



MASTER THESIS

IMPROVING THE TAX COMPLIANCE RATE IN THE
CARIBBEAN BY REDESIGNING THE ENTERPRISE
ARCHITECTURE WITH THE APPLICATION OF
INFORMATION TECHNOLOGIES

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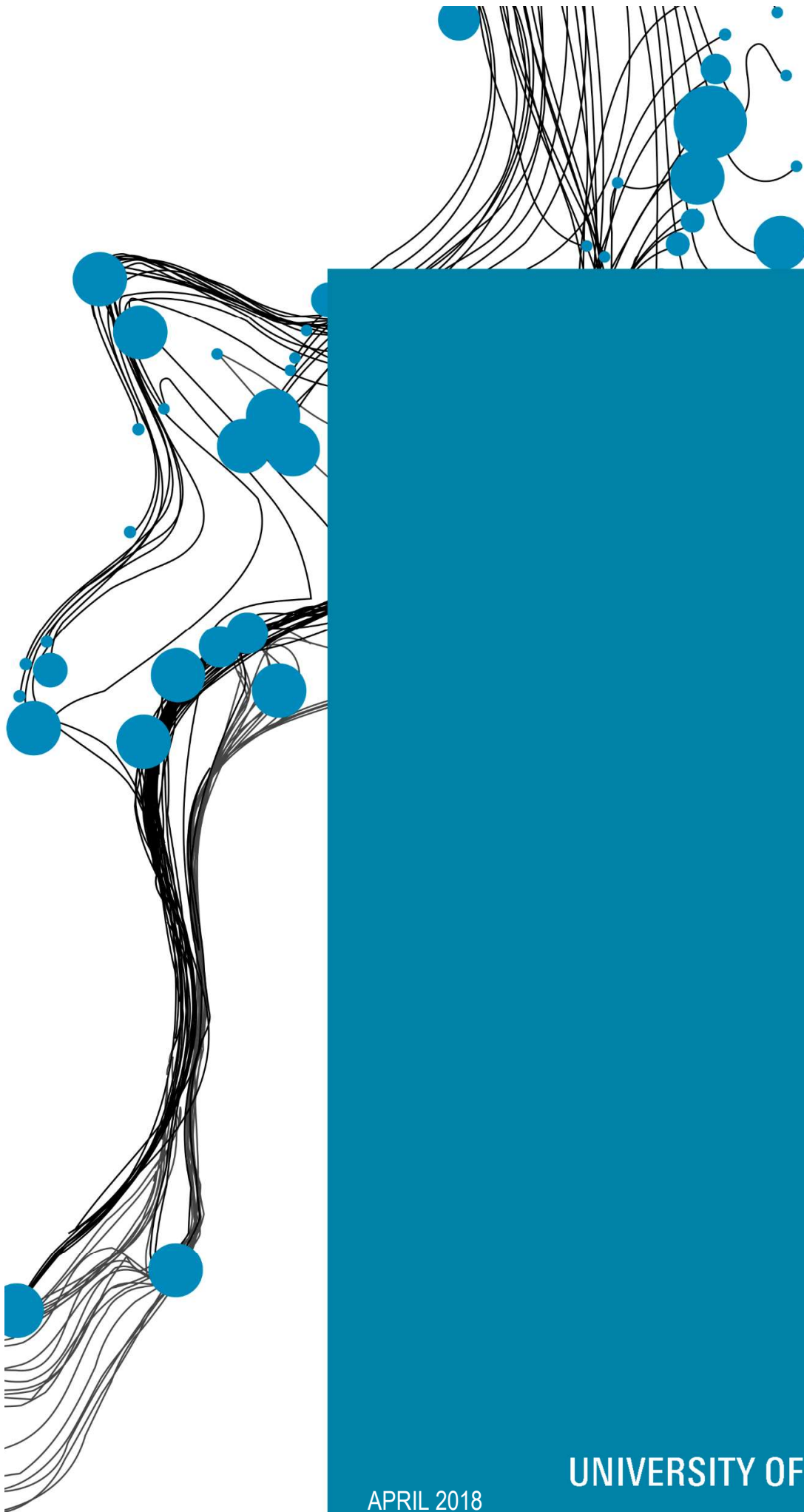
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Management summary

In the Caribbean islands the tax compliance rate is low compared to more western countries. In this master thesis we research how to improve the tax return compliance by designing and redesigning the enterprise architecture for the Caribbean tax authorities with application of information technologies. We answer the question *“How do we redesign the tax return process in an enterprise architecture by applying information technologies to improve the tax compliance in the Caribbean areas?”* by using the Design Science Research Methodology (DSRM).

Tax compliance is defined in four rules. The first is that the taxpayer needs to report the exact tax base to the tax authorities. Secondly, the taxpayer needs to compute the correct tax liability. The third rule is that the taxpayer needs to file the tax return on time. Finally, the fourth rule is that the taxpayer pays the correct amount of tax due on time.

From the range of twenty-four influencing factors of tax compliance that we found in scientific literature we narrowed down to six factors that can be influenced by Information Technologies. These six factors are taxpayers’ perception of audit probability, taxpayers’ knowledge of tax, taxpayers’ perception of the quality of services provided by the Tax Authority, easiness of retrieving tax related information for taxpayers, taxpayers’ perception of fairness, and strength of tax information systems of the Tax Authority.

Information Technologies (IT) we define as the development, implementation, and maintenance of computer hardware and software systems to organize and communicate information electronically. Enterprise Architecture (EA) is a coherent whole of principles, methods, and models that are used in the design and realization of an enterprise’s organizational structure, business processes, information systems, and IT infrastructure.

By applying literature research, we found improvement opportunities of multiple Information Technologies. Based on conducting semi-structured interviews with experts in the field of taxation we designed and redesigned the enterprise architecture. The application of IT in the design and redesign of the enterprise architecture we evaluated during semi-structured interviews. These IT applications are an overall data-layer, prefilled tax returns, online platform, mobile tax application, risk profiling, tax knowledge engineering, and external data exchange.

The results of the research reveal a positive correlation by applying the Information Technologies in the redesign of the enterprise architecture. All proposed Information Technologies show positive relation in tax compliance by applying the IT. Only for a mobile application it was just half of the experts that agreed on the positive effects on tax compliance. In the other applications we find a clear positive relation between the IT and influencing factors on tax compliance.

The most relevant Information Technologies we find is the foundation of one uniform data-layer, which is also the basis for other Information Technologies as risk profiling and an online portal. We evaluated the results of our semi-structured interviews by applying recursive abstraction.

In our conclusion state that we can improve the tax compliance rate by redesigning the application of the IT applications proposed in our enterprise architectures of the tax return process of the Caribbean. We conclude that using TOGAF in combination with the modelling language ArchiMate enables us to design and redesign this enterprise architecture. In addition, we conclude that the implementation of all IT applications that we include in our redesign will improve tax compliance in the Caribbean.

Key words: tax compliance, Information Technologies, Enterprise Architecture.

Preface and Acknowledgements

This master thesis is part of my master programme of Industrial Engineering and Management at the University of Twente. This master thesis is the result of my graduation internship at BearingPoint Caribbean and after the internship we performed the validation by conducting interviews at the Dutch Tax Authority.

First and foremost, I would like to thank my supervisors of the University of Twente, Maria Eugenie Iacob and Lucas Onno Meertens. Your patience, direction and enthusiasm are important for the result of this master thesis.

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Furthermore, the people at the Dutch Tax Authority who kindly accepted me of conducting validation interviews related to our design and redesign of the enterprise architecture, thank you a lot.

Last, but not least, I would like to thank specifically two friends who reviewed this master thesis, Stefan Hessels and Dennis van Haeren. Your extra pairs of eyes made it easier to come to the result that is currently read.

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Part I – Research introduction

In this part we will give an introduction of the research. We start in Part I – Research introduction with the context of the research in Chapter 1. The research proposal will be provided in Chapter 2.

1. Context

In this chapter the context is divided into four paragraphs. We start this chapter with the problem identification in paragraph 1.1. In paragraph 1.2 we give insight in the Caribbean. After that, in paragraph 1.3, we discuss the concept of tax revenues in Caribbean countries. In paragraph 1.4, we will introduce tax compliance. Next, we give more detailed information about BearingPoint Caribbean, the company directly involved during the execution of this research in paragraph 1.5. Finally, in paragraph 1.6 we discuss the development of Information Technology (IT) in Caribbean countries.

1.1 Problem identification

The tax compliance rate in Caribbean islands is relatively low compared to more western countries like the OECD. According to BearingPoint Caribbean implementing IT applications is an interesting opportunity to increase the tax compliance rate for these Caribbean countries. Even for small islands in the Caribbean an improvement of the tax compliance can result in extra millions of tax revenues. These potential extra tax revenues become more relevant since the publishing of the Panama Papers, which makes it more likely that offshore taxes for Caribbean tax havens decrease in the future. In scientific literature we see a lack of research in the design of the enterprise architectures for the taxation process to improve tax compliance by the implementation of IT applications.

1.2 The Caribbean

The Caribbean are located within the Caribbean Sea, the Gulf of Mexico and the Atlantic Ocean. As we visualise in Figure 1 the Caribbean are a group of larger and smaller islands in this area. Most islands have a small number of habitants.



