problems of her family members fuelled the motivation to help others. She said,

My grandmother passed away because of lack of equipment to treat her disease.

Besides, there are two family members that have the same health problems and I want to get a cure for it in order to help other people.

Lady reported, “My interest is to find a cure for cancer since I have seen many people, and even members of my family suffering from this. This motivates me to find a cure.” Lady added,

When I was a child my godmother, who is a medical doctor, mentioned that it is nice when you see that a patient got a cure, and that you can help others. Medicine is the mother of all sciences and it is a way to help other people.

Other biomedical engineering students like Sisa were motivated by the idea of creating things to improve the lives of others. She mentioned in relation to this, “What motivates me most is that I will develop new gadgets to help people in Ecuador and the world and use science for good purposes.” The responses provided above show some biomedical engineering students who were motivated to choose their HE course to help others. We can also see that students from other subjects that were related to curing diseases were also motivated by the idea to contribute to society by improving the health of others. John (biology, interviewee) mentioned in relation to this,

It is important since I want to use my knowledge to help others. There are people that want to get a job to get money, but that is not my case. I want to develop science; I want to work on developing pharmaceutical products and contribute to the development of Ecuador.

These interview responses show that some participants were motivated to help others because they had experienced the suffering of a relative or in other cases, just because they had the desire to use their knowledge for good purposes in the community.

6.3c Inspiration did not come from other people, but from the student

This concept emerges when participants were asked if they recognised anybody's influence on their choice of subject. The majority of the surveyed participants responded that nobody influenced their decision, but instead it came from their own inspiration. Sjaastad (2012) studied sources of inspiration in the choice of science courses in HE and found that there were responses where no person was mentioned as the inspiration for participants' choice of study. Inspiration did not come from other people, but from the student is defined here as the students' own inspiration to choose what they wanted without any external influences. In this regard, the largest single group in Q16 of the survey (see Table 6.1) reported that they were not influenced by other persons (69.7%). Nevertheless, other important categories that emerged from this question after own inspiration were mothers (23.4%), fathers (21.1%), teachers (20.3%), siblings (18.0%) and good friends (17.2%). This finding is in line with the results presented by Maltese, Potvin, Lung and Hochbein (2016, p.112) in relation to college students who reported that no one in particular had been the primary influence on their choice of STEM (34%), followed by those who mentioned parents (27%) or teachers (14%).

Regarding differences between institutions in relation to this motivational factor, Arts students presented a higher percentage than STEM students (60.9% against 39.1%) as it is observed in Table 6.2. This could suggest that when talking about own inspiration, Arts students are more motivated than their STEM counterparts to choose their HE course.

In terms of how this motivational factor varied across the groups in the typology of political dispositions in relation to government message, Table 6.3 shows that active rejecters seemed to be motivated by own inspiration more than the students from the rest of political groups. The apolitical participants did not seem to be motivated by this factor since the

percentage for this group was 0.0%. However, we have to consider that the apolitical group was made up of only three students.

Interview data in relation to own inspiration in the choice of subject can help us better understand this factor. A group of interviewees mentioned that the decision to choose their HE course was made on their own. John (biology) said, 'It is my own decision and interest and nobody told me to study this HE course because I would get more opportunities in terms of jobs or payment.' Hugo (chemistry) mentioned, 'I like chemistry. It is something that other people did not force me to choose.' Micaela (cinematography) mentioned that she was motivated and added, 'I think that you have to do what motivates you, and not because of pressure.' Scarlett (visual arts) said, 'It was a personal decision. It was something I wanted to do. I feel identified with it.'

After own inspiration, the most important categories were mothers (23.4%), fathers (21.1%), teachers (20.3%), siblings (18.0%) and good friends (17.2%). These significant persons will be explored in subsequent lines.

Mothers, fathers and siblings

Significant persons such as mothers, fathers and siblings acted as role models, supporters and provided encouragement in relation to the choice of HE course. In relation to role models and encouragement, Naomi (software engineering, interviewee) said, "Also, my role model is my father who is an information systems engineer." In the survey she mentioned,

My father studied a HE course related to information systems engineering. Every time that I saw my father working with computers, I developed curiosity to know how and why they worked, and definitely growing in that environment with a father that

explained it all to me and who fostered to learn more led me to feel passion for technology. On the other side, my mother always told me that I had been born with the talent for maths, and helped me to make the final decision in relation to the HE course that I chose.

Kevin (nanotechnology engineering, interviewee) also considered close relatives as role models. He said in this respect, “Since I was a child, I was questioning things and I got answers to these questions from my father and my older brother who were role models since they know about mechanics, electricity, telecommunications.” Nadia (cinematography, survey respondent) mentioned her brothers as role models. She reported, “My two brothers draw well and are very skilful to use computers, so that inspired me to focus on animation using computers.”

Teachers

Teachers were mentioned by 20.3% of the survey respondents as sources of inspiration in the choice of their HE course. Some of them acted as supporters and guides as it can be seen in this response: “My biology teacher was a great promoter in my student life, she was who invited me to dream and fight to make my highest dreams come true. She completely trusted in my abilities and taught me to believe in myself.” (Evelyn, survey respondent, levelling semester). Other teachers motivated the students with their comments. Byron (music production, interviewee), for instance, mentioned a luthier who produces musical instruments made of bamboo as an influential person in his study choice since Byron had the possibility to play with him during a concert. ‘During that event, he told me that he was working at the Arts University and that it was a good environment there.’ Other students like Jose (music production, interviewee) received good comments from teachers about his future institution. He commented, ‘Some friends and teachers from high school told me that it

was a great university for arts and this motivated me to come to the Arts University.’ Maria Paula (nanotechnology, interviewee) commented, ‘My high school teachers were very happy because of my decision since they knew the quality of education that I would get at the STEM University.’ These good comments seem to be related to the choice of university more than the choice of subject.

Friends

Drawing on the work of Ball and Vincent (1998) regarding ‘hot’ and ‘cold’ knowledge, Archer, Hutchings and Ross (2003) argued that information available to youngsters about post-16 educational choices can be considered ‘hot’ knowledge (learned through the ‘grapevine’) or ‘cold’ knowledge (formal or official knowledge). In relation to ‘hot’ knowledge, a group of significant persons like friends motivated with their comments about the HEIs. As in the case of relatives, these comments were related more to the choice of university than the choice of HE course. An example is found in the words of Kimberly (visual arts, interviewee) who said, ‘There are other universities that had my major but I got comments that education there was not of good quality. I was also motivated by friends that were already studying at the Arts University.’ Motivation from friends who were already studying at the institutions was not an isolated case. In this respect, Jemina mentioned that friends who studied at the Arts University told her about its education. She said in this regard,

I considered this since I had friends who already studied at the Arts University and they had good comments about their education. Those friends know about music and I considered their words seriously. I felt more confident to study at the Arts University after I heard these comments.

Jemina’s words show how friends’ comments seemed to be important to shape her choice of study.

There were other participants that received good comments about their university from friends. Kerly (physics, interviewee) mentioned in this respect, 'My friends gave me information on their lives at the STEM University and one father of a friend also guided me with information about this institution.' Her high school classmates were already studying at the STEM University, and she reported in relation to them:

My high school classmates who were already studying here at the STEM University [motivated my choice of study]. One day I went to visit them, and what I liked the most was its campus because of the green areas that are missing in other universities that only have concrete, and give you the opportunity to take a breath when you are stressed. Once I even audited an astronomy class during the gap year after I finished high school and the lecturer talked about their astronomy club and the materials that they would use such as telescopes, and I was very happy because, unlike other universities, there was this club and tutors were like your friends, your partners, I even had good comments on the in-class activities that my friends had and their relationship with tutors that were like friends, they are open-minded and ready to solve your doubts. I also noticed that his university was open 24/7.

Kerly's motivation was a combination of significant persons (her former high school classmates), their comments about the university and what she experienced during the visit to the STEM University.

Other students that were motivated by friends' comments were Jose and Eddy. Jose reported that a friend who was studying at the Arts University gave him good comments about the institution. In this regard, Jose said, 'He told me that there were good lecturers and the Arts University had a great academic system for students. He also told me that you have a lot of benefits such as the library, tutoring sessions, audiovisual materials, etc.' Eddy (music

production, interviewee) mentioned that he had a friend who was already studying at the Arts University and they could talk about his friend's studies. 'He gave me good references about the university. He was the only friend who told me this. The rest did not know about the university. I did not have any teachers that motivated me to choose my major.', he said.

Other students who mentioned friends' comments are presented here. Kevin also received comments about his university. He said, 'A friend of mine who was already studying at the STEM University visited our high school and gave talks about the university motivating us to go there.' Hjalmar commented, 'I was also encouraged by friends to go to the Arts University. These friends are in higher levels of my subject.' He added, 'A friend from Cotacachi who is studying at the Arts University encouraged me to study at this institution. He mentioned good things about the university. He was very influential in my decision to come to the Arts University.' We can notice that people's comments who were already studying at the university were important in the decision-making process of the participants. Hjalmar's case is not isolated, and we can see other cases in relation to this. For instance, Tabata said, 'It was people who study at the university who motivated me to go to the Arts University. I did not hear TV or radio advertisements.' She added, 'I did not feel nervous since there were people studying at the Arts University that gave me good comments about the institution.'

As in the case of close relatives, there were friends who discouraged the choice of HE course. Maria Paula received warnings from some high school classmates who told her that her major (nanotechnology) did not have its applications in Ecuador. 'They told me that it only had applications in countries like the US. They told me that scientists would not have opportunities in Ecuador and I should choose a major that gave me money as soon as possible.' This last quote reveals an interesting point in the context of Ecuador: there is fear on behalf of some people of not being able to develop a career as scientists in fields such as

nanotechnology. What could be understood is that there is the idea that scientists only have chances to work and apply their knowledge in developed countries. This idea seems to promote the study of traditional majors that give money ‘as soon as possible’.

6.3d Confidence in the subject

Confidence in the subject is defined in this study as the students’ feeling of trusting their abilities in one or several of the main disciplines required for their HE courses. Confidence is associated with attitudes, feelings, and perceptions in terms of students’ academic abilities (Lent, Brown, & Gore, 1997). Moakler and Kim (2014) found that students were more likely to choose STEM majors when they had strong confidence in terms of mathematics and academic areas. Confidence in the subject was the motivational factor with the highest percentage among the factors that are explored in this chapter (see Table 6.1). It was mentioned by 74.6% of the survey respondents when they reported that they would be able to succeed at their studies. During the interviews, confidence in the subject was reported by several participants who mentioned that they were good at specific subjects and this encouraged them in their choice of their HE course. This suggests that choice of HE course and confidence in the subject have a strong connection.

Regarding differences between institutions in relation to students’ confidence in the subject, arts students presented a higher percentage than STEM students (56.5% against 43.5% as it is shown in Table 6.2). This could suggest that Arts students are more motivated by confidence in the subject than STEM students when they choose their HE course.

In terms of how this motivational factor varied across the groups in the typology of political dispositions in relation to government message, Table 6.3 shows that confidence in the subject was the highest percentage among all the motivational factors for the case of positively influenced students (38.0%). This result suggests that confidence in the subject is

more important for positively influenced students than for students of other political dispositions when they choose their HE course.

Interview data provides more information regarding this motivational factor. Some interviewees reported being good at some subjects during high school, which were main disciplines required in their HE courses. For instance, Andy (mathematics/nanotechnology engineering) reported his skills in two high school subjects and how his teachers encouraged him in relation to this, “I loved physics during high school. I was good at maths and physics and my teachers told me this and because of this, I wanted to study an engineering major.” Andy’s confidence in the subject seemed to increase because of the encouragement of his teachers. In relation to this encouragement, Aschbacher, Li, and Roth (2010) found that pupils who participated in science and found good support among different communities were more likely to strengthen their science identities and be persistent in their science, engineering or medicine (SEM) aspirations than students with less support.

Argenis (chemistry) said in relation to his aptitude in sciences, ‘Since I was in high school, I knew I was good at sciences. The university gave me the opportunity to have what I like. Franklin (mathematics) mentioned his math confidence during elementary and high school experience and how it helped him in the choice of his HE course. He said in this respect,

Maths was the subject in which I got the best scores in elementary and high school. I thought that I could not waste this opportunity of being good at maths. In other subjects, for instance arts or chemistry, I was not as good as in maths. I like maths and I know I will do well in maths at university....

The responses mentioned earlier show that confidence in the subject was also accompanied by interest in the subject, a motivational factor in the choice of HE course that

will be explored in the next section. Being good at a specific subject revealed confidence in it while liking the subject evidenced interest in it. Other interviewees also mentioned the combination of these two factors in their responses. Mabel (mathematics) mentioned, “I am good at maths. Also, I like maths. It is the language that other sciences use.” Hugo (chemistry) reported his confidence and interest in 3 subjects:

I liked maths, physics and chemistry and I am good at them. My brother told me to find an engineering related to chemistry. I found petrochemical engineering and I liked it. I found out that ESPE and the STEM University had this major, and I decided to choose the STEM University.

Sisa (biomedical engineering) also mentioned the two motivational factors that were mentioned above. She said, “I considered three important things. In the first place, what I like to do. Second, what I do well. The third reason was that biomedicine is a new major that the Ecuadorian people need.”

6.3e Interest in the subject

Interest in the subject is defined in this study as students’ enjoyment of a branch of knowledge. As mentioned earlier in Table 6.1, 72.0% of the survey respondents in Q27 (what you most like about your field of study is...) reported that it is an opportunity to do what they love, indicating that interest in the subject was a powerful motivation in the choice of HE course. In relation to the interviews, all of the 43 participants expressed their motivation in terms of interest in their subjects. Regarding this factor, previous research has revealed that interest in the subject is the most influential factor for incoming freshmen of both genders. (Kim, Markham & Cangelosi, 2002; Malgwi, Howe & Burnaby, 2005; Strasser, Ozgur &

Schroeder, 2002). However, confidence in the subject had a higher percentage than interest in the subject in the present study as it can be seen in Table 6.1.

Regarding differences between institutions in relation to interest in the subject, arts students presented higher percentages than STEM students in this motivational factor as it can be seen in Table 6.2 (61.0% against 39.0%). These results suggest that arts students are more motivated than their STEM counterparts when choosing their HE course because of interest in the subject.

In terms of how interest in the subject varied across the typology of political dispositions, Table 6.3 shows that this motivational factor was the third most important in terms of percentage for active rejecters (11.8%). However, active rejecters presented higher percentages in relation to monetary issues and own inspiration.

In relevance to the influence of government message, participants mentioned that it produced no influence on their interest in the subject. Responses indicate that participants were interested in their subjects long before they were exposed to the aforementioned messages. In a considerable number of cases, this interest started during childhood, as it was mentioned by 39.5% of the interviewees. Regarding this finding, a study in the US by Maltese and Tai (2010) found that the majority of their participants (65%) reported that their interest in science had begun before middle school (before participants were 10-11 years old). Typical interview responses in the current study in relation to interest in the subject since childhood included:

‘Since I was a child I have liked numbers and things that deal with processes.’ (Naomi, software engineering)

‘I liked to read about the origin of natural disasters since I was a child.’ (Johanna, geology)

‘Since I was a child, I was motivated when we went from school to museums and ecological lodges. I liked animals, ecosystems, plants. Over the years, I have developed my interest for biology and chemistry.’ (Josue, biology)

“The interest for biology came from my elementary school. I liked natural sciences. During high school I did not have this subject and I was not so happy. I still liked biology.” (John, biology)

I have always played music. Since I was little, I have studied music and I saw the possibility of producing new personal material and also materials from others, and generate a greater space for art here in Guayaquil. This motivated me to come here. (Byron, music production)

‘I liked drawing and painting since I was a child and this motivated me to choose visual arts after I finished high school.’ (Daryl, visual arts)

I have been very interested in music since I was a child. My father played the music of The Beatles, Led Zeppelin, Pink Floyd since I was a child. When I was 8 years, I learned to play the guitar and this motivated me. I choose music production since it is not only about music, but also record, mix or live sounds. (Jose, music production).