Figure 1: Map of the Caribbean region

The islands are partly dependent on tourism, with an annual contribution of two billion US\$ by cruise ships (Business Research and Economic Advisors (BREA), 2013), and financial services for offshore businesses (TaxHavens.biz, 2011). Some of the islands have attractive tax legislation for foreign companies and individuals to decrease taxes, and are named as tax havens, see Figure 2. (Gravelle, 2015)

Table 1. Countries Listed on Various Tax Haven Lists

Caribbean/West Indies	Anguilla, Antigua and Barbuda, Aruba, Bahamas, Barbados, ^{a,e} British Virgin Islands, Cayman Islands, Dominica, Grenada, Montserrat, ^a Netherlands Antilles, St. Kitts and Nevis, St. Lucia, St. Vincent and Grenadines, Turks and Caicos, U.S. Virgin Islands ^{a,e}
Central America	Belize, Costa Rica, ^{b,c} Panama
Coast of East Asia	Hong Kong, ^{b,e} Macau, ^{a,b,e} Singapore ^b
Europe/Mediterranean	Andorra, ^a Channel Islands (Guernsey and Jersey), ^e Cyprus, ^e Gibraltar, Isle of Man, ^e Ireland, ^{a,b,e} Liechtenstein, Luxembourg, ^{a,b,e} Malta, ^e Monaco, ^a San Marino, ^{a,e} Switzerland ^{a,b}
Indian Ocean	Maldives, ^{a,d} Mauritius, ^{a,c,e} Seychelles ^{a,e}
Middle East	Bahrain, Jordan, ^{a,b} Lebanon ^{a,b}
North Atlantic	Bermuda ^e
Pacific, South Pacific	Cook Islands, Marshall Islands, ^a Samoa, Nauru, ^c Niue, ^{a,c} Tonga, ^{a,c,d} Vanuatu
West Africa	Liberia

Figure 2: Countries listed as tax havens (Gravelle, 2015)

1.3 Tax revenues

Tax revenues are a large source of income for most countries, also for the Caribbean. We divide tax revenues into internal- and external tax revenues. Internal tax revenues are generated from habitants and legal entities that operate within the country, while external tax revenues are generated from habitants and legal entities that operate in another country. The largest amount of external tax revenues comes from offshore tax income. Offshore tax means that legal entities that operate in another country, start a legal entity in another country from which the tax administration is processed with the purpose to pay lower tax rates. For Caribbean islands, the offshore taxes have a relevant impact on their total tax revenues. (TaxHavens.biz, 2011)

Since the announcement of the Panama Papers, a debate rises about offshore tax havens. Some Caribbean islands are stated as tax havens in the Panama Papers (Hira, Murata, & Monson, 2016). This causes uncertainty whether these islands will stay an attractive business establishment for offshore companies. That is the reason BearingPoint Caribbean believes it becomes increasingly important to focus more on the internal tax revenues. By collecting more internal tax revenues, these islands become less dependent to offshore tax.

The most relevant internal tax types for this research are value-added tax (VAT), payroll tax (PT), personal income tax (PIT) and corporate income tax (CIT) (of local entities) because the processes of these tax types are mostly related to the process of a tax return. Furthermore, tax revenues can be separated into tax returns and tax assessments. For tax returns the obligation of determining the amount of tax is the responsibility for the taxpayer. Where for tax assessment the responsibility of this determination lies with the tax authority.

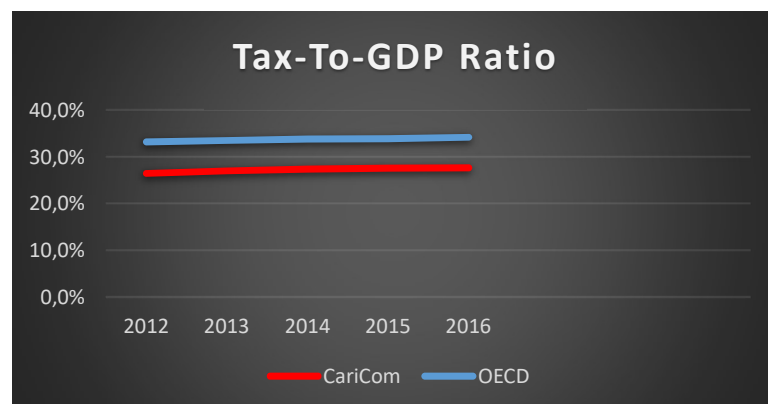


Figure 3: Graph of the Tax-To-GDP ratio from (CariCom, 2016) and (OECD, 2016) in timeline.

A common-used measure for a country's welfare is the tax-to-GDP ratio (Investopedia, 2014). In most of member countries of the Caribbean Community (CariCom) the average rate in 2016 was 27,7 percent (CariCom, 2016), while the OECD average was about 34,4 percent in this similar year (OECD, 2016), see Figure 3. Some countries aim to increase their tax-to-GDP ratio by a certain percentage to address deficiencies in their budgets (Investopedia, 2014). However, if the offshore tax revenues decrease in the Caribbean, because of the Panama Papers, this means a decreasing tax-to-GDP ratio. These lower tax revenues results in lower budgets for policy makers.

1.4 Tax compliance

Tax compliance is a relevant issue in every country that gains revenues in any form of the taxation process. From country-perspective it is the percentage of how accurate a government realizes tax collection from taxpayers before due date.

In Figure 4 we see different levels of taxpayers' attitude towards compliance. A part of all taxpayers is willing to pay taxes, where the government does not need to do anything to achieve compliant tax payments. The other part of all taxpayers is not willing to pay taxes, so the government needs to carry out actions to achieve compliant tax payments. As we can see the part that is willing to comply is relatively larger than the part that is not willing to comply. To effectively increase compliance for all taxpayers, our strategy needs to focus on making it easy and help to comply, and for the small part that is not willing to comply we need to detect and support enforcement by law.

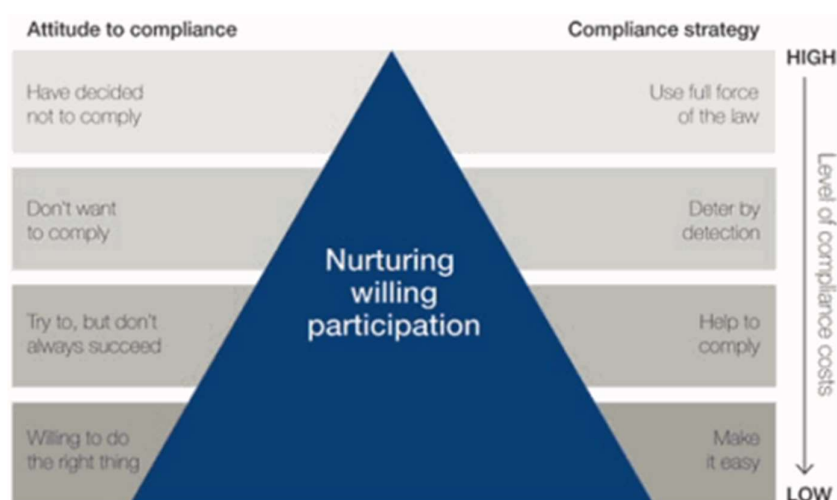


Figure 4: The ATO compliance model - Willingness to comply in relation to attitude to compliance, compliance strategy and compliance costs. (ATO, 1998)

During our literature review in Chapter 3 we will discuss the topic tax compliance in more details.

1.5 BearingPoint Caribbean

BearingPoint Caribbean consults, and implements IT solutions, for Caribbean governments. One of their main areas of expertise is providing IT solutions for tax authorities. However, some Caribbean countries do not use their solutions yet.

The vision of BearingPoint Caribbean is to help governments to perform better, faster and smarter. One of the ways to do this is by realising solutions that support governments increasing their tax revenues increasing revenues, which results in higher income for the governments. These extra revenues increase the national budget for spending in education, infrastructure, the social security, healthcare and much more. The three pillars that BearingPoint Caribbean focusses on are: superior service; low cost; and high compliance. (BearingPointCaribbean, 2016)

We carried out this research from the office in Aruba. Other offices of BearingPoint Caribbean are in Curacao, Bonaire, Sint Maarten and the Netherlands. Their customers and prospects are both in these countries, as well in many other islands like Saba, Sint Eustatius, British Virgin Islands, Anguilla, Barbados, Surinam and more Caribbean islands.

BearingPoint Caribbean makes a Commercial Of-The-Shelf (COTS) solution that is more effective and flexible for making governmental solutions for the customer in many Caribbean countries with the same purposes as tax authorities. With their COTS-solutions BearingPoint Caribbean improves the tax compliance by implementing smart information technologies.

1.6 Information Technologies within Caribbean tax authorities

During our Situation Interviews it was noticed by the employees of BearingPoint Caribbean that the administration offices of Caribbean Islands' Tax offices make less use of automation compared to this results in for example long waiting lines without options to make an online appointment. Furthermore, it was mentioned during these interviews that most tax administrations operate with pen, paper and hand calculators, while more sophisticated countries in the world are working with highly sophisticated information technology systems.

Where IT is involved, Caribbean tax authorities do not use well-developed information technology systems. Many of the countries use legacy systems like SIGTAS. The software is not working properly, because it is not updated for years. And it has high maintenance costs because it is not a COTS product, but it must be fully customised per implementation. SIGTAS has developed an individually version per country and because not all problems are solved employees are partially still working with pen and paper. The efficiency and effectiveness of more sophisticated COTS-developed systems are much higher than SIGTAS and the pen-and-paper approach of Caribbean countries (Bank KfW Development, 2015). For these countries it makes sense that improvement of their IT-infrastructure for their internal taxation processes could be an opportunity.

2. Research proposal

In this chapter we will describe the research problem (2.1), purpose of the research (2.3), theoretical approach (2.3), empirical approach (2.4), scope (2.5), research questions (2.6), research relevance (2.7), research methodology (2.8) and research overview (2.9).

2.1 Research problem

The problem that is the base of this research is the low tax compliance rate in the Caribbean. The tax compliance rate in this region is low compared to more western countries in Europe and United States: According BearingPoint Caribbean the compliance rate for Caribbean countries is assumed to be comparable with the average tax compliance rate of Latin American (LAC) countries. The average tax compliance rate of LAC countries in 2010 according to (Trigueros, Longinotti, & Vecorena, 2012) was 69,6 percent for both VAT and corporate income tax. The tax compliance rates in 2010 in Western-European countries and the United States vary between 77,0 to 91,5 percent (Schneider, Buehn, & Montenegro, 2010).

We assume that the tax compliance rate is improvable. Even for smaller Caribbean islands the tax revenues are many millions of US dollars per year. By improving the tax compliance with even one percent, we generate extra interesting tax revenues. However, for improving the tax compliance rate we find no structured enterprise architectures of the taxation process for to purpose of redesigning the process by using information technologies.

2.2 Purpose

The purpose of this research is to design and redesign an enterprise architecture (EA) of the tax return process that applies information technologies to improve the tax compliance in Caribbean countries.

2.3 Theoretical approach

For our theoretical approach we executed a literature review that focuses on the important subjects around the problem statement. We focussed on subjects as 'tax compliance', 'causes of tax compliance', 'power of government', 'trust in government', 'information technologies', 'process redesign', 'TOGAF', 'ArchiMate', and 'enterprise architecture'.

To find the relevant scientific literature, we performed searches that relate to the key words mentioned above on Scopus and Google Scholar. Furthermore, we applied backward- and forward reference search after gathering more information. Moreover, we research with new specific keywords as specific influencing factors for tax compliance and specific information technologies that we find during our research.