As seen in all the responses presented above, interest in the subject did not seem to be shaped by government’s messages. Long before government’s messages were in the lives of these students, they already had an early interest in their subjects. Nevertheless, government messages seemed to influence students regarding their choice of university in relation to motivational factors such as academic quality and financial benefits (free-of-charge HE and student grants). These university choice factors were observed across the majority of groups of the typology of political dispositions as it was evidenced in Chapter 5 (see Table 5.2).

Besides those participants who reported their interest in the subject during childhood, there were others that mentioned this interest during their high school years. Belen (polymer engineering, interviewee) said, “Since I was in high school I liked subjects such as math and chemistry.” Andy (mathematics/nanotechnology engineering, interviewee) commented,

I loved physics during high school... When I was in my last year of high school, I had to decide about my major and I wanted something different from traditional majors.

Then, I started checking nanotechnology as an alternative. I did research on this major and I realised that this was something that I enjoyed.

Maringe (2006, p. 476-477) found that some participants in his study were showing interest in combinations of subjects (for instance, science and media studies in order to become a science journalist). There is evidence that this was also happening in the current study when a respondent said, “Biomedical engineering combines several fields of knowledge that I like such as biology, anatomy, mathematics and physics.” (Erika, biomedical engineering, interviewee). Esther (biomedical engineering, interviewee) was also attracted by combination of subjects and said,

I liked medicine since I was a child, but as I got older I liked other fields that have to do with biology. When I saw this major I noticed that it combined aspects of technology, medicine, and some things about biology and that’s why I came here.

In terms of differences between Arts and STEM students in relation to interest in the subject, some Arts students had been working in jobs related to their field of study before choosing their HE course. This did not seem to be the case of STEM students who did not report job experiences related to their HE courses before going to university. Dario (music production, interviewee) commented in this respect, “I was motivated to study music production because I am a rapper.” Eddy (music production, interviewee) had been working

on music production before selecting his HE course. He commented, “I had informal music production on my own. I wanted to be a professional in this respect.” Tabata (music production, interviewee) mentioned that her father was a well-known member of an Ecuadorian music band and she had grown up in a musical environment. She reported, “I am a musician and I am interested in music production. I am a composer and I was interested in studying something that helped my artistic career. I play guitar, bass, piano and I sing.” Henry (music production, interviewee) commented, “I had been working informally in my field. I was working as a musician before I came to the Arts University and I was motivated by the idea of getting an undergraduate degree.”

Interest in the subject was so deeply rooted among some participants that they even dropped their studies at other universities to study what they always wanted. Edison (mathematics, interviewee) had been studying another HE course before going to the STEM University. He reported, “Curiosity for numbers. I like numbers. Before I came to the STEM University, I was studying chemistry at another university but I did not like it and I decided to come here.” The responses of Byron and Edison suggest that government policy seemed to influence their motivation to leave their previous HEIs and go to the Arts or STEM University by giving them attractive reasons to choose their current institutions. For example, Edison was motivated to go to the STEM University “since there are more economic benefits than at the former university. Also, all the lecturers are PhDs or masters and it is a better education in this respect.” As mentioned earlier, the government messages seemed to influence their choice of university because of factors such as academic quality and financial benefits.

There were cases of students who had chosen a HE course that was not what they wanted but was related to it. They did this since they did not get the required score in the ENES to get a SENESCYT scholarship to study their subject in another country. This

evidences that for some students, subject choice is not a free choice since they need a good score in the ENES to study what they want. The alternative for these students who realised that their major was not available in Ecuador was to choose what they had at hand in the country and that was related to their HE course. This was done to get knowledge that would be useful later during postgraduate studies in the area that they were interested before entering HE. Their interest in the subject suggested that they would continue studying after ending their undergraduate studies in order to take the subjects that they always wanted, this time as postgraduate students. Comments to illustrate this are presented here:

In my second year of baccalaureate I decided to study renewable energies or something similar and because of that, I wanted to study abroad but I did not reach the desired score (ENES). I decided to come here since there were majors that are related to sciences and renewable energies. (Maria Paula, nanotechnology engineering, interviewee)

Since I was 15, I decided to study aeronautics because I love flying. At the beginning I wanted to be a pilot. I wanted to study abroad, but I could not and I came to the STEM University because it is a different university. Here I decided to study physics to continue my studies in aeronautics in the future. (Ariel, physics, interviewee)

I am a fan of drawing. If I hadn't had this opportunity to study cinematography, I would have been studying visual arts. At the Arts University, there is not a major of animation but I know that I can specialize in this field in the future. I am sure that I chose the right major because animation, which has to do with cartoons, and cinematography are the perfect combination. (Nadia, cinematography, interviewee)

6.3f Monetary issues

Monetary issues are defined here as financial constraints that the participants may have to study what they want at university. Existing studies suggest that financial concerns have an important role in the choice of study at HE. Forsyth and Furlong (2000) included finance among some potential barriers of disadvantaged young people to accessing HE. Callender and Jackson (2008) found that money issues limit lower class students' choice of university more than pupils from higher SES. This factor was reported as a motivation for the choice of HE course by 46.8% of the survey respondents when they were asked whether they considered that monetary issues had been a problem to study what they wanted at university. This was the lowest of all the 6 motivational factors in terms of percentage of respondents as it is shown in Table 6.1.

Table 6.2 shows that the percentage of participants who mentioned financial problems was higher at the Arts than at the STEM University (61.5% against 38.5%). Arts students seemed to have more difficulties in relation to the cost of their HE courses at private universities. Typical responses of Arts students regarding cost of HE courses at private HEIs are presented here:

This university is public which means that is free of charge while the university and institute that I was considering in Quito are private. The cost of HE here is less than in Quito. For example, at the USFQ the cost of a semester is around 5500 and 6000 USD. (Leonardo, cinematography, interviewee)

I was motivated because its free-of-charge education. I found out that the semester at an institute in Quito was very expensive. At the Arts University you have all the necessary equipment for studying. At other universities, you have to pay for them. (Micaela, cinematography, interviewee)

Regarding how this motivational factor varied across the typology of political dispositions, active rejecters presented their highest percentage in Table 6.3 in relation to monetary issues (16.7%) followed by own inspiration and interest in the subject. This suggests that active rejecters were motivated more by financial constraints than own inspiration and interest in the subject regarding their choice of HE course.

Responses that emerged from survey and interview data demonstrate that free-of-charge HE was an important motivation to choose the Arts or the STEM University. Nadia (cinematography, interviewee) had decided on her subject when she was looking for a university. She mentioned a university of Cuenca that had cinematography. She also mentioned Universidad Casa Grande which had audiovisual production. The problem with the latter university was that they did not have what she wanted. She added,

The common denominator of these universities is that they are paid and I am the last of 3 siblings and the budget of my father is not enough to pay for my studies at a private HEI since he is already paying for the studies of one of my brothers. That's why I chose the Arts University since it is public [free-of-charge].

In her case, she was choosing where to study her HE course based on financial limitations. Free-of-charge HE at the Arts University motivated her in her choice of subject since her family had limitations in terms of money. Hugo (chemistry, interviewee) also chose his university based on financial problems. He commented, "In Loja there was chemical engineering, but I did not have enough money to pay for it. The STEM University was a great option since I only had to pay for accommodation (55 USD) and food." He added, "The STEM University education is cheap and my parents could afford it and support me." Hugo's response reveals that his choice of university depended on financial limitations at home. It seems that he was also attracted by cheap accommodation which is located on campus. In the

context of Ecuador (El Comercio, 2018), 55 dollars per month is cheap if this price is compared with private accommodation which should easily be more than the aforementioned price (without taking into consideration that the students will probably have to get money to travel back and forth to the university if they stay out of campus).

Other students that were motivated by free-of-charge HE were Danny (scenic arts, survey respondent) and Lady (biomedical engineering, interviewee) who reported how they benefited from it in terms of their choice of study. Their words are presented here:

Theatre is a wish that I had since I was a child; it was fostered during my youth working as a team with my partners by giving awareness messages that were represented in a play. Years ago, I wanted to continue this growth but unfortunately I saw it far away because of lack of money since I saw it as an elite space for several people and not for all. Today that I have the opportunity to be in the levelling semester, I want to revive the artistic potential and continue with that call that was not completely eliminated. (Danny)

The fact that it was free of charge motivated me. In a private university I would have one of my eyes taken from my face (meaning expensive), and my parents are not able to pay for this kind of education. In a private university I would not have been able to study. (Lady)

Cost of HE courses was even constraining the choice of subject of students like Cira (music and sound arts, interviewee), who mentioned in this respect:

After checking the cost of HE courses, I realised that it was going to be expensive to study arts and I was considering to study something different from what I liked. I

considered psychology. Then, my father let me know about an article in El Telégrafo and I decided I was going to study at the Arts University.

As seen, she was even planning to study a different HE course because of financial limitations. In the end, the Arts University was the solution to her financial concerns.

6.4 Conclusion

This chapter explored motivational factors beyond the government's message that Arts and STEM students reported for selecting their HE courses. The top 6 motivations presented in this chapter were confidence in the subject, interest in the subject, start working to contribute to society, own inspiration to choose a HE course, monetary issues, and get a high-paid job. Confidence in the subject, start working to contribute to society, interest in the subject, and own inspiration were reported by the majority of survey respondents, which evidences that these factors were quite important among the respondents. Additionally, participants' responses reveal that government messages did not influence their interest in the subject. However, government messages did seem to have an influence on the choice of university since there were motivational factors such as academic quality and financial benefits that attracted students at both of the HEIs in this study.

In terms of differences between institutions, arts students presented higher percentages than their STEM counterparts in 5 of the motivational factors explored in this chapter. The only motivational factor that had a higher percentage for STEM students was get a high-paid job. In part, this can be explained because of the opposition that arts students were receiving from their parents in relation to remuneration problems after graduation.

Regarding how the six motivational factors varied in relation to the groups in the typology of political dispositions presented in Chapter 5, passive rejecters seemed to be quite

motivated by getting a high-paid job. Apolitical students seemed to be more motivated than other political groups in terms of helping others. Nevertheless, this finding should be considered with care given that there were only three apolitical students in this study. Active rejecters seemed to be quite motivated by own inspiration. This factor was the second highest in terms of percentage in this political disposition group. Interest in the subject seemed to be important for active rejecters. However, participants in this group mentioned monetary issues and own inspiration as more important motivations, being the former the factor with the highest percentage among active rejecters. Survey and interview data suggest that free-of-charge HE at the Arts and STEM University helped some students to overcome this financial barrier. Lastly, positively influenced students presented their highest percentage in confidence in the subject, which suggests that this political group placed more importance on this factor than the rest of groups in the typology.

The next chapter will explore how the four groups in the typology of political dispositions and how the six motivations reported in this chapter vary by the following background and academic characteristics: gender, SES, geographical region, and attainment.

Chapter 7: Variations of the motivations reported by STEM undergraduates in terms of their demographic and academic characteristics

7.1 Introduction

Chapter 7 introduces key findings in relation to the third research question - Do the motivations reported by STEM undergraduates vary in terms of demographic and academic characteristics (i.e. by gender, SES, geographical region, and attainment? The overarching research question in this analysis is: How do government messages on higher education in Ecuador influence the choice of STEM majors? Chapter 5 explored the extent to which government messages influenced STEM undergraduate's subject choice while Chapter 6 explored influences on subject choice beyond the government messages. This chapter will explore whether the motivational factors reported in Chapter 5 and 6 varied in terms of the demographic and academic characteristics that are addressed in the third research question. In this regard, these four factors that will be explored in this chapter relate to the typology of political dispositions presented in Chapter 5 and the six motivational factors that were explored in Chapter 6 since gender, SES, geographical region, and attainment are reported as factors that have been considered to influence STEM subject choices of young people aged 14-19 (Tripney et al., 2010).

The findings in relation to the third research question demonstrate that the motivations reported by the STEM students did vary in relation to their demographic and academic characteristics. In this regard, females, lower class students, coastlanders, and high attainers were more often positively influenced by government's message. Females presented higher percentages than males in confidence and interest in the subject; lower class students had higher percentages than their middle class counterparts in start working to contribute to society and own inspiration; coastlanders evidenced higher percentages than their

counterparts from the Highlands in terms of getting a high-paid job and start working to contribute to society; and, high attainers presented higher percentages than middle achievers in relation to start working to contribute to society and own inspiration.

The next section of this chapter (7.2 Variations of participants' motivations for their choice of HE course in terms of demographic and academic characteristics) will introduce the findings in relation to the third research question. In 7.3 (Analysis of variations in participants' motivations for their choice of HE course in relation to demographic and academic characteristics), I will present four subsections: gender (7.3a), SES (7.3b), geographical region (7.3c), and attainment (7.3d). This chapter focuses on these four demographic and academic characteristics since they are discussed in the literature on broadening participation of underrepresented groups in STEM fields. In this respect, research on gender (Ceci, Williams & Barnett, 2009; Myers et al., 2015; Shauman & Xie, 1996; Smith & Gorard, 2011;), SES (Chen, 2009; Codioli-Mcmaster, 2017; Lee, 2015; van de Werfhorst, De Graaf & Kraaykamp, 2001; You, 2013), geographical region (Tripney et al., 2010), and attainment (Schultz et al., 2011; Tripney et al., 2010; van de Werfhorst, Sullivan and Cheung, 2003) have been introduced earlier in Chapter 3. Within each of these subsections, I will explore differences in terms of the four groups of political dispositions introduced in Chapter 5 (positively influenced students, active rejecters, passive rejecters, and apolitical students), and the six motivational factors presented in Chapter 6 (get a high-paid job, start working to contribute to society, inspiration did not come from other people, but from the student, confidence in the subject, interest in the subject, and monetary issues) before I present the conclusion in 7.4.

Ethnicity and disability were initially considered as two demographic variables in this study since they are also reported by Tripney et al. (2010) as factors that are considered to influence STEM subject choices of young people. These variables were excluded from the

analysis because of the low number of participants in some of their categories, which might raise ethical issues in relation to their identification. In relation to this, there were five students who reported that they had a disability while there were 94 students who self-identified as Mestizos, seven as Indigenous, three as Afro Ecuadorians, and three as White. For the case of ethnicity, the frequencies of participants in some ethnic groups would not be appropriate for statistical analysis such as the use of chi-square in which the assumption of this statistical test is that '80 per cent of all the cells in a cross-tabulation contain 5 or more cases.' (Cohen, Manion & Morrison, 2007, p. 592). Attainment was included as a variable in the third research question since it is important in the literature on STEM subject choice as it was mentioned above, and it was raised by the thesis advisory panel member during this research.

7.2 Variations of participants' motivations for their choice of HE course in terms of demographic and academic characteristics

This section introduces the findings of this chapter. The results in this chapter are linked to those in Chapter 5 and 6 by explaining whether the motivations reported earlier varied in relation to gender, SES, geographical region, and attainment.

The results in Table 7.1 show a higher percentage of positively influenced students, passive rejecters and apolitical students in the STEM University than at the Arts University. The percentage of active rejecters was quite higher at the Arts University. Regarding gender, females in the positively influenced and the active rejecter group presented higher percentages than their male counterparts. In contrast, men presented higher percentages than women in the passive rejecter and apolitical groups. This may suggest that women in the current study were more engaged in politics than males. Regarding SES, positively influenced students in the lower class presented a higher percentage than their counterparts in

the middle class. In the rest of groups of the typology, higher percentages were observed for the case of middle class students. This suggests that lower class students in the positively influenced group were more prone to be persuaded by the government's message than their middle class counterparts. It also suggests that those who were not influenced by the government were more often middle class students. In terms of geographical region, positively influenced students and apolitical students presented higher percentages among students from the Highlands while rejecters (active and passive) had higher percentages among those from the Coast. Finally, high achievers presented higher percentages in the positively influenced and apolitical groups, while middle achievers presented higher percentages among rejecters (active and passive).