2.4 Empirical approach

For the empirical approach we conducted four semi-structured interviews with experts in the field of Caribbean tax process. To demonstrate and evaluate our design, we conducted eight semi-structured validation interviews with other experts in the field of the Dutch tax process and experience with enterprise architecture.

For shaping the context in Chapter 1 we also use exploratory interviews, information and news related to the research topic via the internet and in local newspapers.

2.5 Scope

2.5.1 The Caribbean

The content of this research focuses on the Caribbean region, because in our findings the problem occurs for most Caribbean islands and not much research is done in this area.

2.5.2 Tax returns process

We focus only on the process of tax returns. We assume, based on the viewpoint of BearingPoint Caribbean, that the impact of the process of tax returns is larger than the process of tax assessments.

2.5.3 No financial products

The scope of the research is the process redesign to improve the tax compliance rate. For that reason, we do not consider the opportunities of different or new financial products in the tax industry.

2.5.4 No changes in laws and regulations

For the same argumentation that yields for financial products, we do not focus on possible changes in the law that improve the compliance rate.

2.6 Research questions

We translate the purpose above into a main research question that we need to answer. This main question is divided into smaller sub-questions which are necessary to solve the problem statement.

Main question: *How do we redesign the tax return process in an enterprise architecture by applying information technologies to improve the tax compliance rate in the Caribbean areas?*

We answer this question by answering the sub-questions that we define below. First, it is important to describe tax compliance in a more scientific context to know what we are specifically dealing with in this research. Also, it is important to get insight in how we influence the tax compliance rate. Below we defined the first two sub-questions.

1. *What is the definition of tax compliance?*
2. *What factors affect the tax compliance?*

Next, we will focus on the IT applications that can improve the influencing factors of tax compliance. The next aspect we need to answer is related to enterprise architecture. We need methods to design and redesign the enterprise architecture for the taxation process in the Caribbean. Now we define the third and fourth sub-questions.

3. *What kind of information technologies do we need to improve tax compliance?*
4. *How do we use an enterprise architecture design for the taxation process?*

Finally, we need to design and redesign the enterprise architecture of the taxation process in the Caribbean. Moreover, we need to evaluate if the design and redesign are valid according to experts in the expertise of taxation processes and enterprise architecture. For these purposes we define the following two sub-questions:

5. *How do we design and redesign enterprise architectures of the current- and improved taxation process in the Caribbean?*
6. *How do experts evaluate our design and redesign of the taxation process to improve the tax compliance by applying information technologies?*

2.7 Research relevance

This research is novel on academic literature. No scientific-based literature exists on how to connect enterprise architecture with tax compliance.

Tax is the largest income for governments. Within tax the most relevant opportunities are in improving the tax compliance rate. By (re-)designing the current enterprise architecture we provide governments structured insights to increase the national tax revenues.

In the Caribbean, information technologies gain a relatively low level of attention compared to more western countries. There is a great opportunity to improve the process of tax compliance by implementing integrated IT solutions within the governmental organizations like the tax authority. This research might provide necessary information to support the opportunities to implement and integrate better IT solutions.

2.8 Research methodology

The problems' context has an information systems (IS) orientation therefore we chose a methodology that fits this field of expertise. After searching for a correct methodology, we find Peffers et al (2007), one of the most cited models in Information Systems design in the field of Design Science Research Methodology (DSRM). Following the methodology (Peffers, Tuunanen, Rothenberger, & Chatterjee, 2007) we use the activities below described in six steps and with the ability to iterate the process. A visual representation of the methodological process can be found in Figure 5. This figure also gives us insight in important iterations that we execute.

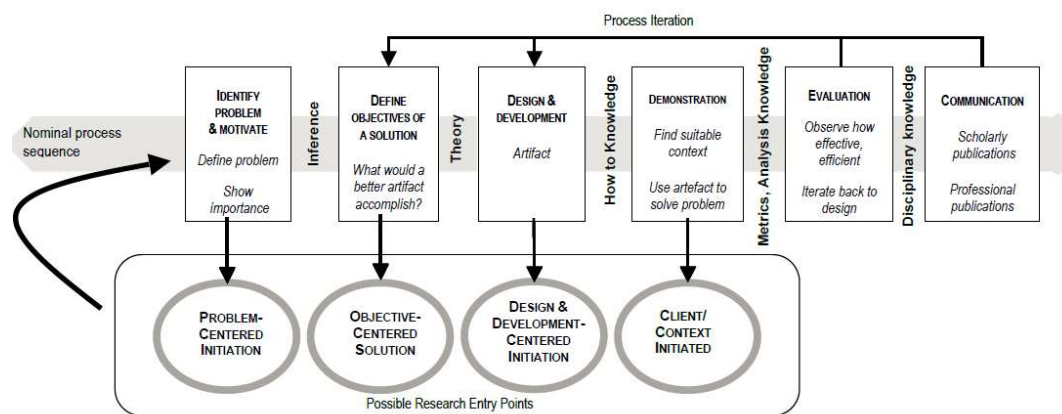


Figure 5: The DSRM iterative process model (Peffers, Tuunanen, Rothenberger, & Chatterjee, 2007)

Step 1: Problem identification and motivation

We identify and motivate the problem in Part I – Research introduction.

Step 2: Defining objective of a solution

We define the objective of our solution in Part I – Research introduction, and Part II – Literature review.

Step 3: Design and development

In we Part III – Designs of enterprise architectures design the enterprise architecture of the current situation. During semi-structured interviews with experts we iterate this step seven times for the current situation, and five times for the improved situation.

Step 4: Demonstration

During our semi-structured interviews with experts we iterate this step ten times for the current situation, and eight times for the improved situation. The results of our demonstration we present in Part III – Designs of enterprise architectures.

Step 5: Evaluation

After our semi-structured interviews with experts we iterate this step ten times for the current situation, and eight times for the improved situation. The results of our evaluation we present in Part III – Designs of enterprise architectures.

Step 6: Communication

The communication of our research we present in this master thesis.

2.9 Research overview

Before we answer the main question, we need to answer the sub-questions. We deal with these sub-questions in the different parts of this research. For a good structure within the framework of answering these questions we separate them to different chapters. In Table 1 we define the sub-questions and we show in which of the chapters we answer the sub-questions.

Table 1: Research overview

Sub-question	Part	Chapter(s)	Research Method
1	II	3	Literature review
2	II	3	Literature review
3	II	2	Literature review and semi-structured interviews with experts
4	II	5	Literature review and semi-structured interviews with experts
5	III	6 and 7	Designing an enterprise architecture and semi-structured interviews with experts
6	III	8	Semi-structured interviews with experts

Part II – Literature review

To answer the first four research questions, we review the literature background related to tax compliance definitions and influencing factors, information technologies and enterprise architecture. In Chapter 3 we start by answering the definition of tax compliance in more detail and we discuss the factors that affect tax compliance. After that, in Chapter 4, we discuss information technologies and how tax authorities use IT to improve the tax compliance rate. Finally, in Chapter 5, we discuss relevant literature about enterprise architectures implications in academic literature to design and redesign the taxation process in Part III – Designs of enterprise architectures.

3. Tax compliance

In this chapter we will first discuss the definition of tax compliance in literature. After that we will define which factors are important in influencing tax compliance from scientific research perspective.

3.1 Definition

In this sub chapter we will gather an answer for our first sub-question: *“What is the definition of tax compliance?”*

Our best definition of tax compliance we can be found in (Franzoni, 2000), which defines that tax compliance for tax returns is related to four rules. The first is that the taxpayer needs to report the exact tax base to the tax authorities. Secondly, the taxpayer needs to compute the correct tax liability. The third rule is that the taxpayer needs to file the tax return on time. Finally, the fourth rule is that the taxpayer pays the correct amount of tax due on time.

In (Randlane, 2016) it can be found that tax compliance is a relatively new scientific research field. Since the beginning of the 1970's the approach focused mainly on an economical cost-benefit view. (Allingham & Sandmo, 1972) found that a taxpayer has two choices, namely declare their income or declare less than their income. Following this view, we define the cost as: the risk that the taxpayer is punished for not paying the correct amount of tax, while the benefit is the amount of unpaid tax that is saved by the taxpayer. From this perspective the choice of being either compliant or noncompliant as a taxpayer is only dependent on the level of enforcement by the government since more enforcement will increase the probability of getting audited and thus being punished for tax evasion.

According to (Randlane, 2016) the perspectives on tax compliance has varied over the years. From the 1990's, the research on tax compliance started to focus more as a behavioural choice that not only depends on the level of enforcement but also on service-oriented aspects. Since 2000 we approach tax compliance in a more trust-related perspective. In Figure 6 we show the timeline of the general scientific view on tax compliance in. This figure visualises the movement from enforced, to more service-oriented and finally to trust-related compliance. Enforced compliance means being forced by the governmental enforcement power, while the voluntary compliance is caused by the level of trust of the taxpayer in the government. In both types of compliance, the governmental services are essential for accomplishing the power- and trust level that is needed to realise tax compliance. During the years these services shifted more from enforcement services to more personal services.

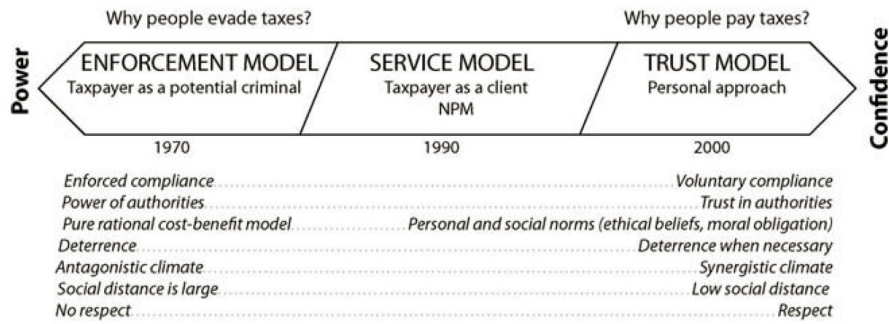


Figure 6: Historical timeline of the scientific view on influencing and improving tax compliance (Kirchler, Hoelzl, & Wahl, 2008).