Table 7.2 shows that women presented higher percentages than men in all the motivational factors excepting confidence in the subject and monetary issues. Lower class students presented higher percentages than their middle class classmates in five of the subject choice factors excepting confidence in the subject. Coast students had higher percentages than their peers from the Highlands in the majority of factors excepting monetary issues. Lastly, high attainers presented higher percentages than middle attainers in relation to get a high-paid job, start working to contribute to society, and own inspiration. These findings will be explored in relation to arts and STEM in the next section.

Focusing only on STEM students, this chapter will demonstrate that those who reported that they were positively influenced by the government messages were more often women, lower class students, coastlanders, and high achievers (see Tables 7.3, 7.5, 7.7, and 7.9, respectively). In terms of the cross-tabulations between the six motivational factors explored in Chapter 6 and the demographic and academic characteristics, the highest percentages were found among females in the factors confidence and interest in the subject (see Table 7.4), lower class students in the factors start working to contribute to society and

own inspiration (see Table 7.6), coastlanders in the factors get a high-paid job and start working to contribute to society (see Table 7.8), and high attainers in the factors start working to contribute to society and own inspiration (see Table 7.10).

Table 7. 1. Typology of political dispositions crosstabulated with demographic and academic variables, and institution

Typology of political dispositions	Gender		SES		Geographical region		Achievement		Institution	
	Male (n=61)	Female (n=42)	Lower class (n=50)	Middle class (n=42)	Coast (n=45)	Highlands (n=47)	High attainers (n=40)	Middle attainers (n=52)	Arts (n=55)	STEM (n=48)
Positively influenced students	29.5%	52.4%	44.0%	31.0%	35.6%	40.4%	45.0%	30.8%	34.5%	43.8%
Active rejecters	8.2%	11.9%	8.0%	11.9%	11.1%	8.5%	2.5%	15.4%	16.4%	2.1%
Passive rejecters	59.0%	33.3%	48.0%	52.4%	53.3%	46.8%	47.5%	51.9%	47.3%	50.0%
Apolitical students	3.3%	2.4%	0.0%	4.8%	0.0%	4.3%	5.0%	1.9%	1.8%	4.2%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Table 7. 2. Variation of the 6 subject choice motivational factors in relation to demographic and academic characteristics at both universities

Subject choice motivational factor	Male (n=61)	Female (n=42)	Lower class (n=50)	Middle class (n=42)	Coast (n=45)	Highlands (n=47)	High attainers (n=40)	Middle attainers (n=52)
Get a high-paid job	44.6%	51.4%	51.1%	43.2%	53.2%	41.5%	60.6%	38.6%
Start working to contribute to society	71.4%	75.7%	80.0%	68.2%	76.6%	70.7%	78.8%	71.9%
Own inspiration	68.4%	71.4%	75.8%	64.5%	72.5%	65.2%	81.0%	63.6%
Confidence in the subject	75.8%	72.9%	74.1%	75.0%	74.6%	74.0%	70.5%	77.3%
Interest in the subject	65.6%	80.4%	78.6%	63.8%	76.8%	66.0%	65.0%	76.2%
Monetary issues	49.2%	43.5%	60.3%	32.7%	45.8%	50.0%	43.2%	50.0%

7.3 Analysis of variations in participants' motivations for their choice of HE course in relation to demographic and academic characteristics

This section will have 4 subsections: gender (7.3a), SES (7.3b), geographical region (7.3c), and attainment (7.3d). In each of these subsections I will report the findings in relation to the four groups in the typology of political dispositions presented in Chapter 5 (positively influenced students, active rejecters, passive rejecters and apolitical students), and the six motivational factors that were introduced in Chapter 6 (get a high-paid job, start working to contribute to society, own inspiration, confidence in the subject, interest in the subject, and monetary issues).

7.3a Gender

In this study, gender is defined as 'the varied and complex arrangements between men and women, encompassing the organization of reproduction, the sexual divisions of labour and cultural definitions of femininity and masculinity.' (Bradley, 2013). The survey question to obtain information on students' gender asked whether they were male or female. Options such as Other or Prefer not to say were not available in the survey, which was an involuntary mistake while the survey was prepared on Qualtrics.

Regarding differences in relation to gender and the political dispositions presented in Chapter 5, Table 7.1 shows that female students in the positively influenced group seemed to be more prone to be persuaded by the government's message than their male counterparts (52.4% against 29.5%). This difference in favour of females was present at both institutions and it was higher at the STEM University (see Table 7.3). The same pattern in relation to higher percentage of females than males was observed among active rejecters (11.9% against 8.2%), with a higher gap between genders at the Arts University (see Table 7.3). In the case of passive rejecters and apolitical students, the percentage was higher for males than females,

as presented in Table 7.1 (59.0% against 33.3%, and 3.3% against 2.4%, respectively). Only for the case of passive rejecters (and not for apolitical students), this difference was observed at both universities, especially at the STEM University, where the difference of percentages between males and females was higher (see Table 7.3). Among the apolitical students, the gap between males and females was higher at the Arts University. These findings suggest that women in the current study were more politically engaged than males. They seemed to express their ideas in relation to government messages and their choice of HE course with more directness than males.

Table 7. 3. Crosstabulation between gender, typology of dispositions in relation to the influence of government's message, and institution

		Political dispositions				Total
		Positively influenced students	Active rejecters	Passive rejecters	Apolitical students	
Institution						
Arts University	Male (n=35)	28.6%	14.3%	54.3%	2.9%	100.0%
	Female (n=20)	45.0%	20.0%	35.0%	0.0%	100.0%
STEM University	Male (n=26)	30.8%	0.0%	65.4%	3.8%	100.0%
	Female (n=22)	59.1%	4.5%	31.8%	4.5%	100.0%

Table 7.2 shows that females presented higher percentages than males in all the factors excepting two of them: confidence in the subject and monetary issues. Interest in the subject seemed to be very important among females since they presented the highest percentage in this factor (80.4%). Upon closer examination of how the motivational factors

differed in relation to gender at each university (see Table 7.4), we can notice that STEM male participants were more motivated than their female counterparts in terms of getting a high-paid job (60.9% against 47.4%). Women in STEM presented the highest percentages in the STEM group in relation to own inspiration, confidence in the subject, and interest in the subject (80.0%, 82.6% and 81.0%, respectively). In relation to confidence in the subject, arts students presented a different pattern than the one found among STEM students, revealing that males had a higher percentage than females (86.5% against 64.0%) Regarding own inspiration, female students at both HEIs reported higher percentages than male students in relation to this factor. The percentage for STEM and Arts females in relation to own inspiration was 80% and 66.7%, respectively. With respect to interest in the subject, women at both institutions were more motivated than males, which aligns with previous research that found that women reported greater intrinsic motivation than men (Ferssizidis et al., 2010). The difference in percentages among men and women in relation to this motivational factor was higher among STEM than Arts students. Lastly, regarding the higher percentage for STEM women than their male counterparts in relation to confidence in the subject (82.6% against 62.1%), this finding is contrary to previous research which has suggested that females had lower math confidence than males. (Moakler & Kim, 2014).

Table 7. 4. Variations of the 6 subject choice motivational factors in relation to gender and institutions

	STEM University		Arts University	
	Male (n=26)	Female (n=22)	Male (n=35)	Female (n=20)
Get a high-paid job	60.9% (n=14)	47.4% (n=9)	33.3% (n=11)	55.6% (n=10)
Contribute to society	73.9% (n=17)	73.7% (n=14)	69.7% (n=23)	77.8% (n=14)
Own inspiration	76.9% (n=10)	80.0% (n=8)	64.0% (n=16)	66.7% (n=12)
Confidence in the subject	62.1% (n=18)	82.6% (n=19)	86.5% (n=32)	64.0% (n=16)
Interest in the subject	50.0% (n=13)	81.0% (n=17)	77.1% (n=27)	80.0% (n=20)
Monetary issues	39.3% (n=11)	40.9% (n=9)	56.8% (n=21)	45.8% (n=11)

Interview data reveals that there were doubts in relation to choice of HE course among females like Camila (cinematography). She said with respect to this, ‘My doubts were about studying cinematography and not knowing what I would do after graduating. I am not going to be a medical doctor or a teacher. It is more complicated and I am a woman.’ Camila suggested that women have more difficulties than men in terms of job opportunities in her field. This seemed not to be the case among STEM females who considered that they would have greater opportunities to get a job since they were going to study a new HE course in the country. Esther (biomedical engineering) said in relation to this,

They were very influential [the government’s messages] because of the new majors that they offered instead of the traditional one that I was thinking about which was medicine... The messages about new majors in the country such as biomedicine or nanotechnology attracted me a lot, and knowing that not being traditional majors, there would be new places to work.

A possible explanation for the difference in confidence to get a job in the future could be, on the one hand, the importance that is given to STEM in the country, and on the other, the discouragement that arts students receive from significant persons regarding their subject choice and the opportunities that they would get after graduating.

7.3b SES

The definition of SES that is employed in the current study is that of social stratification provided by Payne (2000) who mentions:

the concept of social stratification as a particular form of social division emphasises the idea that individuals are distributed among the levels or layers of a social hierarchy because of their economic relations. These layers or ‘social strata’ are real social groupings, forged together through both their economic relations and their associated social relations and interactions; groupings that are able to reproduce themselves over time.’ (p. 21-22).

Payne goes further and states that social stratification is a typical social division which is different from others in that it is firmly based in economic relations. He presents three social classes in his book: the advantaged classes, the intermediate classes, and the subordinate classes. SES in the current study considered these 3 categories using different names from those proposed by Payne: upper class, middle class, and lower class, respectively. These social classes were based on participants’ self-identification and the data revealed that there were not any respondents from the upper class at the two universities in this research.

Regarding differences in relation to SES and the political dispositions presented in Chapter 5, Table 7.1 shows that lower class students in the positively influenced group from both HEIs presented a higher percentage than their middle class counterparts (44.0% against 31.0%). Table 7.5 shows that STEM positively influenced students presented the same

pattern mentioned earlier and the gap between both classes was even higher (57.1% against 18.8, respectively). However, arts students presented a higher percentage in the middle class than in the lower class (38.5% against 27.3%). This may suggest that STEM lower class students in this political disposition group were more prone to be persuaded by the government’s message. Active rejecters, passive rejecters, and apolitical students from both universities presented higher percentages among middle class students than those in the lower class as presented in Table 7.1. This pattern was also found among STEM students in the three political groups as seen in Table 7.5. This could suggest that as SES increases, there will be more students that will report not being influenced by the government in relation to their choice of HE course. Nonetheless, arts students who reported not being influenced by the government presented higher percentages in the lower class (excepting the case of apolitical students who did not appear in the arts group in Table 7.5).

Table 7. 5. Crosstabulation between SES, typology of dispositions in relation to the influence of government's message, and institution

		Political dispositions				Total
		Positively influenced students	Active rejecters	Passive rejecters	Apolitical students	
Institution						
Arts University	Lower class (n=22)	27.3%	18.2%	54.5%	-	100.0%
	Middle class (n=26)	38.5%	15.4%	46.2%	-	100.0%
STEM University	Lower class (n=28)	57.1%	0.0%	42.9%	0.0%	100.0%
	Middle class (n=16)	18.8%	6.3%	62.5%	12.5%	100.0%

Table 7.2 shows that lower class students from both universities presented higher percentages than their middle class counterparts in all the factors excepting confidence in the subject. Start working to contribute to society and interest in the subject seemed to be important for lower class students since they presented the highest percentages (80.0% and 78.6%, respectively). Upon closer examination of how the motivational factors differed in relation to SES at each university (see Table 7.6), STEM middle class students only presented a higher percentage than their lower class peers in the factor get a high-paid job (62.5% against 50.0%), while confidence in the subject presented the same percentage for STEM lower class and middle class students. The highest percentages among STEM students in this table were found among lower class students in relation to the factors start working to contribute to society and own inspiration (79.2% and 80.0%, respectively). Among arts students, the highest percentages were found in the lower class group in relation to the factors start working to contribute to society and interest in the subject (81.0% against 82.1%, respectively).

Table 7. 6. Variations of the 6 subject choice motivational factors in relation to SES and institutions

	STEM University		Arts University	
	Lower class (n=28)	Middle class (n=16)	Lower class (n=22)	Middle class (n=26)
Get a high-paid job	50.0% (n=12)	62.5% (n=10)	52.4% (n=11)	32.1% (n=9)
Contribute to society	79.2% (n=19)	68.8% (n=11)	81.0% (n=17)	67.9% (n=19)
Own inspiration	80.0% (n=12)	75.0% (n=6)	72.2% (n=13)	60.9% (n=14)
Confidence in the subject	70.0% (n=21)	70.0% (n=14)	78.6% (n=22)	78.1% (n=25)
Interest in the subject	75.0% (n=21)	47.1% (n=8)	82.1% (n=23)	73.3% (n=22)
Monetary issues	46.7% (n=14)	30.0% (n=6)	75.0% (n=21)	34.4% (n=11)

Chapter 5 presented findings in relation to students' motivations to study at the Arts and STEM University because of financial benefits such as student grants and free-of-charge HE, which were reported in three groups of the typology of political dispositions (see Table 5.1 and 5.2). These financial factors seemed to influence some interviewees like Lady (biomedicine, lower class, positively influenced). She said in relation to this, "The government messages about scholarships motivated me to come to the STEM University. Also, HE is free of charge and you worry less about funding." The government message in terms of giving opportunities to poor students so they can study their desired HE course seemed to grab the attention of other interviewees like Daniela (nanotechnology, lower class, positively influenced), who reported in relation to this, "Where they [the government messages] influenced me more was in the support that is given to youngsters who are making an effort to go to the STEM University in special those who do not have a lot of money..." In Chapter 5, Daniela's words are presented in relation to the considerable influence of government messages on her choice of study in terms of HE courses such as nanotechnology that could be studied by poor students.

Interview data also shows that the motivation to get financial benefits at the two universities in this study grabbed the attention of some students who reported no influence from the government on their choice of HE course. For instance, Jimmy (literature, middle class, active rejecter) seemed to be attracted by the idea of free-of-charge HE when he said, "I was also motivated by the cost of education since the classes should be expensive if they were private, but it is totally free of charge." Edison (mathematics, middle class, passive rejecter) commented, "I was not motivated directly by the government. The economic support that I receive at the STEM University is what motivated me directly." Edison also mentioned that he had previously checked the possibility of studying his HE course at

another HEI, but decided to study at the STEM University because of more financial benefits:

I was studying the possibility to go to EPN since they have my major. This was my first option until I learned that the STEM University also had the major that I wanted.

I decided to come to the STEM University since there are more economic benefits than at the former university.

Although these interviewees denied the influence of government on their choice of subject, their responses suggest that at some point they were taking elements from the government message in relation to giving economic benefits to students to make their final decision regarding the university where they would study their HE course.

7.3c Geographical region

Ecuador is divided into four geographical regions: Costa (Coast), Sierra (Highlands), Región Amazónica (Amazon region), and Islas Galápagos. In order to determine the participants' geographical region during this study, the information on the city or province where they lived was used to classify them into one of the four regions of Ecuador:

Participants from the Galapagos Islands and the Amazon region do not appear in this subsection due to lack of them in the sample.