The concept of power and trust as the two main pillars of tax compliance originates from the slippery slope framework of (Kirchler, Hoelzl, & Wahl, 2008). Power relates to the enforcement by the authorities that influences the level of tax compliance. This consists of all legal actions that a government executes to enforce taxpayers to pay the correct amount of tax on time. This includes laws about tax enforcement and the realised actions that the tax authority executes. The other pillar, trust, relates to the voluntary compliance of taxpayers who have a larger willingness to pay taxes (Prinz, Muehlbacher, & Kirchler, 2014). This voluntary compliance is a result of the services that a government provides to make it more reliable and easier for taxpayers to succeed the tax administration and collection process. An example is that people do not need to wait at the tax office for hours.

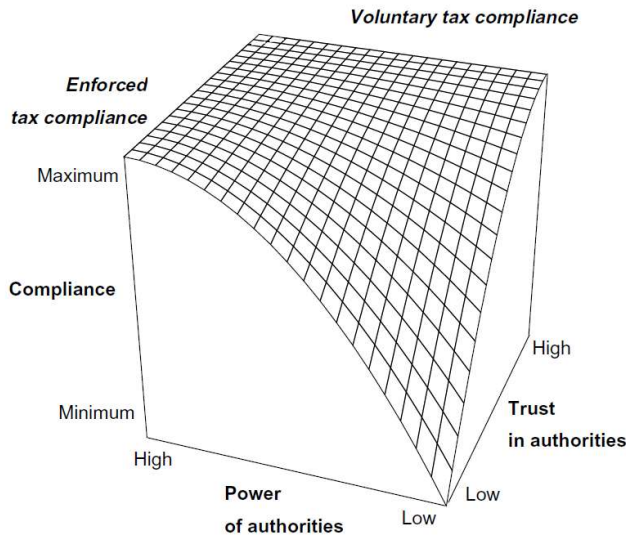


Figure 7: The combination of power and trust according (Kirchler, Hoelzl, & Wahl, 2008).

The slippery slope framework is a framework in which both the power of tax authorities and trust in the tax authorities are relevant dimensions for understanding enforced and voluntary compliance. Dynamic interactions between power and trust are considered. Using the framework as a conceptual tool, the influencing factors that we have studied are reviewed with reference to the power and trust dimensions. The image in Figure 7 gives an overview of the interaction between power and trust.



Figure 8: Relations and causes of tax behaviour (Kirchler, Hoelzl, & Wahl, 2008).

In Figure 8, we also find a distinction in tax non-compliance. With tax noncompliance we mean that taxpayers do not meet the four rules of compliance. We can divide the actions of noncompliant taxpayers into tax avoidance and tax evasion. Below we state two simple definitions of the distinction between these two.

“When the law draws a line, a case is on one side of it or the other, and if on the safe side is none the worse legally that a party has availed himself to the full of what the law permits. When an act is condemned as evasion, what is meant is that it is on the wrong side of the line.” (Bullen vs. Wisconsin, 1916).

According to (Riddle, 1981) the basic difference is *“Tax evasion involves illegality, and avoidance does not. We should note that some forms of tax avoidance are more complex than others, and due to their complex nature, some avoidance schemes may be subjected to scrutiny by the tax department.”*.

In this chapter we have discussed several definitions of tax compliance. First, we distinguished four rules for tax compliance. Furthermore, we have recognised several aspects of tax compliance, such as voluntary and enforced tax compliance, the main pillars trust in- and power of governments, the distinction between compliance and non-compliance, and the difference between tax evasion and tax avoidance.

3.2 Influencing factors

In this paragraph we will answer the sub-question: *What factors do influence the tax compliance?*

In the scientific literature many different articles can be found that mention the influencing factors of tax compliance. A detailed deviation comes from (Marandu, Mbekomize, & Ifezue, 2014). In this review of eighteen scientific articles about tax compliance, a range of variables used for the determination of tax compliance is presented. The variables are divided in 'Attitude', 'Subjective norms', 'Perceived Behavioural control' and 'Others'. We reviewed these variables according our need and we show the influencing factors in Table 2.

Table 2: Variables that influence tax compliance (Marandu, Mbekomize, & Ifezue, 2014)

Influencing factor:	Source:
PERCEPTION OF EQUITY AND FAIRNESS	(Jimenez, 2013)
COGNITIVE PRIMING	(Maciejovsky, Schwarzenberger, & Kirchler, 2012)
Perception of provision of public goods	(Fjeldstad & Semboja, 2001)
TAX KNOWLEDGE	(Palil & Mustapha, 2011)
Expected costs of non-compliance	(Hai & See, 2011)
Unfair treatment of citizens	(Ali, Fjeldstad, & Sjursen, 2014)
Known number of tax evaders	(Sinnasamya, Bidin, & Ismail, 2015)
Unapproved tax preparer influence	(Hai & See, 2011)
Unapproved account preparer influence	(Hai & See, 2011)
LEGAL SANCTIONS (PENALTIES AND FINES)	(Alm, Jackson, & McKee, 1992)
PROBABILITY OF BEING AUDITED	(Alm, Jackson, & McKee, 1992)
The role of tax authority	(Stamatopoulos, Terzakis, & Vrontaki, 2015)
Corrupt government	(Muhrtala & Ogundeji, 2013)
Corporate tax burden	(Allingham & Sandmo, 1972)
Poor working conditions of tax agent	(Sinnasamya, Bidin, & Ismail, 2015)
STRENGTH OF TAX INFORMATION SYSTEM	(Abdoli, Eskandari, & Kalhor, 2015)
Accumulation of tax case	(Ahangar, Bandpey, & Rokny, 2011)
Complexity of tax law	(Ahangar, Bandpey, & Rokny, 2011)
Lack of proper tax culture	(Ahangar, Bandpey, & Rokny, 2011)
Poor enforcement of direct tax law	(Stamatopoulos, Terzakis, & Vrontaki, 2015)
Corruption of tax agents	(Ahangar, Bandpey, & Rokny, 2011)
Tax rate	(Alm, Jackson, & McKee, 1992)
Affiliation to current government	(Damayanti, Sutrisno, Subekti, & Baridwan, 2015)
QUALITY OF SERVICES	(Kamil, 2015)

In Table 2 we distinct the factors that are more relevant for this research which are marked in blue. During expert interviews with employees of BearingPoint Caribbean we chose to improve these factors by using information technologies. We discuss this more extensively in Chapter 4.

We will now discuss the six blue marked factors in more details. We start with the perception of equity and fairness. Jimenez (2013) refers to the perception of equity and fairness the government treats taxpayers of taxpayers. According to (Maciejovsky, Schwarzenberger, & Kirchler, 2012) cognitive priming means the easiness to retrieve tax-related information for taxpayers. The variable tax knowledge refers to the level of tax knowledge that taxpayers apply during the process of tax returns (Palil & Mustapha, 2011). We use the probability of being audited as risk of being audited, which means, according to multiple articles such as (Alm, Jackson, & McKee, 1992) the risk of being caught by the tax authority. The strength of tax information systems refers to the level of strength of the information systems of the tax authorities to process the tax returns and audits (Abdoli, Eskandari, & Kalhor, 2015). Finally, the quality of governmental services relates to the services that the governments provide from the tax authorities and in broader perspective (Kamil, 2015). We will only use the services that the tax authorities provide towards the taxpayers, since that is our focus.

Another approach comes from (Nur-tegin, 2008). We find the influencing factors that cause tax compliance specifically for corporate tax compliance, which payroll tax is part of. In this a distinction is made between traditional determinants and non-traditional determinants. The traditional determinants are audit rate, penalty rate, tax rate and firm size. The non-traditional determinants are equity/fairness, uncertainty, compliance costs, corruption and corporate control.

In order to improve tax compliance, we must improve the factors that influence tax compliance within the governmental organization. Since we focus on software architecture in this improvement we decided to focus on factors that we influence by using advanced software solutions.

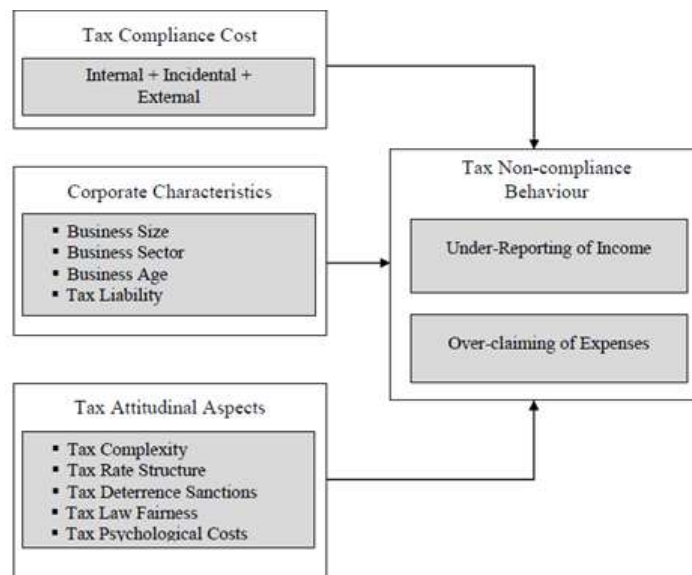


Figure 9: Influencing factors on tax compliance by (Sapiei, Kasipillai, & Eze, 2014)

Another tax compliance model that has more focus on taxation is (Sapiei, Kasipillai, & Eze, 2014). This model is about corporate taxpayers in Malaysia, which we find in Figure 9.

We find that (Engida & Baisa, 2014) has a common approach to specify the variables that are influencing the taxpayers' compliance rate. Figure 10 gives an idea about the influencing factors of tax compliance according to these authors.

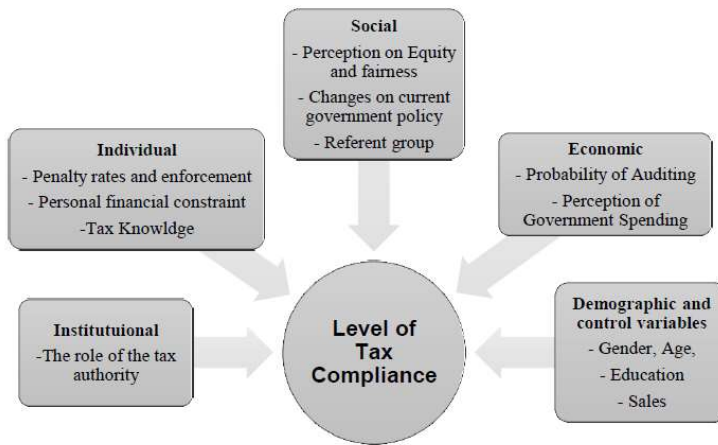


Figure 10 Influencing factors on tax compliance by (Engida & Baisa, 2014)

In this paragraph we discussed the answer on the sub-question: *What factors do influence the tax compliance?* Several factors have been distinguished. However, not all are applicable for our research. Ultimately, we will use the following factors to be incorporated in our Enterprise Architect model:

- Taxpayers' perception of fairness
- Easiness of retrieving tax related information for taxpayers
- Taxpayers' knowledge of tax
- Taxpayers' perception of audit probability
- Strength of tax information systems of the Tax Authority
- Taxpayers' perception of the quality of services provided by the Tax Authority

4. Information technologies

We define information technology as the development, implementation, and maintenance of computer hardware and software systems to organize and communicate information electronically (Random House, 2017). In this chapter we will present various case studies where IT was implemented to improve tax compliance. From these cases we will distil various best practices to research in the redesign of our Enterprise Architecture.