Regarding differences in relation to geographical region and the political dispositions presented in Chapter 5, the results in Table 7.1 suggest that government message had more influence on positively influenced students from the Highlands than those from the Coast (40.4% against 35.6%). Apolitical students had a higher percentage in the Highlands while active and passive rejecters presented higher percentages among participants from the Coast. Upon closer examination of the data at each university (see Table 7.7), there was a different pattern than the one mentioned at the beginning of this paragraph in relation to positively influenced students from both HEIs, showing that STEM students in this political disposition

group presented a higher percentage in the Coast than in the Highlands (50.0% against 41.2%). The opposite was the case for arts students in this political group. This suggests that STEM students from the Coast were more influenced by the government’s message than their STEM counterparts from the Highlands. Active rejecters in this table presented higher percentages among Highlands students at both universities while passive rejecters presented the same percentage for STEM students in both geographical regions and a higher percentage for arts students from the Coast. Apolitical students were only observed at the STEM University where the Highlands group presented a higher percentage than their counterparts from the Coast.

Table 7. 7. Crosstabulation between geographical region, typology of dispositions in relation to the influence of government's message, and institution

		Political dispositions				Total
		Positively influenced students	Active rejecters	Passive rejecters	Apolitical students	
Institution						
Arts University	Coast (n=35)	31.4%	14.3%	54.3%	-	100.0%
	Highlands (n=13)	38.5%	23.1%	38.5%	-	100.0%
STEM University	Coast (n=10)	50.0%	0.0%	50.0%	0.0%	100.0%
	Highlands (n=34)	41.2%	2.9%	50.0%	5.9%	100.0%

Students from the Coast presented higher percentages than their counterparts from the Highlands in five of the motivational factors excepting monetary issues (see Table 7.2). Interest in the subject, start working to contribute to society, and confidence in the subject presented the highest percentages among students from the Coast (76.8%, 76.6%, and 74.6%, respectively). Table 7.8 shows how the six motivational factors varied in relation to geographical regions within each university. STEM students from the Coast presented higher percentages than their counterparts from the Highlands in all the factors excepting two: confidence in the subject and monetary issues. Get a high-paid job, start working to contribute to society, and own inspiration seemed to be very important among coastal students in their choice of subject since they presented the highest percentages among all the factors (83.3% in each of the three factors). As for the arts students, higher percentages were observed among participants from the Coast in all the factors excepting monetary issues. Confidence and interest in the subject seemed to be very important in the choice of HE course among arts students from the Coast since these were the highest percentages for them in this table (80.0% and 77.8%, respectively).

Table 7. 8. Variations of the 6 subject choice motivational factors in relation to geographical region and institutions

	STEM University		Arts University	
	Coast (n=10)	Highlands (n=34)	Coast (n=35)	Highlands (n=13)
Get a high-paid job	83.3% (n=10)	42.9% (n=12)	42.9% (n=15)	38.5% (n=5)
Contribute to society	83.3% (n=10)	71.4% (n=20)	74.3% (n=26)	69.2% (n=9)
Own inspiration	83.3% (n=5)	76.5% (n=13)	70.6% (n=24)	33.3% (n=2)
Confidence in the subject	57.1% (n=8)	75.0% (n=27)	80.0% (n=36)	71.4% (n=10)
Interest in the subject	72.7% (n=8)	61.8% (n=21)	77.8% (n=35)	76.9% (n=10)
Monetary issues	21.4% (n=3)	47.2% (n=17)	53.3% (n=24)	57.1% (n=8)

7.3d Attainment

Attainment in this study was defined by the participants' final scores in the ENES or Examen Nacional para la Educación Superior (National Exam for Higher Education). This exam is required to enter public HE in Ecuador. Two groups were created for the analysis in this subsection: middle achievers were defined as those students who scored 600-900 points, and high achievers were defined as those students who obtained 901-1000 points. STEM students were the majority in the group of high achievers (42 out of the 44 high achievers were from the STEM University) while Arts students were the majority in the group of middle achievers (58 out of 66 students in this group were Arts students). This difference is due to the higher scores required to study at the STEM University where students need more than 900 points in the ENES (the exception was the case of 8 STEM students who scored between 801 and 900 points). Prior research suggests that a motivational factor that directly

influences the choice of a STEM major is math attainment (Crisp, Nora & Taggart, 2009; Wang, 2013).

The results in Table 7.1 suggest that government's message had more influence on the choice of subject among high achievers than middle achievers in the positively influenced group from both universities (45.0% against 30.8%, respectively). This pattern was observed at the Arts University (50.0% against 30.4%, respectively) and the STEM University (44.7% against 33.3%, respectively) as presented in Table 7.9. In the case of those students who reported no influence from the government in relation to their choice of HE course, active and passive rejecters presented higher percentages among middle achievers than high achievers as shown in Table 7.1 (15.4% against 2.5% and 51.9% against 47.5%, respectively), while apolitical students presented a higher percentage among the high attainers. In the case of active rejecters (see Table 7.9), high attainers were only found at the STEM University (2.6%) while middle attainers were only found at the Arts University (17.4%). Passive rejecters presented a higher percentage among middle attainers at the STEM University, which suggests that STEM passive rejecters tended to be more middle achievers. Considering that STEM high attainers seemed to be more influenced by the government message than STEM middle attainers, these findings may also suggest that as students' attainment rises, government message will influence STEM students more in their choice of HE course. In this regard, further research with a larger sample is needed to better understand the influence of government messages on the choice of HE course of high and middle achievers. Lastly, the apolitical group only presented percentages for STEM high achievers and arts middle achievers (5.3% and 2.2%, respectively).

Table 7.9. Crosstabulation between attainment, typology of dispositions in relation to the influence of government's message, and institution

		Political dispositions				Total
		Positively influenced students	Active rejecters	Passive rejecters	Apolitical students	
Institution						
Arts University	High attainers (n=2)	50.0%	0.0%	50.0%	0.0%	100.0%
	Middle attainers (n=46)	30.4%	17.4%	50.0%	2.2%	100.0%
STEM University	High attainers (n=38)	44.7%	2.6%	47.4%	5.3%	100.0%
	Middle attainers (n=6)	33.3%	0.0%	66.7%	0.0%	100.0%

Table 7.2 shows how the six motivational factors varied in relation to attainment. High attainers presented higher percentages than middle attainers in the motivational factors get a high-paid job, start working to contribute to society, and own inspiration. Start working to contribute to society and own inspiration seemed to be important for high attainers since they presented the highest percentages for this group (78.8% and 81.0%, respectively). Middle attainers presented higher percentages than high attainers in the factors confidence in the subject, interest in the subject and monetary issues. Confidence and interest in the subject had the highest percentages among middle achievers (77.3% and 76.2%, respectively), which suggests that they were important factors in their choice of HE course. Table 7.10 evidences that high achievers at the STEM University presented higher percentages than STEM middle

achievers in five of the factors excepting confidence in the subject. The highest percentages for high achievers were observed in the factors start working to contribute to society and own inspiration (78.1% and 80.0%, respectively), which suggests that they were important in the choice of HE course for this group of students. Confidence in the subject presented the highest percentage among STEM middle achievers (75.0%), which suggests its importance within this group. High achievers at the Arts University presented higher percentages than their middle class counterparts in all of the factors excepting interest in the subject and monetary issues. However, these higher percentages should be taken with care since they only represented one or two students. Among arts middle achievers, confidence and interest in the subject seemed to be the most important factors (77.6% and 78.6%, respectively).

Table 7. 10. Variations of the 6 subject choice motivational factors in relation to attainment and institutions

	STEM University		Arts University	
	High achievers (n=38)	Middle achievers (n=6)	High achievers (n=2)	Middle achievers (n=46)
Get a high-paid job	59.4% (n=19)	37.5% (n=3)	100.0% (n=1)	38.8% (n=19)
Contribute to society	78.1% (n=25)	62.5% (n=5)	100.0% (n=1)	73.5% (n=36)
Own inspiration	80.0% (n=16)	66.7% (n=2)	100.0% (n=1)	63.4% (n=26)
Confidence in the subject	69.0% (n=29)	75.0% (n=6)	100.0% (n=2)	77.6% (n=45)
Interest in the subject	65.8% (n=25)	57.1% (n=4)	50.0% (n=1)	78.6% (n=44)
Monetary issues	45.2% (n=19)	12.5% (n=1)	0.0% (n=0)	55.2% (n=32)

7.4 Conclusion

The findings in this chapter demonstrate that the motivations reported by the STEM undergraduates in this research did vary in terms of their demographic and academic characteristics. Government's messages seemed to be more influential among the following types of STEM students: women, lower class, coastlanders, and high attainers. These types of people presented higher percentages at the STEM University than their counterparts in terms of gender, SES, geographical region, and attainment. Regarding the relationship between the demographic and academic characteristics of STEM students and the motivational factors explored in Chapter 6, women presented higher percentages than men at their university in the factors confidence and interest in the subject; lower class students reported higher percentages than their middle class counterparts in the factors start working to contribute to society and own inspiration; coastlanders showed higher percentages than their counterparts from the Highlands in terms of getting a high-paid job and start working to contribute to society; and, high attainers presented higher percentages than middle achievers in relation to start working to contribute to society and own inspiration. These higher percentages were at the same time the highest within each demographic and academic characteristic.

The next chapter will present the overarching argument of this thesis and the contribution to knowledge of the current study. It will also show the patterns of each of the groups in the typology of political dispositions in relation to motivational factors beyond the government, and the participants' background and academic characteristics.

Chapter 8: Discussion

8.1 Introduction

This thesis has focused on the Ecuadorian government initiative to increase the number of students taking STEM subjects at university and through this study, a typology of political dispositions in relation to government's influence on HE course choice has been developed, which has four types of students: positively influenced, active rejecters, passive rejecters, and apolitical. Positively influenced students are generally those who agree with the idea of being influenced by the government when they chose their HE course; active rejecters are students who are aware of the government message and actively reject the idea that they were influenced by it when they chose their HE course; passive rejecters are students who reported awareness of the government message and passively stated that it did not influence their choice of subject at university; and apolitical students were those who reported that they were aware of the government message but were not interested in politics and reported that the government did not influence their choice of HE course.

The literature has evidenced that government initiatives to persuade young people to take STEM subjects have had its effectiveness (Henriksen, Jensen & Sjaastad, 2015; Smolentseva, 2016). The current study confirms these previous findings demonstrating that the Ecuadorian government initiative to encourage young people to choose STEM subjects influenced a significant minority of respondents. Nonetheless, this study goes a step further and evidences that there are different political reactions to the government's message, which we did not know before. The contribution to knowledge of this thesis is the development of the abovementioned typology, which has not been addressed before in the literature, showing that a significant minority of STEM students are influenced by the government message when they choose their HE course, and that is related to particular motivational factors, and

the students' demographic and academic characteristics. In this regard, Figure 8.1 shows the answers to the three research questions in this study and the overarching argument in this chapter.

There are 4 main sections in this chapter. Section 8.2 will discuss the findings in relation to the first research question on the extent to which the current Ecuadorian government's message about the importance of STEM subjects has influenced the subject choices of students in higher education in Ecuador. Section 8.3 will address the second research question on the motivations that undergraduate students enrolled on STEM degree programmes reported for selecting their courses. In section 8.4, I will discuss the third and last research question regarding whether the motivations reported by STEM undergraduates vary in terms of demographic and academic characteristics (i.e. by gender, SES, geographical region, and attainment). Finally, I will present the summary of this chapter in 8.5.

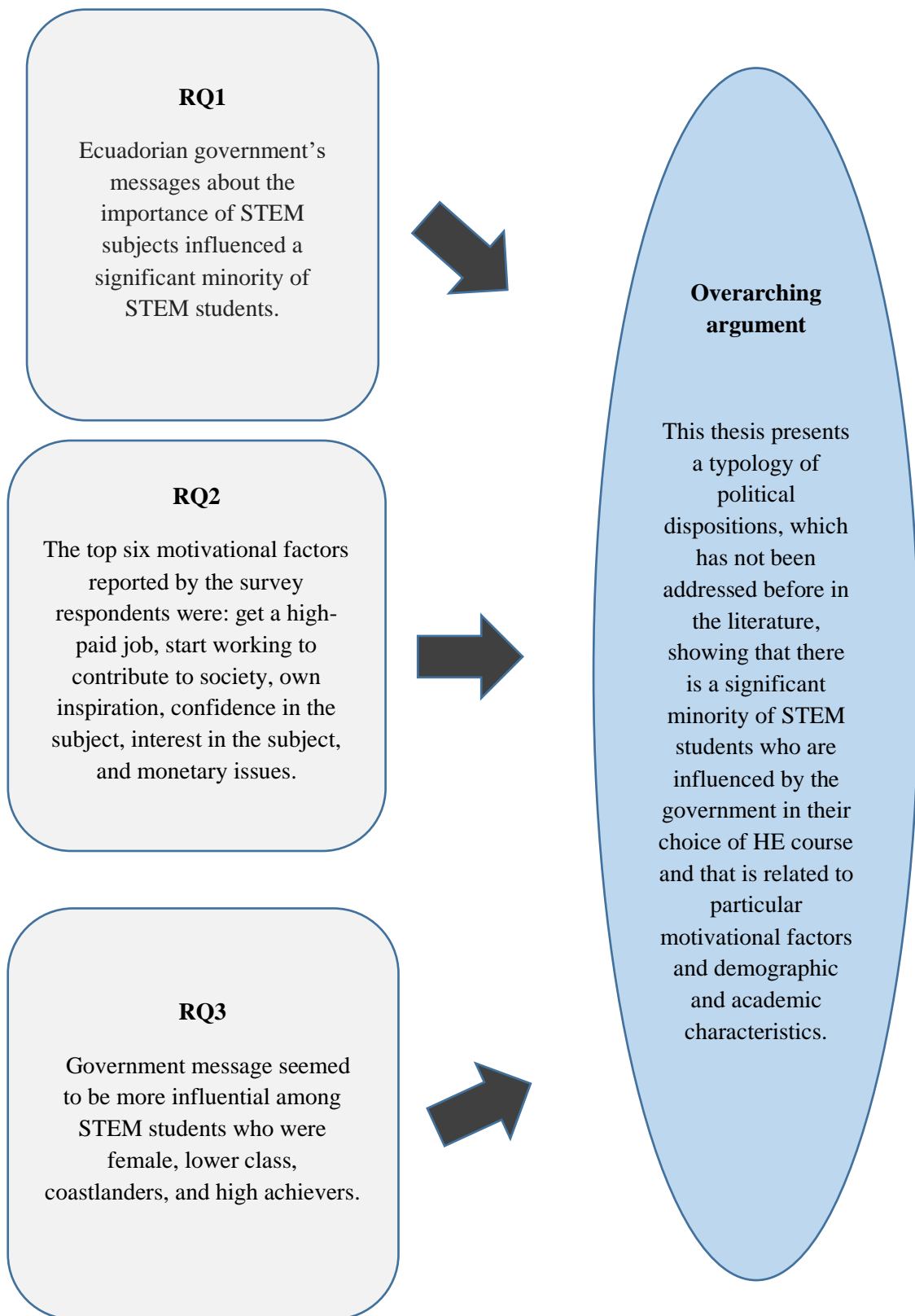


Figure 8. 1. Answers to the three research questions in this study and the overarching argument of the discussion chapter

8.2 Influence of the Ecuadorian government's message about the importance of STEM subjects on the choice of STEM undergraduate courses in Ecuador

Discussion of findings in this section will be guided by the first research question: To what extent has the current Ecuadorian government's message about the importance of STEM subjects influenced the subject choices of students in higher education in Ecuador?

The literature has evidenced that government initiatives to persuade people to go into STEM have had effectiveness (Henriksen, Jensen & Sjaastad, 2015; Smolentseva, 2016). The current study confirms these previous findings showing that the Ecuadorian government initiative to encourage people to study STEM subjects influenced a significant minority of respondents. Nevertheless, this study goes further and shows that there are different political reactions to the government's initiative, which were not addressed in the literature until now. These different reactions to government's initiative were presented in Chapter 5 in the typology of political dispositions in relation to government's message. Four reactions to government discourse were identified in this typology: positively influenced students, active rejecters, passive rejecters, and apolitical students.

As explained in 5.2, positively influenced students are those who admitted having been influenced by the government's message when they chose their HE course. This group represented 38.9% of the survey respondents in Q7. As shown in Table 7.1, 43.8% of STEM students and 34.5% of arts students were classified as positively influenced students. This seems to suggest that a positively influenced student would be expected to be enrolled in a STEM rather than arts field, or that a STEM student is more prone to be persuaded by the government message than an arts one. Nevertheless, while, as far as I am aware, no previous study on these matters has been reported, this result seems to contradict other studies that

suggest sciences and engineering students to be less frequent in political leadership than those in Humanities and Arts (Murphy & Coyle, 2012; Scott, 1968).

As shown in 5.2, active rejecters account for 9.7% of the survey respondents in Q7. These students are aware of the government message and actively reject the idea that they were influenced by it when choosing their HE course. Moreover, they are absolutely sceptic of the government claims, and engage with the government message in a defensive and often disrespectful manner. Table 7.1 shows that 16.4% of arts and 2.1% of STEM students are active rejecters. This gap between arts and STEM students further supports the idea that arts students are more prone to show a rejecting attitude towards the government message. Also, another indication of this arises when combining passive and active rejecters and comparing this number to the positively influenced. From this, it can be observed that the gap in Table 7.1 widens even further between arts and STEM students: arts: passive + active rejecters (63.7%) – positively influenced (34.5%)= 29.2%; STEM: passive + active rejecters (52.1%) – positively influenced (43.8%)= 8.3%.

The survey results presented in 5.2 provided a basis for an overall description of what involves being a passive rejecter. These students reported awareness of the government message and stated that it did not influence their choice of HE course. However, they tend to show some scepticism and engage with the government message in a more mindful and value-based way. In terms of frequency, the majority of the surveyed participants in the typology of political dispositions (48.5%) were classified as passive rejecters. As shown in Table 7.1, 47.3% of arts and 50.0% of STEM students were classified as passive rejecters. For the positively influenced students, these proportions were respectively 34.5% and 43.8%. Despite that a slightly higher proportion of STEM students are passive rejecters than those in arts, the differences between passive rejecters and positively influenced being more significant among arts students than STEM students is interesting. The fact that these

differences are driven by smaller proportion of arts students being positively influenced, seems to suggest that arts students are more prone to show a rejecting attitude towards the government message.

Regarding apolitical students, only 2.9% of the survey respondents in Q7 were found to be in this group. These students reported not being interested in politics at all. Yet, they were aware of the government message, but reported that it was not influential to their choice of HE course. Apolitical students were more often found in STEM than in Arts. Table 7.1 shows that 4.2% of STEM against only 1.8% of arts students fall in this group of the typology of political dispositions.

As seen, the largest single categories in the abovementioned typology were the passive rejecters and the positively influenced students. There was not a huge difference between the percentages of these two groups, and the percentage for positively influenced students evidenced that they are still a considerable group that is almost two fifths of the sample. Within this group of students who mentioned that they had been influenced by the government message, there are more STEM than arts students who say that they are influenced by the government (21.4% against 17.5%, as it is seen in Figure 5.1) which is in line with the government discourse. Additionally, almost half of the STEM students mentioned that the government had been influential in their subject choice (21.4% of positively influenced students against 26.2% of the other groups in the typology, as presented in Figure 5.1). These percentages demonstrate that the government discourse influenced a significant minority of respondents since there is a large group of positively influenced students who reported that they were influenced by government messages, and they are more likely to be STEM.

The inclusion of university choice factors in this thesis is useful to show how the government policy motivated students, even rejecters (both active and passive) and apolitical students as it can be seen in Table 5.2. One of the points that was made earlier in this thesis is that subject is something that is decided at quite a young age (some students even reporting that their interest in the subject started during their childhood) and government does not have much influence on students' subject choice. However, I argue that it has influenced the university that students chose. In relation to this, academic quality and financial benefits were two motivational factors that were reported by students when they choose the Arts or STEM University, and these factors are related to the Ecuadorian government narrative. Academic quality was a shared motivational factor reported by students in the four groups of the typology as presented in Table 5.2. Students were motivated by the quality of education and lecturers that they would find at the Arts and STEM University. This finding is supported by the existent literature that shows that university's academic reputation influences undergraduate student choice, and is one of the top factors to select a university (Briggs, 2006; Ahmad & Buchanan, 2015). Besides academic quality, the students were also motivated to choose their HEI by financial benefits such as free-of-charge HE and student grants at both institutions.

Regarding choice of university, students were constantly mentioning the influence of government in relation to institution choice rather than subject choice, which was unexpected. This unanticipated consideration of government influence could have an explanation since there were financial benefits at both institutions (such as free-of-charge HE and student grants). Another explanation could be the idea of academic quality of the two universities advertised by the Ecuadorian government. In this regard, the idea of studying at a university of quality and having foreign lecturers who had PhDs seemed to grab the attention especially of STEM students. The Ecuadorian government policy in terms of providing

academic excellence and economic welfare seemed to be effective to attract some students to study their HE courses at the two universities in this study.

Students' narratives in relation to their political dispositions and their choice of subject should be considered carefully. Active rejecters evidenced a clear rejection towards Correa's government, and in some cases there were participants who self-identified as being against Correa. Even if they were influenced at some point, these participants could have been inclined to deny government's influence since they are against the government. In the case of the apolitical group, it could be the case of students who follow politics but did not want to be identified as followers of a political party. They may prefer to stay safe by avoiding political conversations with strangers, which is one of the challenges of doing research on political topics. As for the positively influenced group, the issue of correlation and causation should be taken into consideration. It is possible that the reason there is a high proportion of STEM students reporting that they were influenced by the government message is because it aligns with their choices, which does not mean that the government caused it.

Lastly, the inclusion of the Arts University as a comparison group was useful to detect the active rejecters in the typology of political dispositions. Without the arts students, the typology would have lost 90% of the active rejecters, and perhaps the typology would have had just three groups.

8.3 Motivations reported by undergraduate students enrolled on STEM degree programmes for selecting their courses

The discussion of findings in this section will be guided by the second research question: What motivations do undergraduate students enrolled on STEM degree programmes report for selecting their course?

Chapter 6 addressed the second research question, which concerned the factors beyond the government influencing students' subject choices, as reported by themselves. In combination with students' exposure to government messages, there are motivational factors for the choice of HE course beyond these messages. In several questions of the survey and as presented in Chapter 6, students reported as motivations for choosing a STEM undergraduate course the following six factors: get a high-paid job, start working to contribute to society, own inspiration, confidence in the subject, interest in the subject, and monetary issues. These motivational factors are relevant because they may help us to design persuasive interventions beyond the government message, perhaps in line with the proposals of early involvement by van Eijck and Roth (2009), which enhance attractiveness of STEM education.

The findings in Chapter 6 showed that confidence in the subject, start working to contribute to society, interest in the subject, and own inspiration were mentioned by the majority of survey respondents, which suggests that these factors were very important in the choice of HE course in this study.

The findings show that confidence in the subject presented the highest percentage among the six motivational factors. This finding is consistent with literature that indicates that students' choice of major mainly depends on their confidence that they will succeed in that major (Eccles, 1987). Start working to contribute to society, a factor that aligns with Good Living narrative in relation to helping others, was the second highest percentage among

all the motivational factors. The percentage was higher among arts than STEM students. Nevertheless, the interview data suggested that this factor was a characteristic of those students whose subjects were related to taking care of other people such as biology or biomedical engineering, which is in line with Skatova and Ferguson's (2014) findings who evidenced that one of the motivations to choose medical degrees was the idea of helping others.

Interest in the subject was the third motivational factor in terms of highest percentage, presenting a difference of 2.6 percent points in relation to the first factor (see Table 6.1), which suggests that it was very important in the choice of HE course. This finding is similar to previous studies that have demonstrated that interest in the subject is the most influential factor for incoming freshmen of both genders. (Kim, Markham & Cangelosi, 2002; Malgwi, Howe & Burnaby, 2005; Strasser, Ozgur & Schroeder, 2002). Furthermore, a sizable group of interviewees (39.5% of them) reported that interest in their subjects started during childhood and government message did not influence this interest. Significant persons and extrinsic experiences were reported as factors that motivated them to generate an interest in their subjects. With respect to interest in the subject at an early age, research in the US by Maltese and Tai (2010) evidenced that the majority of their participants (65%) reported that their interest in science had started before middle school (before participants were 10-11 years old). The findings in Maltese and Tai's research and the current study suggest that if a government wants to persuade young people to go into STEM subjects, they should focus on developing interest in STEM among children since early age appears to be a crucial period to develop interest in science. Additionally, factors that demotivate students in science classes such as transmissive pedagogy, decontextualized content, and unnecessary difficulty of school science (Lyons, 2006) should be taken into account if a government wants more

young people taking STEM subjects. Further research can be done to understand how government policy can motivate children to like STEM subjects.

As mentioned above, government influence in relation to sparking interest in the subject appears to be limited for a large group of interviewees who had already an early interest in their subjects. However, there seemed to be an influence of the government on the choice of university because of academic quality and financial benefits, as it was already discussed in 8.2. Inspiration did not come from other people, but from the student was the fourth factor in terms of highest percentage among all the motivations reported in Chapter 6. Arts students presented a higher percentage than STEM students in this factor, which was the single largest category in Q16 followed by mothers, fathers, teachers, siblings and good friends, as it was presented in 6.3c. These findings are similar to those reported by Maltese, Potvin, Lung and Hochbein (2016, p. 112). Regarding significant persons' comments, Ball and Vincent's (1998) 'hot' knowledge seemed to motivate some participants to study at the Arts and STEM University.

Getting a high-paid job was the fifth of all the motivational factors in terms of percentage of respondents and it was reported by less than half of the survey respondents. This outcome is contrary to that of Al-Fattal (2010) who found that the most important issue regarding motivation to pursue HE was the economic future prospect in terms of getting a good job. The percentage of survey respondents was higher at the STEM University than at the Arts University, which could be explained in part by the discouraging comments that arts students received from significant persons (such as parents) in relation to unemployment or not having a job that would give arts students enough money to live upon graduation. Monetary issues (financial problems) presented the lowest percentage of the motivational factors in relation to the percentage of respondents. Less than half of the respondents mentioned this factor. The percentage of students who reported this factor was higher at the

Arts than at the STEM University. The interview data revealed that government policy in terms of providing financial benefits at both HEIs (such as free-of-charge HE, student grants, and cheap accommodation) motivated some students to choose their institutions.

One interesting finding, as shown in Table 6.3, is that only 22.9% of the positively influenced students reported getting a high-paid job as significant. This factor was actually the least significant for the positively influenced students, while it was considered important by 65.7% of the passive rejecters. As stated in 6.3a, getting a high-paid job refers to having expectations of high remuneration after graduation. It can therefore be assumed that remuneration is not an important motivator for the positively influenced students, although Table 6.2 shows that this factor is more motivating for STEM rather than arts students.

Another important finding, although in less extent than passive rejecters, is that 38.0% of those that reported confidence in the subject as being motivational were positively influenced students (see Table 6.3). As introduced in 6.3d, confidence in the subject refers to the students' feeling of trusting their abilities in a subject. This finding has similarities with that of Eccles (1987) who indicates that students' choice of major mainly depends on the confidence that they will succeed in their major and Moakler and Kim's (2014) findings who evidenced that students were more likely to choose STEM majors when their confidence in relation to mathematics and academic areas was strong. These results provide some tentative initial evidence that encouraging students to choose a HE course that builds upon their previously attained knowledge may persuade students into STEM fields.

Table 6.3 also shows that monetary issues stands out as significant for active rejecters, being the highest percentage in this political group (16.7%). Although passive rejecters and positively influenced students are more frequent among those that responded monetary issues being a motivational factor, it constitutes the most important factor reported by the active

rejecters. As introduced in 6.3f, monetary issues refer to financial limitations that restrict students from pursuing what they want at university. This suggests that if the active rejecters were financially capable, they may choose a different major and university.

Also, 13.2% of those claiming that inspiration did not come from others, but themselves were active rejecters (see Table 6.3). Again, while this proportion was higher for the passive rejecters and positively influenced respectively, it is likewise the second most important motivator for choosing their current HE course among the active rejecters. As presented in 6.3c, this means rejecting the idea that others might have influenced students' choice of HE course. Instead, this decision was the result of their own inspiration and reflection. So, there were no role models, friends or parents who could help them decide or from whom they could get guidance. Regarding this, a study in Turkey by Korkmaz (2015) reported that the idea of working with something that fits students' own attitudes and values constitutes an important factor for those in a STEM field.

The most obvious finding, as discussed above, is that 65.7% of those that reported being motivated by the possibility of getting a high-paid job are passive rejecters. By contrast, only 22.9% of them are positively influenced. This result indicates that passive rejecters make career choices based on expected wages. Therefore, it is likely that linking HE policy goals with wage-related discourses may attract passive rejecters into STEM fields.

Another important finding is that 51.8% of the students attracted by the idea of contributing to society were passive rejecters, while 35.7% were positively influenced (see Table 6.3). As introduced in 6.3b, this relates to the idea of working in something that is important and meaningful to others. Korkmaz (2015) and Garibay (2015) agree that this is a significant motivator for those in STEM and health care related occupations. These results provide some tentative initial evidence that encouraging students to choose a HE field that

may directly support the struggles of disadvantaged individuals may attract passive rejecters into STEM education.

Most apolitical students reported being motivated by the idea of start working to contribute to society (3.6% as presented in Table 6.3). As seen in 6.3b and discussed above regarding the passive rejecters, their choice of major is motivated in the expectation that this will be helpful to others in need, and is a motivation most often found among STEM students.

8.4 Variations in the motivations reported by STEM undergraduates in terms of demographic and academic characteristics

In this section, the discussion of findings will be guided by the third research question: Do the motivations reported by STEM undergraduates vary in terms of demographic and academic characteristics (i.e. by gender, SES, geographical region, and attainment)?

The third research question investigated how both, the political dispositions and the motivational factors beyond government's influence are distributed across gender, SES, geographical region, and attainment. These variables are a proxy of different identities (not all of them though) that a student from the sample observed may have. That is, a given student can be simultaneously a female (or male), of the lower (or middle) class, from the Coast (or the Highlands), and having attained a high (or medium) mark in the ENES. Except for the case of geographic region being Coast or Highlands, which is a specific issue for countries sharing the Andes Mountains, the literature on HE has addressed these variables widely, as discussed in Chapter 3. For instance, Moakler and Kim (2014) examined the gap between male and female confidence in mathematics. Similarly, Jordan and Levine (2009) investigated the gap between low – and middle-income children in mathematics-related

skills. These gaps need to be addressed with policies to promote higher enrolment in STEM fields.

As mentioned in Chapter 7, the answer to the third research question is that the motivations reported by STEM undergraduates did vary in relation to their demographic and academic characteristics. STEM positively influenced students were more often women, lower class, coastlanders, and high attainers. In relation to the STEM positively influenced group, females reported higher confidence and interest in the subject than their male counterparts. STEM lower class students had higher percentages than middle class students in relation to start working to contribute to society and own inspiration. STEM students from the Coast presented higher percentages than their counterparts from the Highlands in relation to get a high-paid job and start working to contribute to society. Finally, STEM high attainers revealed higher percentages than middle attainers in the factors start working to contribute to society and own inspiration.