The research of (Dias & Fontana, 2014) about e-filing in Latin America concludes that in the observed countries e-filing exists and differs in the quality of results. This is the largest difference lies within in the usability of the data in the gathered electronical files. A better implementation according to (Edward & Ambrose, 2017) is the use on-line tax filing in which the data is filed with online questionnaire or form. In this method we can transfer the data to a database after which it is easier and more reliable to use than complete electronical documents. Also, Edward & Ambrose (2017) conclude that the tax returns are executed more effective by the tax administer because of the online filing.

The results of (Kotakorpio & Laamanenby, 2016) shows us that an IT solution of prefilled tax returns reduces the administrative costs for the tax authority as well as it reduces the compliance costs for the taxpayers. A drawback that we state is that taxpayers also accept prefilled tax returns to easy and that could have a negative effect on the tax compliance as well. However, the overall conclusion is that prefilled tax returns improve tax compliance.

In 2014, we see further technological service improvements for the taxpayers in China. The Chinese government introduced a mobile tax application. Since then, taxpayers can receive tax information on a timelier and more convenient basis. Tax officials can also use text messaging to offer a range of services such as reminders about upcoming tax deadlines and information on important tax matters. (Brondolo & Zhang, 2016)

In (Boer & Van Engers, 2003) we find the use of knowledge engineering for tax legislation. The first purpose of the research was the to compare multiple tax legislations. However, as we find in the Dutch Tax Authority, the idea of tax knowledge engineering can be implemented in the tax form. This means that the tax regulation is structured and modelled in the (digital) tax form. With this technology taxpayers are not required to know the exact tax legislation, because the legislation is directly applied during filing the tax form.

In (United States Patentnr. US 7,627,504 B2, 2009) we find the United States method of using information systems for storing data regarding tax compliance. In this document we find the need for the use of a single database specially designed to meet the tax compliance and planning needs of the company in all tax jurisdictions. The data must be comparable and for that purpose being standardised using the standard language XML. In this standardised language data is accepted from different systems into the tax authority's database. Standardised XML-format makes the data easily usable for standardised analysing.

In more than ten Caribbean countries the tax authorities of the government use the IT system of SIGTAS. This is an under-performing IT system and it does not collaborate well between the various departments of the government. This collaboration between different governmental organizations and departments is relevant to realize significant improvement in tax compliance. For a successful data exchange between businesses and governmental institutions it is required to have a standardised data-format. (Ulman & Z., 2010)

According to (McKerchar & Evans, 2009) strong risk profiling data needs to be gathered, cleaned and analysed. These data can be used in risk profiles are based upon the characteristics of the taxpayer concerns. Characteristics can be past compliance behaviour, transaction patterns, data matches of third party information, understanding of industry norms, and past behaviour of the tax advisers that the taxpayer uses. In (Abrie & Doussy, 2006) we find that also South Africa uses risk profiling to improve audit effectiveness and decrease tax noncompliance based on data gathering and analysis’.

In this chapter we have presented various case studies where IT was used in order to improve tax compliance. From these studies we have distilled the following best practices:

- The use of online portals for tax filing in which the data is filed with online questionnaires or forms.
- Using prefilled tax returns in which tax authority fills the tax form (partly) for the taxpayer.
- Mobile applications can improve the communication between the tax authority and the taxpayer.
- Tax knowledge engineering can incorporate legislation within the tax filing application.
- Data should be organised in one single data layer, where data should be standardised.
- Data profiling for taxpayers’ noncompliance risks can be used for audit assessment.

5. Enterprise architectures

This chapter is about enterprise architecture. First, we start with the definition. We proceed with the added value that a well-designed EA has for a government and the tax authority and what EA approach the literature provides.

We start by giving three definitions of enterprise/software architecture.

1. *Enterprise architecture management involves tasks that substantially contribute to the operations of an enterprise, and to its sustainable market presence.* (Buckl, et al., 2009)
2. *Enterprise architecture advocates model-based decision-making on enterprise-wide information system issues. To provide decision making support, enterprise architecture models should not only be descriptive but also enable analysis.* (Buschle, Ullberg, Franke, & Sommestad, 2010)
3. *Enterprise architecture is a coherent whole of principles, methods, and models that are used in the design and realization of an enterprise's organizational structure, business processes, information systems, and IT infrastructure.* (Bernaert, Poels, Snoeck, & De Backer, 2015)

The implementation of enterprise architectures improves the tax compliance in a more indirect way. In the work of (Winter & Joachim, 2008) we find that the importance of enterprise architecture is not only understood in corporate IS/IT departments. The broad potential for organizational planning as well as for compliance management, business continuity management, risk management etc. are successively discovered by the business side as well. Especially this compliant management and risk management are in the scope of our research.

In the work of (Jonkers, et al., 2004) we find the importance of behavioural aspects of the layers for enterprise architecture. Other factors that are important to overcome inadequacies in the implementation of an IT program are updating a strategic planning process. Also, the development and implementation of an enterprise architecture is set as a necessary standard for the implementation of the IT program (Getter, 2007).

In Denmark the government also uses enterprise architecture to realize one of their objectives of the modernization program to improve the services of citizens and business. At the same time, we see that EA is used to increase the efficiency of the public administration. (Rønnebæk, 2003).

Part III – Designs of enterprise architectures

In this part we will design and redesign the enterprise architecture of the taxation process in the Caribbean. Interviews are conducted to gather insights from experts in the field of the taxation industry and experts in the field of IT- and enterprise architecture. First, in Chapter 6 we design the enterprise architecture of the current situation in the Caribbean. Secondly, we redesign the current situation according to the literature from the previous chapters and according to the insights from expert interviews in Chapter 7. Third, we validate our results, in Chapter 8, based on expert interviews in the field of tax and EA.

The enterprise architecture that we design, and redesign is for improving tax compliance in the process of tax returns. We use TOGAF ADM (step B and step C) to design a ArchiMate two-layer architecture of the business process and applications. We chose to exclude the technological layer, because it does not add significant value for this research and makes the design unnecessary more complex (Open Groep Standard, 2016).

Moreover, we chose to use the language of ArchiMate, because it is the international accepted architecture language to model a business with service-oriented enterprise architecture. According (Madewell, 2015) the primary use of TOGAF ArchiMate is to assess the impact from the as-in and to-be situation, which in this research is relevant to determine if improvement in tax compliance occurs after implementing the information technologies to the enterprise architecture.

During our design and redesign we applied step B and step C from the TOGAF approach, see Figure 11. First, we only designed the business process of the taxation process in the Caribbean. According to this process flowchart we started with the designing the business layer and the relationship between the business layer. Next, we combined application elements in the design of the business layer and improved the design by adding, changing and deleting actors, relations and other elements. In this part we show the results of our design and redesign of the taxation process in the Caribbean.

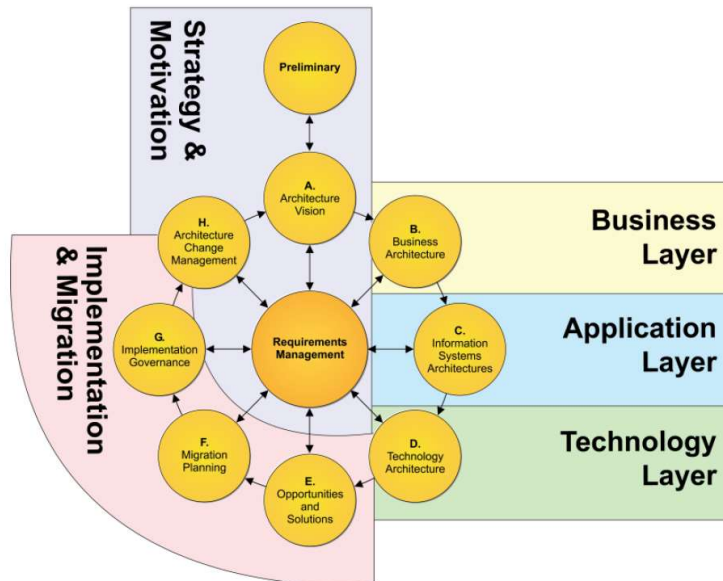


Figure 11: TOGAF method (Open Groep Standard, 2016)

6. Design of current situation

In this chapter we design the current situation. We start with a fishbone diagram to determine what criteria affect the factors that influence the tax compliance. After that we make the causal diagram from the six influencing factors of tax compliance that we choose in Chapter 3. Finally, we design the enterprise architecture of the current situation of the taxation process in the Caribbean.

6.1 Fishbone diagram

We develop the fishbone diagram with the purpose to map cause-effect relation for IT characteristics and the factors that influence tax compliance. We interviewed three experts in the field of taxation according the questionnaire in Appendix A: Questions interviews, Interview 1. Based on these semi-structured interviews we created the Fishbone-diagram in three iterative steps and we see the outcome below in Figure 12.

Earlier during this research, we have six factors that influence tax compliance, which we will define as follow:

- Taxpayers' perception of fairness
- Easiness of retrieving tax related information for taxpayers
- Taxpayers' knowledge of tax
- Taxpayers' perception of audit probability
- Strength of tax information systems of the Tax Authority
- Taxpayers' perception of the quality of services provided by the Tax Authority

We chose to focus on these six of the influencing factors of tax compliance. These factors we need to incorporate in the redesign by implementing information technologies. According to (Sun, Fan, Xin, Xiang, & Chou, 2013) we can characterize IT in the technology characteristics. We narrow our research into accuracy, easiness, accessibility, speed, transparency, effectiveness and efficiency to make it more plausible that we can affect the influencing factors of tax compliance by implementing IT. The influencing factors combined with the IT characteristics results in the cause-effect matrix which can be found in Figure 12.

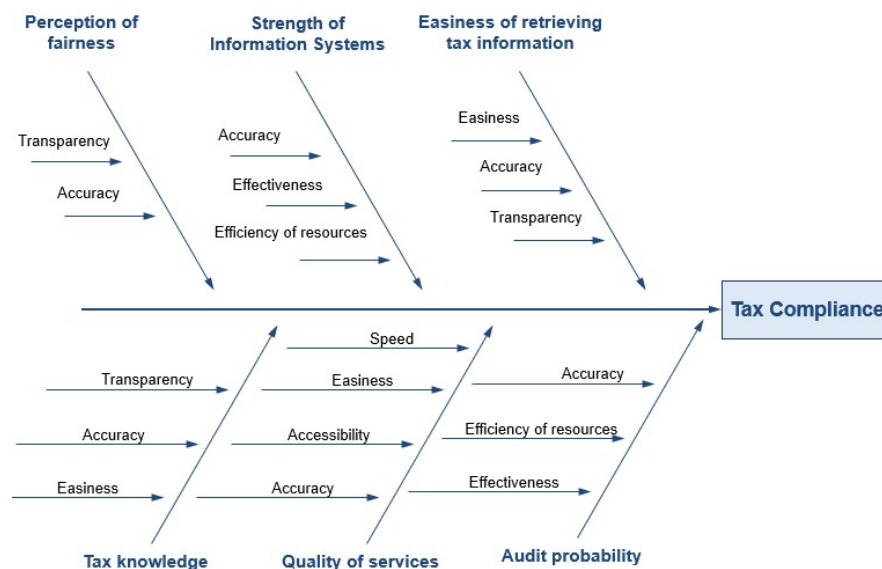


Figure 12: Fishbone diagram to image the causes & effects of tax compliance that we influence by IT (Ilie & Ciocoiu, 2010)

6.2 Causal diagram in enterprise architecture

In Figure 13 we find the most important influence factors that we decide to focus on during our research translated to ArchiMate. These factors have the most impact on compliance and in our enterprise architecture all influencing factors have a positive impact on the tax compliance. In Chapter 8 we discuss all these factors individually regarding the impact of information technologies in the enterprise architecture.

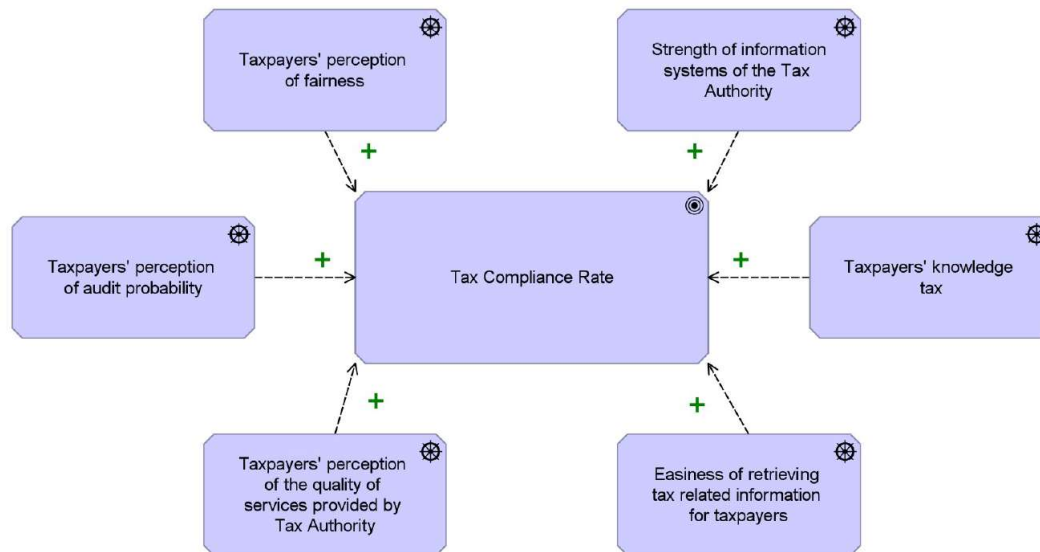


Figure 13: Most important influence factors that are relevant in an enterprise architecture.

6.3 Enterprise architecture current tax return process

In Figure 14 we start with a design of the simplified current architecture, a Caribbean architecture of the tax return process. For designing this enterprise architecture, we interviewed three experts in the field of taxation according the questionnaire in Appendix A: Questions interviews, Interview 2 and Interview 3.

As we see in the design the registration need to be done manually and the trigger is the responsibility of the taxpayer. In any practical situation the taxpayer needs to get a personal registration number by visiting the tax authority in person. After this step the tax authority knows the name of that specific taxpayer, but not which specific tax-type someone has to pay.

In most Caribbean countries it is almost impossible to file tax returns online through an online portal, since in most Caribbean countries an online portal does not exist. The taxpayer still fills the tax forms by hand and hand it over on paper to the tax authority. The tax authorities are still working on processing tax forms of even four or five years ago. This results in many papers and in a long waiting time until taxpayers are certain about the acceptance of the filed tax returns.

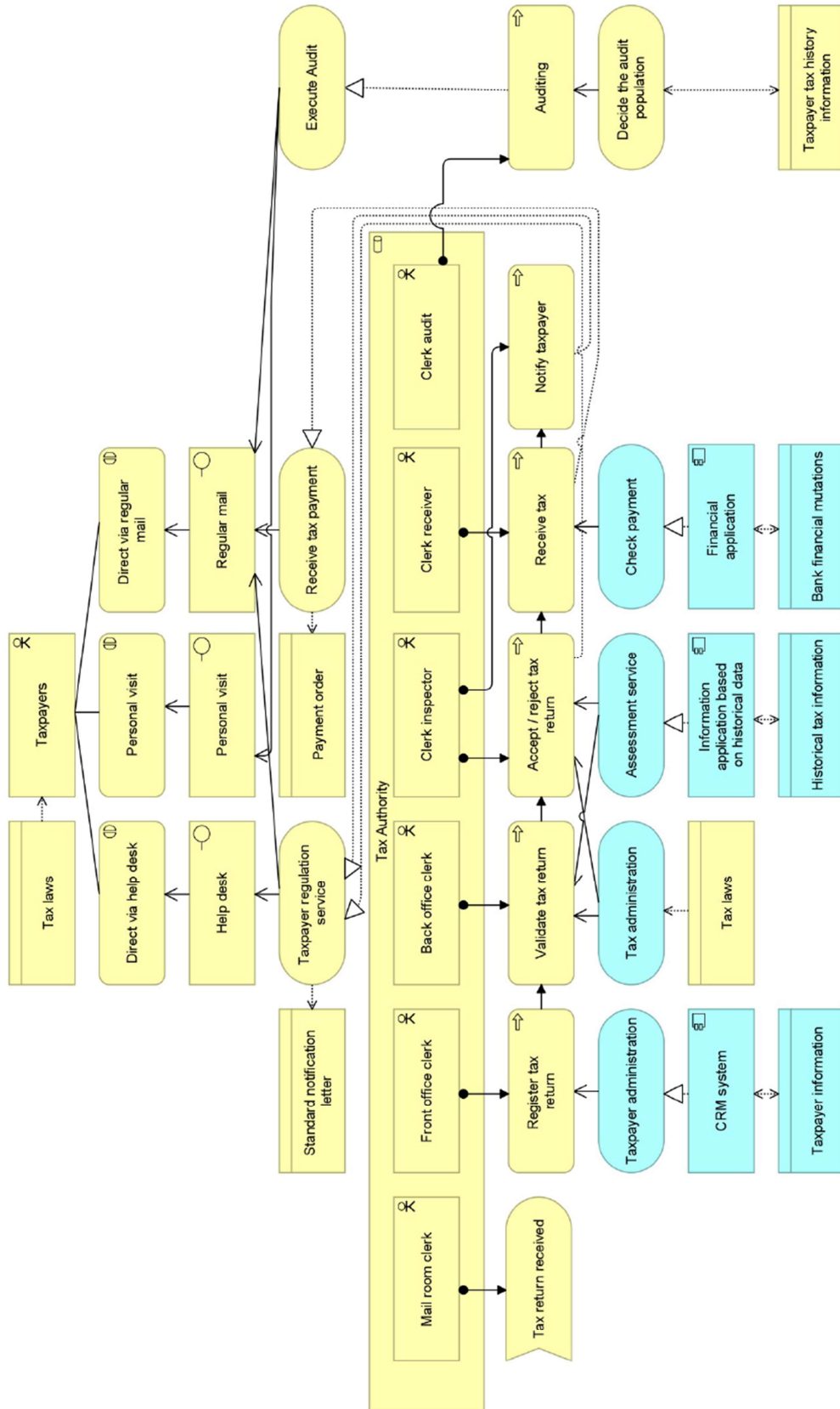


Figure 14: ArchiMate architecture of current Caribbean tax return process

More relevant, we see that all departments use individual databases which do not communicate standardised to each other. The data is not always reliable and in the same format in both databases. This differing data takes time and it is error-sensitive. In practice the communication within different departments is not the best-case scenario as you see in the design.

The government does not really cooperate between tax authority departments and other (governmental) institutions like the chamber of commerce, banks, permit departments, social security and many others. The combination of all these data makes it possible to execute active data analytics to stimulate risk profiling. The next step is to optimise the auditing process by using the risk profiling for detecting possible non-taxpayers or high-risk frauds. During the research we saw manual risk profiling on paper based on only historical tax returns.

7. Redesign of improved situation

In Chapter 6 we showed the design of the current enterprise architecture. Via the combination of this design and our literature we can redesign the enterprise architecture and include the information technologies in the redesign. After completing the first complete redesign we carry out semi-structured interviews with eight experts in the field of taxation and enterprise architecture according the questionnaire in Appendix A: Questions interviews, Interview 4. Earlier on we have distilled various best practices to improve tax compliance:

- The use of online portals for tax filing in which the data is filed with online questionnaires or forms.
- Using prefilled tax returns in which tax authority fills the tax form (partly) for the taxpayer.
- Mobile applications can improve the communication between the tax authority and the taxpayer.
- Tax knowledge engineering can incorporate legislation within the tax filing application.
- Data should be organised in one single data layer, where data should be standardised.
- Data profiling for taxpayers' noncompliance risks can be used for audit assessment.