Regarding the third research question, an important result was that 52.4% of female students, while only 29.5% among male, were positively influenced (see Table 7.1). In this regard, Walsh and Mitchell (2005) claim that female consumers are more prone to be persuaded than men by marketing practices. It is possible, therefore, that stimulating a supportive position about women in science and arts may persuade a greater number of women to choose these fields. However, a note of caution is due here, since this research does not consider the popularity of the government at data collection time. In relation to this, chances are that positively influenced correlate with political support, although these results cannot claim that positively influenced equals sympathy for the government. In this regard, further research is needed to examine how the popularity of the government may influence the decision on choice of HE course.

Regarding the relationship between attainment and the typology, 15.4% of the middle attainers were active rejecters (see Table 7.1). As introduced in 7.3d, attainment is here defined in terms of the students' score in the ENES, being high attainers those that reached more than 900 points (in a scale from 1 to 1000 points), and middle attainers those between 600 and 900 points. Also, we had seen in Chapter 7 that high attainers were far more frequent in STEM than in Arts. So, this further confirms that active rejecters are more prone to be arts students.

Moreover, Table 7.1 shows that among both, females and middle class students, 11.9% are active rejecters. These are the second most important demographic variables for describing the active rejecters. For the case of SES, this result provides a clear contrast with that of the positively influenced students, who were more often self-identified as being lower class. Conversely, similar to the positively influenced students, female active rejecters were more prevalent than males. This suggests that females in STEM are more expected to be positively influenced, whereas females in Arts are more often active rejecters.

Significant findings in relation to passive rejecters are: first, 59.0% of males and 33.3% of females were passive rejecters (as presented in Table 7.1). In contrast, as discussed above, only 29.5% of males were positively influenced. Thus, males are more prone to be passive rejecters. This result shows that, when it comes to political disposition relevant to HE policy, gender matters.

Another important finding is that among middle class participants, 52.4% were passive rejecters and only 31.0% were positively influenced (see Table 7.1). This gap is narrower among lower class students, which were 48.0% and 44.0%, respectively. This indicates that middle class students are more expected to be passive rejecters, and in contrast, the lower class tend to be positively influenced. This result suggests that the lower the SES,

the more expected a student to be positively influenced, and thus, the more prone to be persuaded by the government claims. These results are in line with those of Wantchekon et al. (2017) in that efforts to persuade voters had a better return in the lower income population.

Middle attainers in this sample are more frequently observed in the Arts University, in part, because the STEM University used in this research requires a score in the top quartile of the ENES. Table 7.1 shows that 51.9% of middle attainers were passive rejecters, while 30.8% of them were positively influenced. As for the high attainers, 47.5% were passive rejecters and 45.0% were positively influenced students. While both high and middle attainers show a higher proportion of passive rejecters, the wider gap that middle attainers show between passive rejecters and positively influenced students suggests that high attainers (which are more often STEM students) are expected to be more prone to be persuaded by the government message.

Another result that relates being apolitical with having chosen a STEM field is that 5.0% of high attainers, against only 1.9% of middle attainers, were apolitical students (see Table 7.1). Moreover, all apolitical students self-identified as being middle class. When it comes to gender, 3.3% among males against 2.4% of females were apolitical. Thus, apolitical students are more expected to be among middle class males in STEM.

A final consideration in relation to the background and academic characteristics explored in Chapter 7. Regarding attainment, limited agency in relation to subject choice was evidenced by some students who reported that they could not study their desired major in another country because they could not get the required high scores in the ENES, which evidences that the choice of HE courses in Ecuador is not a free choice for some students (especially for those who want to study STEM subjects who would be required higher scores

in the national examination). Further research could be done on how the Ecuadorian government can support this kind of high achievers who want to study abroad.

8.5 Conclusion

This chapter has presented a typology of political dispositions in relation to government's influence on the choice of HE course, which has not been addressed before in previous research, showing that there is a significant minority of STEM students who are influenced by government messages in their choice of HE course and that is related to particular motivational factors and demographic and academic characteristics. The answer to the first research question showed that there is a significant minority of STEM students who are influenced by the government messages. Before, we knew that governments' initiatives to encourage people to take STEM subjects had its effectiveness across different countries. The findings in the current study demonstrated that this was also happening in Ecuador. Before we knew that there were government policies to encourage people to go into STEM and there would be an increase in numbers of people taking STEM subjects but we did not know that there was a connection between students saying that they chose a HE course because their government encouraged them. As far as I am aware, the literature does not mention this. Before, it seems like there was only correlation, but now there is evidence of a large number of students reporting that the government did influence them in relation to their choice of STEM undergraduate course. We did not know it before and now we do, which is the main contribution to knowledge of the current study.

Regarding the typology, the chapter provided a descriptive account for each of the political dispositions as follows: the positively influenced are more often lower class female highlanders enrolled in a STEM field rather than arts, high attainers and motivated by their confidence in the subject. Active rejecters are more often middle class coastlander women

enrolled in arts that are middle attainers, and are motivated by monetary issues and own inspiration. Passive rejecters are more frequently middle class coastlander males, middle attainers and slightly more often in STEM and motivated by high-paid jobs and the idea of contributing to society. Lastly, apolitical students are more often middle class highlander males, high attainers and enrolled in STEM, motivated by contributing to society.

Females in this study seemed to be more engaged in politics since they were in higher percentages than males in the two political disposition groups that expressed their ideas about political topics with more openness (positively influenced students and active rejecters). Positively influenced women at each university seemed to be more influenced by the government's message than their male counterparts, being this difference higher among STEM students. Active rejecters were more often women from arts. Further exploration of the data in relation to passive rejecters and apolitical students suggest that females seemed to be taking more active roles than males in relation to talking about politics and their choice of subject. Passive rejecters and apolitical students seemed to have a more passive position than females in relation to talking about politics and their choice of HE course since males in these two groups presented higher percentages than females at both institutions. The reason why women seemed to be more active while men seemed to be more passive in relation to talking about government influence and their choice of HE course is beyond the scope of this research but it could be addressed in future studies.

This chapter also covered the choice of university, which is beyond the focus of this study. The influence of government messages on generating interest in the subject is limited since interest in the subject is sparked at a young age and government does not have much influence in this respect. However, the data suggests that government messages influenced the choice of the STEM and Arts University. The influence of government in terms of university choice rather than subject choice was unexpected in this study that focuses on the

latter level. Rather than leaving this out of the thesis, it was considered an opportunity to enrich this study and show how government policy influences students decisions beyond the level of subject choice. Two motivational factors related to students' economic welfare (free-of-charge HE and student grants) and academic quality (excellence university and lecturers who have PhDs), which align with the government's narrative, emerged as some students' reasons for choosing their HEI. The Ecuadorian government policy seemed to be effective to attract students to study at these two national projects given the sizable percentage of interviewees that reported these factors. This knowledge could be used by governments in other developing countries that want to have more young people in their STEM public universities.

Regarding limited agency in subject choice, this study evidenced that the choice of HE courses in Ecuador is not a free choice for some students especially for those who want to study STEM subjects abroad, which demand higher scores in the ENES to be able to get a SENESCYT scholarship. In this regard, government policy could focus to raise young people's prior attainment so they can be better prepared to pass examinations such as the ENES or other tests that are required to get access to their desired HE course.

Chapter 9: Conclusion

9.1 Answers to research questions

This thesis investigated how government policy influenced the choice of STEM undergraduate programmes in Ecuador. Regarding the first research question (the extent to which the current Ecuadorian government's message about the importance of STEM subjects influenced the course selection of the respondents), a significant minority of STEM students (45.0%) reported that their subject choice had been influenced by the government message. Nevertheless, this influence was not as strong as the influence of other motivational factors. Additionally, the findings suggest that the government's main influence was on university choice, not subject choice. In relation to the second research question (motivational factors beyond the government message) the students reported as top motivations for selecting their HE courses the desire to get a high-paid job, start working to contribute to society, own inspiration, confidence in the subject, interest in the subject, and monetary issues. As regards to the third research question (variations of the motivations in terms of background and academic characteristics), the government message was more influential among STEM students who were female, lower class, coastlanders, and high achievers.

This research presented a typology of political dispositions in relation to government's influence on HE subject choice with four types of students: positively influenced, active rejecters, passive rejecters, and apolitical. Previous studies on higher education subject choice have evidenced that government initiatives to augment the number of young people who choose STEM subjects can be effective, which was confirmed in the current study. This research found that there were different political reactions to the Ecuadorian government's message about the importance of STEM subjects. In this regard,

the contribution to knowledge of this thesis is the development of the abovementioned typology, which has not been addressed before in previous studies on higher education subject choice, showing that a sizable percentage of STEM students were influenced by the government when they selected their undergraduate programme, and that was related to six particular motivational factors, and the students' demographic and academic characteristics.

9.2 Strengths and limitations of the study

The use of mixed methods research design is a strength in this study since there is a combination of qualitative and quantitative approaches that helped to better understand the research problem than either approach alone. Additionally, this research design uses the strengths of quantitative and qualitative research, and the use of both qualitative or quantitative approaches is adequate to address the complexity of the problems addressed in social science research. By using this research design, the numerical data that emerged in the quantitative sections of this research could be explained by qualitative sections (the quotes that the participants were providing during the interviews).

The data were generated from closed and open-ended questions in the online survey and from interview quotes. A limitation of this study was the small number of survey respondents (128 participants) which is a reminder to be careful with these results in terms of generalising to the whole population. Additionally, very low number of participants were found in two of the independent variables in the third research question (ethnicity and disability), which meant that these variables were excluded from the analysis because they could cause issues regarding identification of participants and problems with statistical analysis.

Another limitation is that this study just explored the persuasion of the Ecuadorian government and did not deepen on the persuasion of other public and private Ecuadorian

universities. Further research can be done in relation to how the persuasion of other HEIs interacted with the government's message to shape the choice of HE courses.

9.3 Implications for theory and practise

The results in this study have implications for theory and practise. First, in terms of theory, the typology of political dispositions in relation to government's message presented in this study extends existing literature that deals with government initiatives to increase the number of students taking STEM subjects at university. The main implication is that the government ability to promote STEM education by simply endorsing it as a positive thing for students themselves and for the country as a whole, is constrained by the political disposition of students. In this regard, the results showed that the government message to attract students into STEM fields may be well-suited for those typified as positively influenced students, but may, conversely, be irrelevant for the decision of rejecters both passive and active. For the latter, instead, the motivators that can help are of different nature, such as comparatively higher expected wages and availability of funding to fully cover tuition and living costs.

Also, this study has provided new empirical evidence, which extends previous works on science education. On this matter, Wells, Sanchez, and Attridge (2007) had similar findings in that confidence in the subject and interest in the subject were the main motivators for undertaking a STEM field. According to Makhmasi et al. (2012), this has to do with good teaching and involves the capability of teachers for properly delivering science curricula.

In terms of implications for practice, these findings can be useful for education policy makers. In this regard, the typology presented in this thesis can be used as a theoretical base from which to build intervention programmes to engage students in STEM fields. For instance, these findings may help education authorities to re-think the science curriculum, as noted by Osborne, Simon, and Collins (2003), in such a way that enhances students' interest

and confidence in science. Also, in terms of the government direct participation, messages that raise awareness of how STEM careers can contribute to society can be delivered through multiple channels other than the government message. This could include, for instance, the HEIs themselves and elementary/high school teachers. Lastly, to address financial limitations, which happen to be more often associated to rejecters' motivations, government may consider alternatives to direct scholarship transfers (e.g. subsidies or economic incentives to HEIs). This can engage students, especially passive and active rejecters, discouraged not only by their attitudes towards the government but also by the bureaucratic processes involved in scholarship funding.

9.4 Recommendations for further research

As mentioned earlier in this thesis, the analysis of subject choice was retrospective. The participants in this study were already in their first year at university and had chosen their subjects when data collection took place. Further research could focus on subject choice motivational factors of students in their last year of high school, which could be done by using surveys. The study would have a second stage where some of the survey respondents could be interviewed once they are in their first year at university to compare how their decisions in relation to choice of undergraduate programme went from aspiration to actual choice.

This research suggested that STEM passive rejecters tended to be more middle achievers while positively influenced students tended to be high achievers. These findings may also suggest that as students' attainment rises, the government's message will influence STEM students more in relation to their choice of undergraduate programme. Further research with a larger sample is needed to better understand the relationship between

government's influence on the choice of STEM undergraduate programmes and differences in students' attainment.

This research did not consider the popularity of the government during data collection time. It is possible that positively influenced correlate with sympathy for the government. In this regard, further research is needed to examine how the popularity of the government may influence the choice of STEM undergraduate programmes.

As noted earlier, this research just explored the influence of the Ecuadorian government messages on STEM subject choice and did not deepen on the messages of other public and private universities in Ecuador. A future study investigating how the messages of other universities interacted with the government's message to shape STEM subject choice.

Appendix A

Main study survey (Arts University and STEM University)

Welcome to this survey on decision-making about the choice of undergraduate studies in Ecuador.

This survey is intended for Ecuadorian students currently enrolled in their first year at the

The respondents who qualify and complete the survey will receive a knowledge voucher to attend a talk on how to use autodidacticism to learn English (without leaving Ecuador!) and prepare for the IELTS or the TOEFL. During this talk, which will be based on the researcher's personal experience as an EFL learner, those who attend the talk will have the opportunity to enter into a book voucher prize draw to get graded readers to improve their English. In addition, the abovementioned group will have the option to stay informed about the project results via e-mail.

This survey is part of the thesis of an Ecuadorian student who got his full-paid SENESCYT scholarship to do a PhD in Education at the University of York. This survey will inform the body of research with a preliminary study about the motivation for student prospects in Ecuador when choosing a higher education programme.

The Ecuadorian government has acknowledged that ameliorating Higher Education Institutions (HEIs) within our country is very important to create a fairer society. You are part of this positive change since you are a select group of top students across our nation who were chosen based on the principles of meritocracy, transparency and equal opportunity to study at public Ecuadorian HEIs. Your answers in this survey will generate a better understanding of the issue in order to improve our higher education system.

Completing the survey

This survey will ask about your decision-making process when choosing your fields of study, as well as demographic information.

On average, the survey takes 20 minutes to complete, depending on how many questions are relevant to you.

There are four sections to the survey:

1. Influence of messages on the importance of your major on your choice of study.
2. Motivations for your choice of study.
3. Background characteristics and your motivation to choose a major.
4. Demographic information

Please answer as many questions as you can. Except for those which direct you through the survey, none of the questions are compulsory. Where multiple-choice

questions are provided, please choose the option that best describes your situation, or enter your response into the 'other box' if necessary. The survey will not allow you to move backwards, but there is an option to save your answers and finish the survey at a future time. The option to 'save and continue' works by placing a cookie on your browser which keeps track of your survey progress.

Please note that the link to collect your responses will be open until February 28th, 2017 at midnight.

The information you provide will be confidential and stored securely until 2019 according to EU data protection regulation. The survey has received full approval from the Ethics Committee of the Department of Education, University of York, which is leading the survey. There will not be any information from the project which will cite findings in a way that enables people to identify you. Also, data will not be shared with other individuals or institutions including the participating universities. By beginning this survey, you acknowledge that you have read this information and agree to participate in this research.

If you have any questions about this survey or the study, please feel free to contact any of the following persons: Julio Rivadeneira Barreiro (researcher) at jcrb500@york.ac.uk, Dr Sally Hancock (researcher's supervisor) at sally.hancock@york.ac.uk or the Chair of the Education Ethics Committee at education-research-administrator@york.ac.uk

Many thanks for taking part of your time to complete this survey!

Survey on decision-making about the choice of undergraduate studies

Institution

- Arts University
- STEM University

Semester:

- Levelling semester
- First semester (major)

¿What is your field of study?

- Cinema
- Literature
- Performing arts
- Sonic arts
- Visual arts
- Life sciences and biotechnology
- Chemical sciences and engineering
- Geological sciences and engineering
- Physical sciences and engineering
- Social sciences and innovation
- Information and technology sciences
- Music production
- Sound production

In case your field of study was not included above, please write it here:

1. Influence of messages on the importance of your major on your choice of study.

Q1 How important in your view is your field of study for the development of Ecuador?

- Extremely important
- Very important
- Moderately important
- Slightly important
- Not at all important

Q2 What is your understanding of the current Ecuadorian government's policy / position towards higher education in our country?

Q3 What is your understanding of the mission and vision of your university?

Q4 Did the current Ecuadorian government's message about the importance of your major influence your choice of study at some point?

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

Q5 How do you think your studies are going to help Ecuador's development?

Q6 What is the most interesting thing you want to obtain from your future career? Why?

Q7 Was there any message from the Ecuadorian government during its television or radio programs that influenced your decision to choose your current major? Please explain. (The programs considered in this question are the Citizens' Outreach programs or sabatinas, speeches to the nation by the president or vice-president of Ecuador, Buen Vivir TV or Ama la vida TV programs, etc.)

2. Motivations for your choice of study

Q8 How old were you when you decided that you were going to study at a university?

Q9 How old were you when you decided to study your current major?

Q10 What motivated you to study at the Arts University / STEM University?

Q11 List three things you consider strengths about your future career.

Q12 What things would you like to do regarding your career once you graduate? Please select all that apply.

- Do a master's in my field of study
- Get a high-paid job
- Start working to contribute to society
- Start my own business to put into action what I learned
- Other (please specify): _____

Q13 What was your favourite subject during high school?

- Arts-related subjects
- Biology
- Chemistry
- Literature
- Maths
- Physics
- Technical drawing
- Other (please specify): _____

Q14 What are your favourite subjects at university?

- Arts-related subjects
- Biology
- Chemistry
- Literature
- Maths
- Physics
- Technical drawing
- Other (please specify): _____

Q15 What were some of your hobbies during high school?

- Go to museums
- Go to science fairs
- Play a musical instrument
- Read for pleasure about Arts-related topics
- Read for pleasure about STEM (science, technology, engineering and maths) topics
- Play sports
- See documentaries on arts
- See documentaries on engineering
- Solve maths problems
- Other (please specify): _____

Q16 Have any of the following inspired you to study your Arts or STEM (Science, Technology, Engineering and Mathematics) major? Check all that apply.

- My mother
- My father
- My siblings
- A relative
- A teacher
- An academic counsellor
- An authority at my school
- A good friend
- A guest lecturer / career talk
- An open house visit at a university
- Inspiration did not come from other people, but from I.
- Other (please specify): _____

Q17 If so, what made the abovementioned person or event inspirational?

Q18 Do you know someone you would say did not want you to study your Arts or STEM major?

- My mother
- My father
- My siblings
- A relative
- A teacher
- An academic counsellor
- An authority at my school
- A good friend
- Other (please specify): _____

Q19 If so, what reasons did s/he give?

Q20 Did you experience any barriers when choosing to study this subject?

- Yes
- No

Q21 If so, what kind of barrier?

- Financial problems
- Teachers discourage it
- Past educational attainment
- Unsure whether I am suited to this subject
- Other (please specify): _____

Q22 Did your parents have reading materials or other elements at home to foster your interest in your current studies?

- Yes
- No

Q23 If so, what kind of materials?

Q24 Did you have family support regarding your choice of study?

- Yes
- No

Q25 Please explain:

Q26 How confident are you about your choice of major?

- I definitely think I would not be able to succeed at my studies
- I think I would not be able to succeed at my studies
- At times I think I will succeed and at other times I think I will not succeed
- I think I would be able to succeed at my studies
- I am very confident I will succeed at my studies

Q27 What you most like about your field of study is...

- that it is an opportunity to do what I love
- that my preparation will be useful to create a fairer society
- that I will be able to get a high-paid job in the future

Q28 Other (please specify):

Q29 How do you feel about your studies?

Q30 Did you consider studying outside of Ecuador via SENESCYT's scholarships?

- Yes
- No

If No Is Selected, Then Skip to 3. Background characteristics and you...

Q31 If so, why did you decide to stay in Ecuador? Select up to three choices.

- I want to be closer to my family home
- I feel taking the TOEFL or the IELTS is a big obstacle
- Studying in a foreign country is a plan that I have for postgraduate studies
- Financial problems
- I feel comfortable with the food, weather, traditions and people of my country
- I feel too young / unprepared for such a transition
- I want to be part of Ecuador's higher education system
- Other: _____

3. Background characteristics and your motivation to choose a major

Q32 Could you please confirm your final score in the ENES examination?

- 600-700
- 701-800
- 801-900
- 901-1000

Q33 Do you consider monetary issues have been a problem to study what you wanted at the university level?

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

Q34 Do you think that gender has influenced your study choice?

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

Q35 Why? (Please explain):

Q36 If you have a disability, how do you feel the higher educational system in Ecuador has supported you to study at university?

Q37 Other comments, observations or suggestions about the choice of study or higher education in Ecuador.

4. Demographic information

Q38 Hometown and province

Please state the occupation / job title of your father

Please state the occupation / job title of your mother

Q39 Socio-economic status:

- Lower class
- Lower-middle class
- Middle class
- Upper-middle class
- Upper class

Q40 Ethnic group:

- Indigenous
- Afro-descendant
- Mestizo
- White
- Others: _____

Q41 Gender:

- Male
- Female

Q42 Disability:

- Yes
- No

Q43 Could you please confirm the monthly family income (total)?

- 100-500 USD
- 501-1000 USD
- 1001-1500 USD
- 1501-2000 USD
- 2001-3000 USD
- Other: _____

Q44 Do your parents have higher education qualifications?

- Yes
- No

If No Is Selected, Then Skip to If yes, please specify:

Q45 If yes, please specify:

	Undergraduate degree	Master degree	PhD
Father	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mother	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Appendix B

Interview schedule

Hi! My name is Julio Rivadeneira Barreiro and I am collecting data for my PhD. This interview will have three sections that will go from general to particular topics: major and institution choice, higher education and the Ecuadorian government, and personal factors, major and institution. This interview is being recorded with your permission. If you do not want to answer a question, please feel free to do it. The informed consent form that you just signed let you know about my study and the ethical considerations.

The first section of our interview is major and institution choice.

Before starting, could you please tell me the major that you are studying?

1. Can you tell me what motivated you to choose this particular major? How confident are you that you have chosen the 'right' major?

(Probes: What problems did you find? Who supported you during this time? How do you feel now? Any uncertainties then or now?)

2. Can you tell me what motivated you to study at the Arts University/STEM University?

(Probes: government, advertising, finance, intrinsic interest for major, university prestige - which other universities did you consider and dismiss?)

3. How did you feel about the fact that the Arts University/STEM University is a very new university? Do you have any reflections about its future prospects?

(Probes: Did you receive warnings about this? Who or what warned you? Who or what helped you overcome the nervousness regarding the newness of the Arts University/STEM University? Do you still feel nervous about the newness of your university? If so, why?)

Now we are going to move to the second section of our interview which is about higher education and the Ecuadorian government.

4. To what extent do you think your field of study is important for the development of Ecuador?

(Probes: Is this important to you? How does your field of study help to change the economy of Ecuador? What do you know about the production matrix in Ecuador? What influential messages on the importance of your field of study did you hear before choosing your major? Who mentioned them?)

5. To what extent do you think your university is contributing to the development of Ecuador?

(Probes: Is this important to you? What is the connection with local citizens and area? What is the connection with the citizens of all the country?)

6. What do you know about the current government policy for higher education in Ecuador?

(Probes: What are the positive aspects of this government policy? What has to be improved?)

7. Can you tell me the extent to which messages from the current Ecuadorian government influence your decision to study your major at the Arts University/STEM University?

(Probes: How influential were the Ecuadorian government messages in your decision? Which message(s) and why?)

The last section of this interview is about personal factors, major and institution

Before starting this new section, I want to explain that instead of being repetitive, I want to encourage deeper reflection on how personal characteristics and background explain your choices. Think of it as an opportunity to tell more about your personal story.

8. Can you tell me more about how your family members, friends, teachers, other people or events shaped your decision to study your major at the Arts University/STEM University?

(Probes: Who or what, and why? How influential were they?)

9. Could you tell me more about the extent to which financial aspects influenced your study and or institutional choice?

(Probes: Were there any financial concerns? What financial benefits attracted you to study at the Arts University/STEM University? What financial problems were affecting your choice of study at the Arts University/STEM University? How did you deal with financial problems while you were choosing your major?)

10. Did you face any challenges when making the transition to enrolling as a student at the Arts University/STEM University?

(Probes: Do you continue to face any challenges as a student? How have these been overcome/ what would help?)

11. To what extent do you believe that the Arts University/STEM University offers fair admissions procedures?

(Probes: Are those students from certain backgrounds excluded (e.g. low SES, ethnic group, gender, disability)? How does the Ecuadorian government help students from low SES?)

Before finishing, would you like to add a final reflection about a topic that we discussed during our interview?

Many thanks for your valuable contribution to my study. Have an excellent day!

Appendix C



Informed Consent Form

Decision making about the choice of study: drivers for Ecuadorian student prospects when choosing a higher education programme

Dear student,

Julio Rivadeneira Barreiro is currently carrying out a research project, and its purpose is to describe undergraduate students' decision-making and motivations for studying STEM and Arts. I am writing to ask if you are able to take part in the study.

This research is being conducted in partial fulfilment of the requirements for a PhD degree in the PhD in Education program at the University of York, United Kingdom.

What would this mean for me?

Taking part in the study will involve data collection from interviews on the process of decision making and motivations that led the students to choose their undergraduate fields of study. The participants will be first-year students in both universities who would like to volunteer. The interviews will take around 45 minutes to 1 hour. The study will take place inside your university in two different days between June 2016 and September 2017. Before being interviewed, every student will complete one survey, and the sample of interviewees will be selected from those participants who opt-in.

The group of volunteers who opt-in to be interviewees will be given \$ 10 plus a cup of coffee and crackers or cookies to be served during the interview session. The only possible

discomfort will be the time and effort required of the participants to complete the interviews.

Anonymity

The data that you provide (e.g. information and video recordings of the interview) will be stored by code number. Any information that identifies you will be stored separately from the data.

Storing and using your data

Data will be stored in secure filing cabinets and/or on a password protected computer. The data will be kept until 2024 (five years after the researcher completes his PhD studies around 2019) after which it will be destroyed. The data may be used for future analysis and shared for research or training purposes, but participants will not be identified individually. If you do not want your data to be included in any information shared as a result of this research, please do not sign this consent form.

You are free to withdraw from the study at any time during data collection and up to two weeks after the interview.

You will be given the opportunity to comment on a written record of your interview.

Information about confidentiality

The data that we collect (videos, audio recordings, transcripts or other kind of information) may be used in *anonymous* format in different ways. Please indicate on the consent form attached with a if you are happy for this anonymised data to be used in the ways listed.

Please note: If we gather information that raises concerns about your safety or the safety of others, or about other concerns as perceived by the researcher, the researcher may pass on this information to another person.

We hope that you will agree to take part. If you have any questions about the study that you would like to ask before giving consent or after the data collection, please feel free to contact Julio Rivadeneira Barreiro (researcher) at jcrb500@york.ac.uk, Dr Sally Hancock (researcher's supervisor) at sally.hancock@york.ac.uk, or the Chair of the Education Ethics Committee at education-research-administrator@york.ac.uk

If you are happy for you to participate, please complete the form attached.

Please keep this information sheet for your own records.

Thank you for taking the time to read this information.

Yours sincerely,

Julio Rivadeneira Barreiro

**Decision making about the choice of study: drivers for Ecuadorian student prospects
when choosing a higher education programme**

Consent Form

Please initial each box if you are happy to take part in this research.

I confirm that I have read and understood the information given to me about the above named research project and I understand that this will involve me taking part as described above.

I understand that the purpose of the research is to describe undergraduate students' decision-making and motivations for studying STEM and Arts.

I understand that data will be stored securely in a locked filing cabinet or on a password protected computer and only Julio Rivadeneira Barreiro will have access to any identifiable data. I understand that my identity will be protected by use of a code or pseudonym.

I understand that my data will not be identifiable and the data may be used

in publications that are mainly read by university academics

in presentations that are mainly attended by university academics

in publications that are mainly read by the public

in presentations that are mainly attended by the public

freely available online

I understand that data will be kept for five years after the researcher finish his PhD after which it will be destroyed.

I understand that data could be used for future analysis or other purposes (other research purposes)

I understand that I can withdraw my data at any point during data collection and up to two weeks after the interview takes place.

I understand that I will be given the opportunity to comment on a written record of my responses.

Appendix D



Education Ethics Committee Ethical Issues Audit Form

This questionnaire should be completed for each research study that you carry out as part of your degree. Once completed, please email this form to your supervisor. You should then discuss the form fully with your supervisor, who should approve the completed form. You must not collect your data until you have had this form approved by your supervisor (and possibly others - your supervisor will guide you).

Surname / Family Name:	Rivadeneira Barreiro
First Name / Given Name:	Julio
Programme:	PhD in Education
Supervisor (of this research study):	Dr. Sally Hancock
Topic (or area) of the proposed research study:	
Decision making about the choice of study: Drivers for Ecuadorian student prospects when choosing a higher education programme.	
Where the research will be conducted:	
Ecuador (Provinces of Imbabura and Guayas)	
Methods that will be used to collect data:	
Qualitative methods	
If you will be using human participants, how will you recruit them?	
In order to recruit participants, I will consider two HEIs in Ecuador: a STEM university (Institution A), and an Arts university (Institution B). There, I will send e-mails explaining the research project to undergraduate students who are in their first year. I will also give them online informed consent forms so they can read them and decide whether they want to be part of the study. Convenience sampling will be used by inviting all subjects to participate during the survey. During the second stage, participants will have the opportunity to opt-in to be part of the interviews. At this point, the researcher will make sure whether there are all of these three Ecuadorian ethnic groups: Indigenous, Black and Montubio people. Since the aforesaid groups are socially excluded in Ecuador, the interviews will target them to get a better understanding of	

<p>their backgrounds. In case one or more of these ethnic groups is missing, purposive sampling will be used to recruit participants. The information on their ethnicity will be obtained from the surveys.</p>

All supervisors, please read Ethical Approval Procedures: Students.

Taught programme supervisors. Note: If the study involves children, vulnerable participants, sensitive topics, or an intervention into normal educational practice, this form must also be approved by the programme leader (or Programme Director if the supervisor is also the Programme Leader)

Research student supervisors. The application is a joint one by the research student and supervisor(s). It should be submitted to the TAP member for initial approval and then to the Higher Degrees Administrator who will seek a second opinion from a designated member of Education Ethics Committee.

All students: forms may also require review by the full Ethics Committee (see below).

First approval: by the supervisor of the research study (taught students); or TAP member (research students) (after reviewing the form):

Please select one of the following options.

I believe that this study, as planned, meets normal ethical standards. I have checked that any informed consent form a) addresses the points as listed in this document, and b) uses appropriate language for the intended audience(s).	<input type="checkbox"/>
I am unsure if this study, as planned, meets normal ethical standards	<input type="checkbox"/>
I believe that this study, as planned, does not meet normal ethical standards and requires some modification	<input type="checkbox"/>

Supervisor/TAP member's Name (please type):	Dr. Sally Hancock / Dr. Paul Wakeling
Date:	Click here to enter a date.