We try to incorporate these best practices in our redesign. The result of our redesign to improve tax compliance by using information technologies in the taxation process in the Caribbean, we find in Figure 15. In the next chapter we zoom in into a partition of the enterprise architecture to determine if the information technologies have a positive effect on the influencing factors for tax compliance. We also validated the accuracy of the positive effects of the information technologies on the influencing factors during the validation interviews. The results can be find in Chapter 8.

In the redesigned situation we change the separated databases into one overall data-layer. Also, the data are used to fill in a part of a pre-filled tax return. This means that taxpayers need to do less effort to accomplish the filing of a tax return. On the other hand, we use the overall data-layer to build sufficient risk profiling, in combination with data from external parties. External parties are credit funds, banks, insurance undertakings, chamber of commerce, hospitals and many more. We also use data analytics for improving the audits and detection of non-compliant taxpayers.

At the other part of the design we created a web portal and a mobile app. This makes it easier and faster to communicate. In the web portal we built in the pre-filled tax returns and in this pre-filled tax returns we include tax knowledge engineering. The online portal makes it possible to file your tax, pay your tax and to register as a taxpayer online. Taxpayers do not have to wait unnecessary long anymore.

Summarised we add the following information technologies in the design of the enterprise architecture: overall data-layer, prefilled tax returns, online platform, mobile application, social media, risk profiling, tax knowledge engineering and data exchange with other institutions. In the next chapter we discuss per tax compliance influencing factor which of these information technologies has impact on the influencing factor.

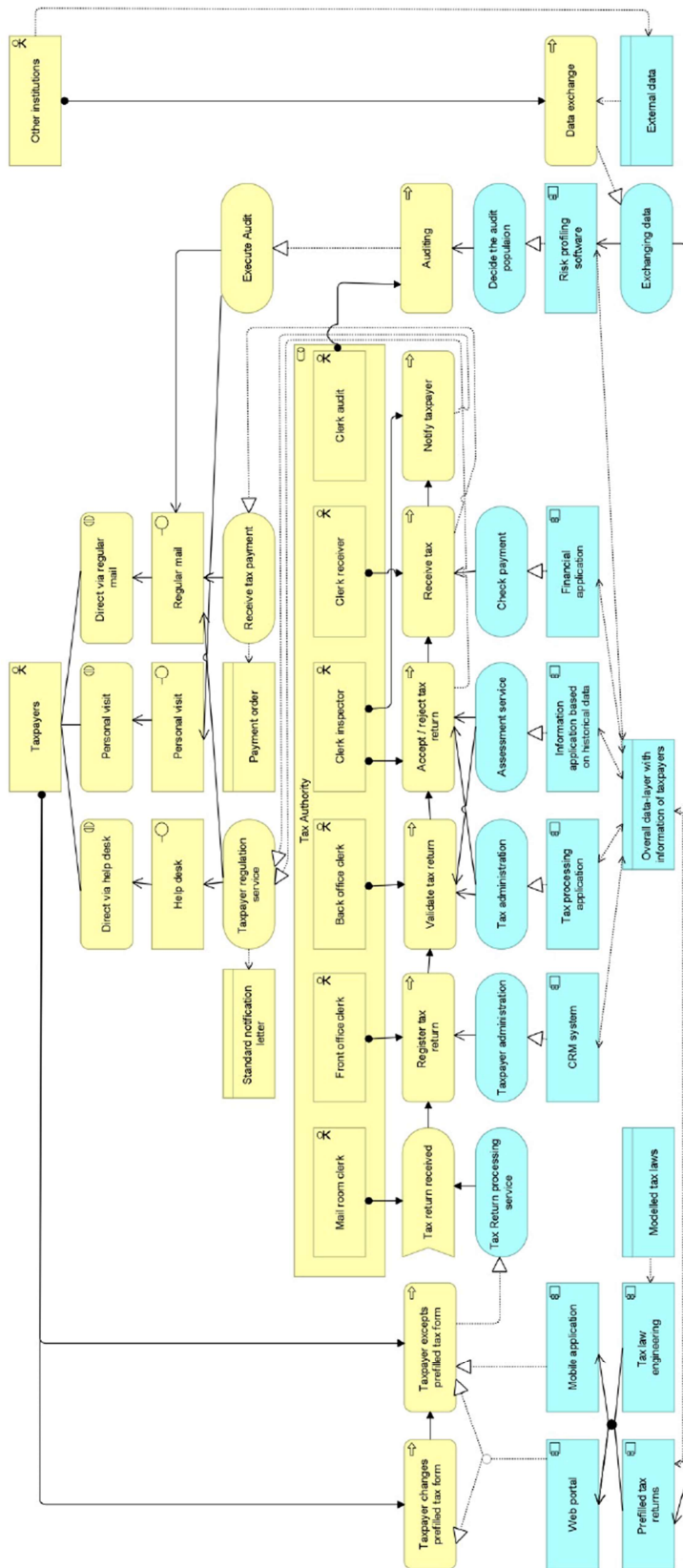


Figure 15: ArchiMate architecture of improved Caribbean tax return process with improvement in tax compliance

In Figure 16 and Figure 17 we show the differences between both design of the current situation and the redesign of the improved situation. This view gives a better understanding of the specific changes in the current design into the improved redesign that improves tax compliance by implementing information technologies.

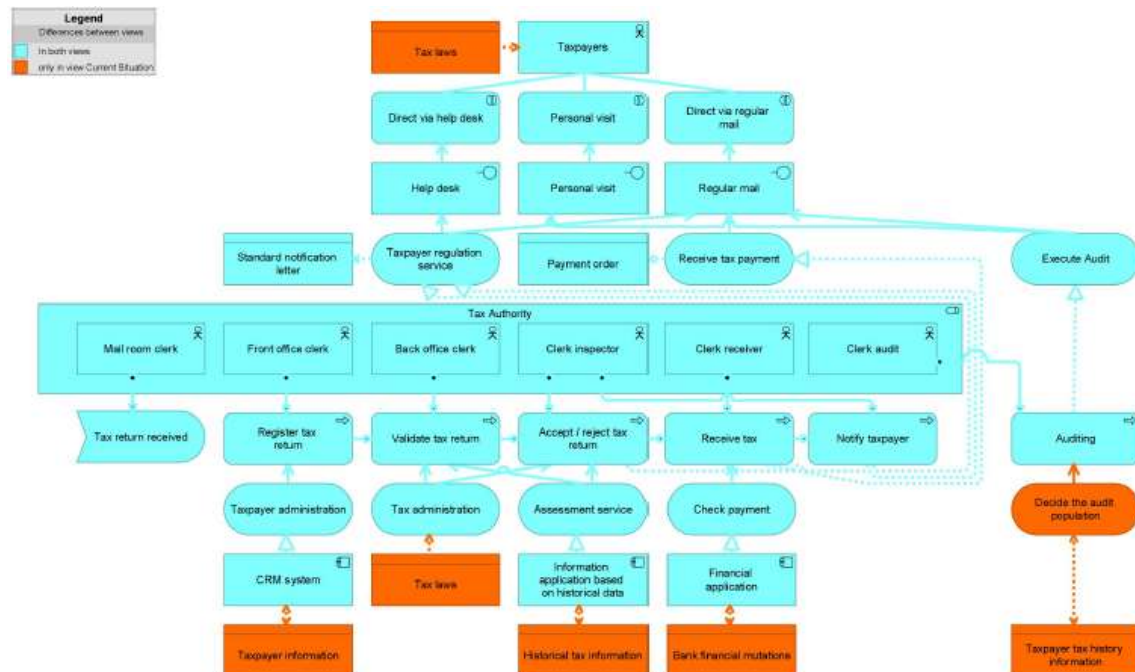


Figure 16: The changes in the design of the current situation into the improved situation

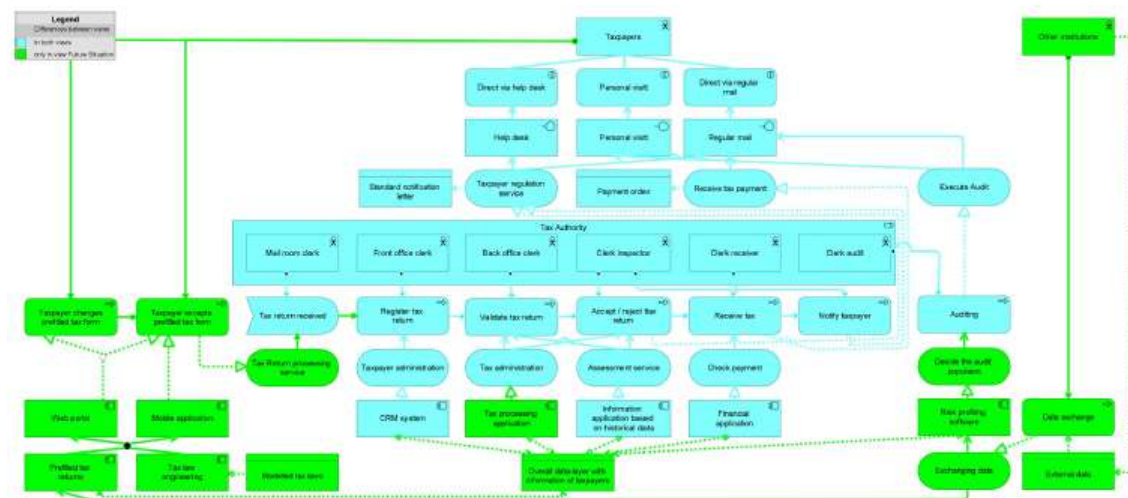


Figure 17: The changes in the redesign of the improved situation compared to the current situation

8. Evaluation of results

In this chapter we describe the evaluation of the redesign that we suggest in the previous chapter. We validate the improvements in the information technology and discuss the effect on tax compliance in the situation of the redesign. During our eight semi-structured validation interviews the experts brought insight in the effects from information technologies on the influencing factors of tax compliance. We discuss the impact of the changing enterprise architecture on audit probability, tax knowledge, quality of services, easiness to retrieve information, perception of fairness, strength of the information systems and finally on tax compliance. All experts declare without any doubts the positive effect from all six chosen individual influencing factors on tax compliance.

8.1 Taxpayers' perception of audit probability

According our model we state that the more sophisticated risk profiling for prioritising the auditing strategy improves the audit probability. During the interviews all experts validated that risk profiling, the overall data-layer, and external data exchange are positively related to the audit probability. In Figure 18 we find the design of this influencing factor in the enterprise architecture.