Taught student supervisors - If the study involves children, vulnerable participants, sensitive topics, or an intervention into normal educational practice (see Ethical Approval Procedures: Students), please email this form for second approval to the Programme Leader

(or Programme Director if the supervisor is also the Programme Leader). For this second approval, other documents may need to be sent in the same email e.g. the proposal (or a summary of it) and any informed consent and participant information sheets. If the study has none of the above characteristics, the supervisor should email this completed form to the Programme Administrator. This signals the end of the approval process and data collection can begin. If the study has none of the above characteristics, the supervisor should email this completed form to the Programme Administrator. This signals the end of the approval process and data collection can begin. The member of the EEC will notify the Programme Administrator only when the final outcome has been decided.

Second approval: by the Programme Leader; or Programme Director; or designated Ethics Committee member for research students:

Please select one of the following options:

I believe that this study, as planned, meets normal ethical standards. I have checked that any informed consent form a) addresses the points as listed in this document, and b) uses appropriate language for the intended audience(s).	<input type="checkbox"/>
I am unsure if this study, as planned, meets normal ethical standards	<input type="checkbox"/>
I believe that this study, as planned, does not meet normal ethical standards and requires some modification	<input type="checkbox"/>

Name of Programme Leader; or Programme Director; or Ethics Committee member (please type):	
Date:	Click here to enter a date.

The supervisor should now email this completed form to the Programme Administrator, unless approval is required by the full Ethics Committee (see below).

Approval required by the full Education Ethics Committee

If the application requires review by the full Education Ethics Committee, please select one of the following options then forward the application to the Research Administrator (education-research-administrator@york.ac.uk).

The study involves deception	<input type="checkbox"/>
The study involves an intervention and procedures could cause concerns	<input type="checkbox"/>

The topic is sensitive or potentially distressing	<input type="checkbox"/>
The study involves vulnerable subjects	<input type="checkbox"/>
Other reason:	

Name of Programme Leader; or Programme Director; or TAP member (please type):	
Date:	Click here to enter a date.

FOR COMPLETION BY THE STUDENT

Data sources

- 1 If your research involves collecting secondary data only go to SECTION 2.
- 2 If your research involves collecting data from people (e.g. by observing, testing, or teaching them, or from interviews or questionnaires) **go to SECTION 1.**

SECTION 1: For studies involving people

- 3 Is the amount of time you are asking research participants to give reasonable? **YES**
- 4 Is any disruption to their normal routines at an acceptable level? **YES**
- 5 Are any of the questions to be asked, or areas to be probed, likely to cause anxiety or distress to research participants? **NO**

- 6 Are all the data collection methods used necessary? **YES**
- 7 Are the data collection methods appropriate to the context and participants? **YES**
- 8 Will the research involve deception? **NO**
- 9 Will the research involve sensitive or potentially distressing topics? (The latter might include abuse, bereavement, bullying, drugs, ethnicity, gender, personal relationships, political views, religion, sex, violence. If there is lack of certainty about whether a topic is sensitive, advice should be sought from the Ethics Committee.) **NO**

If YES, what steps will you take to ensure that the methods and procedures are appropriate, not burdensome, and are sensitive to ethical considerations?

- 10 Does your research involve collecting data from vulnerable or high risk groups? (The latter might include participants who are asylum seekers, unemployed, homeless, looked after children, victims or perpetrators of abuse, or those who have special educational needs. If there is a lack of certainty about whether participants are vulnerable or high risk, advice should be sought from the Ethics Committee. Please note, children with none of the above characteristics are not necessarily vulnerable, though approval for your project must be given by at least two members of staff; see above). **NO**

If YES, what steps will you take to ensure that the methods and procedures are appropriate, not burdensome, and are sensitive to ethical considerations?

- 11 Are the research participants under 16 years of age? **NO**
- If NO, go to question 12.**

If YES, and you intend to interact with the children, do you intend to ensure that another adult is present during all such interactions? Choose an item.

If NO, please explain, for example:

i) This would seriously compromise the validity of the research because [*provide reason*]

ii) I have/will have a full Disclosure and Barring Service check (formerly Criminal Records Bureau check). Choose an item.

iii) Other reasons:

Payment to participants

12 *If research participants are to receive reimbursement of expenses or any other incentives, including financial, before or after the study, please give details. You should indicate what they will receive and, briefly, the basis on which this was decided.*

The group of volunteers who would be interested in collaborating on this research by completing the survey will receive a knowledge voucher to attend a talk on how to use autodidacticism to learn English (without leaving Ecuador! ☺) and prepare for the IELTS or the TOEFL. During this talk, which will be based on the researcher's personal experience as an EFL learner, those who attend the talk will have the opportunity to enter into a book voucher prize draw to get graded readers to improve their English. In addition, the abovementioned group will have the option to stay informed about the project results via e-mail. Those participants who opt-in to be interviewees will be given \$ 10 plus a cup of coffee and crackers or cookies to be served during the interview session.

It is often considered good practice to consider what the researcher might offer the participants, in the spirit of reciprocity. Some ideas of what this might be include: materials at

the end of the study, a workshop summarising the results of the study, a delayed treatment/intervention at the end of the study, an indication about where the findings might be accessed at a later date, a letter or token of thanks. Please ensure that you have considered the potential for reciprocity in your research.

If your study involves an INTERVENTION i.e. a change to normal practice made for the purposes of the research, go to question 13 (this does not include 'laboratory style' studies i.e. where ALL participation is voluntary):

If your study does not involve an intervention, go to question 20.

- 13 Is the extent of the change within the range of changes that teachers (or equivalent) would normally be able to make within their own discretion? Choose an item.
- 14 Will the change be fully discussed with those directly involved (teachers, senior school managers, pupils, parents – as appropriate)? Choose an item.
- 15 Are you confident that *all* treatments (including comparison groups in multiple intervention studies) will potentially provide some educational benefit that is compatible with current educational aims in that particular context? (Note: This is *not* asking you to justify a non-active control i.e. continued normal practice) Choose an item.

Please **briefly** describe this / these benefit(s):

- 16 If you intend to have two or more groups, are you offering the control / comparison group an opportunity to have the experimental / innovative treatment at some later point (this can include making the materials available to the school or learners)? Choose an item.

If NO, please explain:

- 17 If you intend to have two or more groups of participants receiving different treatment, do the informed consent forms give this information? Choose an item.
- 18 If you are randomly assigning participants to different treatments, have you considered the ethical implications of this? Choose an item.
- 19 If you are randomly assigning participants to different treatments (including non-active controls), will the institution and participants (or parents where participants are under 16) be informed of this in advance of agreeing to participate? Choose an item.

If NO, please explain:

General protocol for working in institutions

- 20 Do you intend to conduct yourself, and advise your team to conduct themselves, in a professional manner as a representative of the University of York, respectful of the rules, demands and systems within the institution you are visiting? **YES**
- 21 If you intend to carry out research with children under 16, have you read and understood the Education Ethics Committee's *Guidance for Ethical Approval for Research in Schools*? Choose an item.

Informed consent

- 22 Have you prepared Informed Consent Form(s) which participants in the study will be asked to sign, and which are appropriate for different kinds of participants? **YES**

If YES, please attach the informed consent form(s).

If NO, please explain:

23 Please check the details on the informed consent form(s) match each one of your answers below. Does this informed consent form:

- a) inform participants in advance about what their involvement in the research study will entail? YES

- b) if there is a risk that participants may disclose information to you which you may feel morally or legally bound to pass on to relevant external bodies, have you included this within a confidentiality clause in your informed consent form? YES

- c) inform participants of the purpose of the research? YES

- d) inform participants of what will happen to the data they provide (how this will be stored, who will have access to it, whether and how individuals' identities will be protected during this process)? YES

- e) if there is a possibility that you may use some of the data publicly (e.g. in presentations or online), inform the participants how identifiable such data will be and give them the opportunity to decline such use of data? YES

- f) give the names and contact details (e.g. email) of at least two people to whom queries, concerns or complaints should be directed? One of these people should be on the Education Ethics Committee (please use education-research-administrator@york.ac.uk) and not involved with the research. YES

- g) in studies involving interviews or focus groups, inform participants that they will be given an opportunity to comment on your written record of the event? YES

If NO, have you made this clear this on your consent form? Choose an item.

If NO, please explain why not:

h) inform participants how long the data is likely to be kept for? **YES**

i) inform participants if the data could be used for future analysis and/or other purposes?

YES

j) inform participants they may withdraw from the study during data collection? **YES**

k) provide a date/timescale by which participants will be able to withdraw their data and tell the participants how to do this? (NB. If your data is going to be completely anonymised, any withdrawal of data needs to happen before this.) **YES**

*NA if your data will be anonymous at point of collection

If your answer was NO to any of the above, please explain here, indicating which item(s) you are referring to (a-j):

24 Who will be asked to sign an Informed Consent Form? Please select all that apply:

CATEGORY	
Adult research participants	<input checked="" type="checkbox"/>
Research participants under 16	<input type="checkbox"/>
Teachers	<input type="checkbox"/>

Parents	<input type="checkbox"/>
Head/Senior leadership team member	<input type="checkbox"/>
Other (please explain)	<input type="checkbox"/>

- 25 In studies involving an **intervention** with under 16s, will you seek informed consent from parents?

Choose an item.

If NO, please explain:

If YES, please delete to indicate whether this is 'opt-in' or 'opt-out'

If 'opt-out', please explain why 'opt-in' is not being offered:

SECTION 2

Data Storage, Analysis, Management and Protection

- 26 I am accessing data from a non-publicly available source (regardless of whether the data is identifiable) e.g. pupil data held by a school or local authority, learners' work.

NO

If YES, I have obtained written permission, via an informed consent document, from a figure of authority who is responsible for holding the data. This informed consent a) acknowledges

responsibility for releasing the data and b) confirms that releasing the data does not violate any informed consents or implicit agreements at the point the data was initially gathered.

Choose an item.

27 I have read and understood the Education Ethics Committee's *Guidance on Data Storage and Protection* YES

28 I will keep any data appropriately secure (e.g. in a locked cabinet), maintaining confidentiality and anonymity (e.g. identifiers will be encoded and the code available to as few people as possible) where possible. YES

29 If your data can be traced to identifiable participants:

a) who will be able to access your data?

Julio Rivadeneira Barreiro and Dr. Sally Hancock

b) approximately how long will you need to keep it in this identifiable format?

The identifiable format will be kept approximately two weeks after the interviews take place. After that, data will be anonymized.

30 If working in collaboration with other colleagues, students, or if under someone's supervision, please discuss and complete the following:

We have agreed:

a) Julio Rivadeneira Barreiro and Dr. Sally Hancock will be responsible for keeping and storing the data

b) Julio Rivadeneira Barreiro and Dr. Sally Hancock will have access to the data

c) Julio Rivadeneira Barreiro and Dr. Sally Hancock will have the rights to publish using the data

Reporting your research

- 31 In any reports that you write about your research, will you do everything possible to ensure that the identity of any individual research participant, or the institution which they attend or work for, cannot be deduced by a reader? YES

If NO please explain:

--

Conflict of interests

- 32 If the Principal Investigator or any other key investigators or collaborators have any direct personal involvement in the organisation sponsoring or funding the research that may give rise to a possible conflict of interest, please give details:

The investigator and his supervisor do not work in any of the institutions that will be part of the study.
--

Potential ethical problems as your research progresses

- 33 If you see any potential problems arising during the course of the research, please give details here and describe how you plan to deal with them:

--

Student's Name (please type):	Julio César Rivadeneira Barreiro
Date:	26 May 2016

Please email this form to your supervisor. They must approve it, and send it to the Programme Administrator by email.

NOTE ON IMPLEMENTING THE PROCEDURES APPROVED HERE:

If your plans change as you carry out the research study, you should discuss any changes you make with your supervisor. If the changes are significant, your supervisor may advise you to complete a new 'Ethical issues audit' form.

For Taught Masters students, on submitting your MA dissertation to the programme administrator, you will be asked to sign to indicate that your research did not deviate significantly from the procedures you have outlined above.

For Research Students (MA by Research, MPhil, PhD), once your data collection is over, you must write an email to your supervisor to confirm that your research did not deviate significantly from the procedures you have outlined above.

Appendix E

Request for research visit to [REDACTED] – Julio Rivadeneira Barreiro

Dear colleagues,

I am writing to introduce myself as the academic supervisor of Julio Rivadeneira Barreiro.

Julio is completing his PhD in Education at the Department of Education, University of York, UK.

Julio's doctoral study is investigating students' motivations for studying STEM (science, technology, engineering and maths) programmes at university. He wishes to collect primary data from first year undergraduate students at [REDACTED] to solicit this information. This will involve him administering a large-scale survey and conducting follow-up interviews with a group of student volunteers.

Julio is seeking your permission and support to conduct this study at [REDACTED]. He is a recipient of the prestigious SENESCYT scholarship, and will take full responsibility for collecting the data from students. He has received full ethical approval to conduct this research, from the Department of Education Ethics Committee, at York.

I believe that Julio has already written to you requesting permission to undertake this research, and I am writing to follow up on this request. I believe that the work involved for colleagues at [REDACTED] will be minimal, and the disruption to students will also be negligible. Briefly, Julio is proposing to undertake the following:

1. Pilot study of students' motivations: comprising an online survey (which he will distribute and monitor) of current second year STEM students at [REDACTED], to be completed between October and December 2016

2. Main study of students motivations: comprising an online survey to all first year undergraduates enrolled on STEM programme, and follow-up interviews with twenty of these students, between January and May 2017

Julio expects to visit [REDACTED] for the first time in October-December 2016, and would greatly appreciate your cooperation in assisting him to establish this study. This will entail allowing him to send the survey to students by email, and allowing him to promote the survey on campus. As stated, with the exception of initial assistance in distributing the survey to the correct students, he will be able to gather this data largely independently.

By way of an incentive and thank you for participation, he will be able to prepare an accessible summary report detailing findings from [REDACTED]'s students, which, I am sure, will be very valuable to the institution.

If you would like to know more about the study, please do not hesitate to contact myself or Julio (copied here). I have attached here the research proposal and ethics application. If you require sight of any other related documentation, please do let us know.

In anticipation, Julio and I look forward to working with you.

Many thanks in advance, and very best wishes,

Sally

List of Abbreviations and Acronyms

BGU: *Bachillerato General Unificado* (Unified General Baccalaureate)

CEAACES: *Consejo de Evaluación, Acreditación y Aseguramiento de la Calidad de la Educación Superior* (Council of Evaluation, Accreditation and Assurance of Quality of Higher Education)

CONEA: *Consejo Nacional de Evaluación y Acreditación de la Educación Superior del Ecuador* (Ecuadorian Higher Education Evaluation and Accreditation National Council)

CR: Citizens' Revolution

EGB: *Educación General Básica* (Basic General Education)

GAR: *Grupo de Alto Rendimiento* (Group of High Performance)

HE: higher education

HEIs: higher education institutions

HES: higher education system

ENES: *Examen Nacional para la Educación Superior* (Higher Education National Exam)

IFTH: *Instituto de Fomento al Talento Humano* (Institute of Human Talent Encouragement)

INEC: *Instituto Nacional de Estadísticas y Censos* (Census and Statistics National Institute)

SENESCYT: *Secretaría de Educación Superior, Ciencia, Tecnología e Innovación*

(Secretariat of Higher Education, Science, Technology and Innovation)

SENPLADES: *Secretaría Nacional de Planificación y Desarrollo* (Development and Planning National Secretariat)

SNNA: *Sistema Nacional de Admisión y Nivelación* (Admission and Levelling National System)

STEM: Science, Technology, Engineering and Mathematics

S&T: science and technology

TPM: Transformation of the production matrix

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