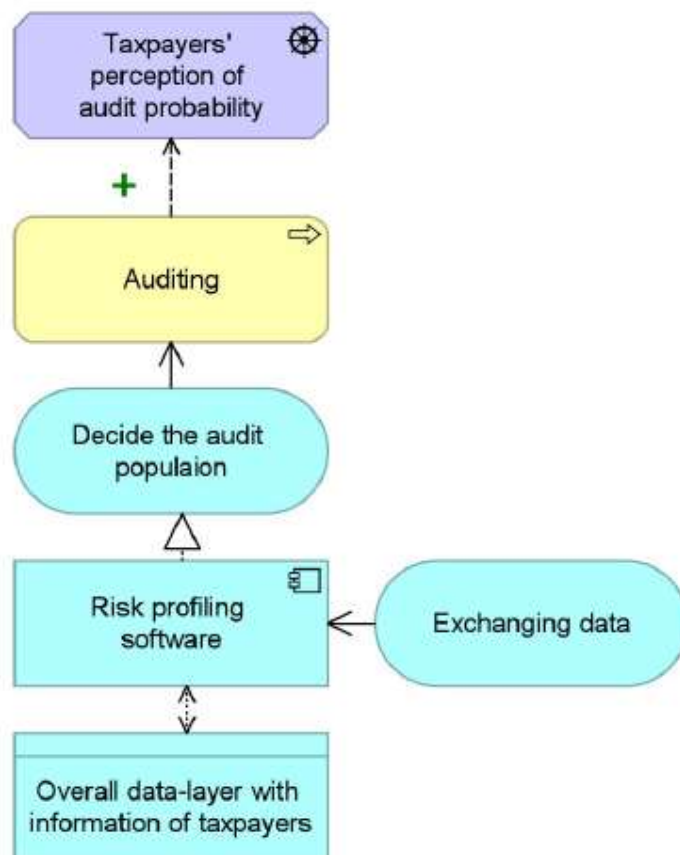


Figure 18: The enterprise architecture that influences the factor 'audit probability'

8.2 Taxpayers' knowledge of tax

For the influencing factor tax knowledge, we find the corresponding enterprise architecture that impacts the tax compliance in Figure 19. During interviews with experts the result on tax knowledge engineering was an eight-out-of-eight score. This means that the implementation of tax knowledge engineering in the (digital) tax form has a positive relation to increase the level tax knowledge and consequently to increase the tax compliance. Only four of the experts agree that the web application could be a very good tool to affect tax knowledge (in combination with tax knowledge engineering).

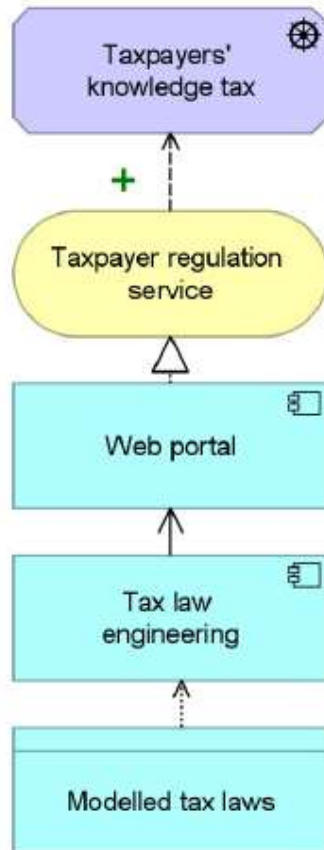


Figure 19: The enterprise architecture that influences the factor 'tax knowledge'

8.3 Taxpayers' perception of the quality of services provided by the Tax Authority

To show the influence of quality of services on tax compliance we show design of the enterprise architecture in Figure 20. We find that a significant influence occurs by using an online platform. Also, the prefilled tax returns. Tax knowledge engineering ranks relatively high according to the interviewed experts. However, the impact of the mobile app related to quality of services is questioned according the interviews.

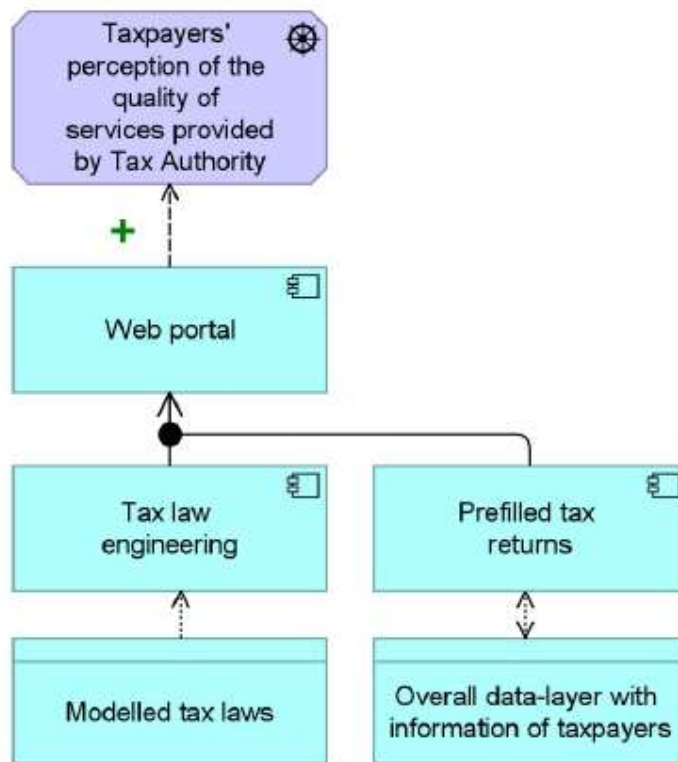


Figure 20: The enterprise architecture that influences the factor 'quality of services'

8.4 Easiness of retrieving tax related information for taxpayers

In another way the easiness to retrieve information is also influenced by a specific enterprise architecture. We find this architecture in Figure 21. According to our interview sessions a large impact is shown from prefilled tax returns and the online platform. As an important basis for both information technologies all the experts value the positive relation with a well-developed overall data-layer and six of them also relate the easiness of retrieving tax related information on the exchange from other external data. This is the first influencing factor, with a good score (five-out-of-eight) for the mobile application. Experts evaluate the mobile application as a fast, easy and accessible channel to accept prefilled tax returns.

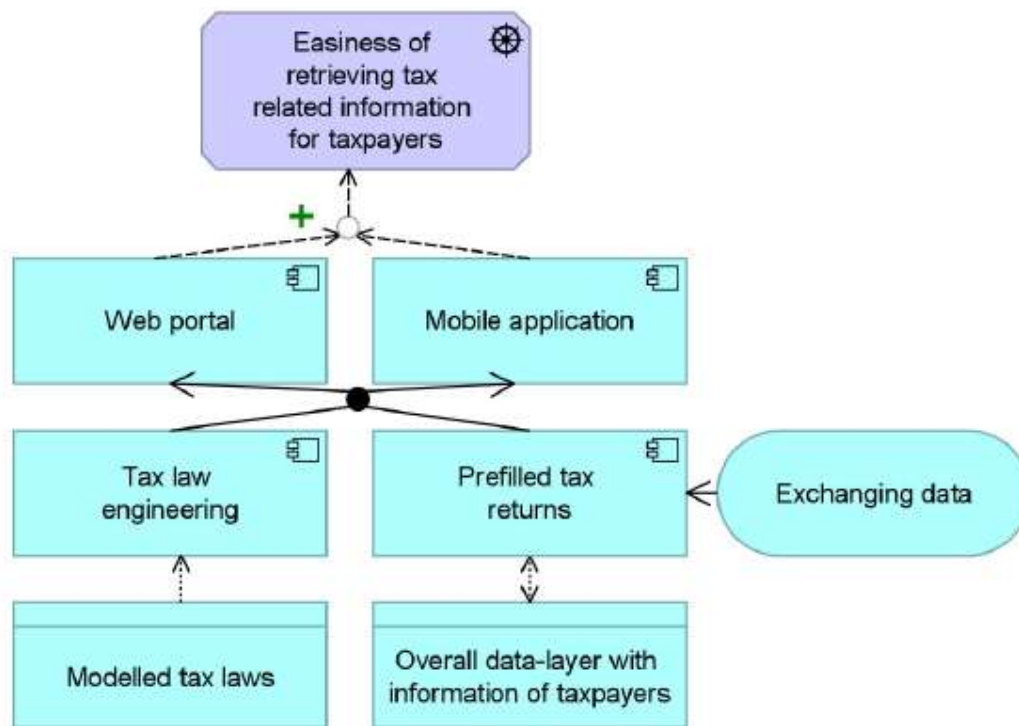


Figure 21: The enterprise architecture that influences the factor 'easiness to retrieve information'

8.5 Taxpayers' perception of fairness

The enterprise architecture of the influence factor 'perception of fairness' is shown in Figure 22. The only information technologies that scores relative high in influence on perception of fairness are the risk profiling in combination with the overall data-layer (both more than half). The other potential interesting IT alternative that scores four-out-of-eight is prefilled tax returns.

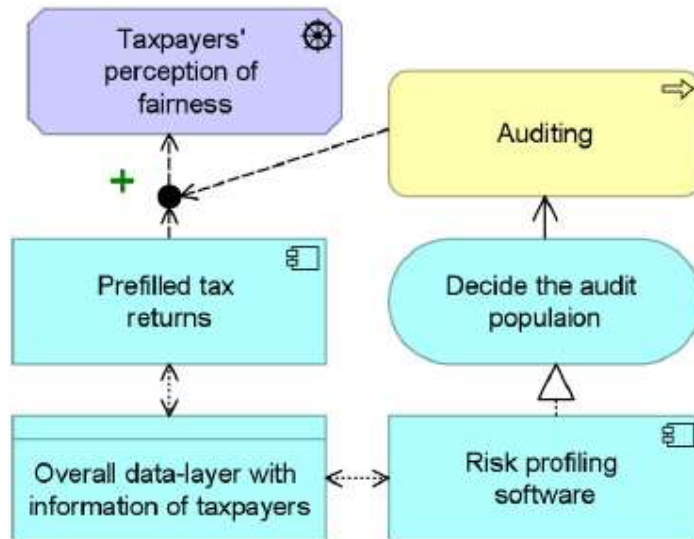


Figure 22: The enterprise architecture that influences the factor 'perception of fairness'

8.6 Strength of tax information systems of the Tax Authority

For the strength of information systems, we show the impact of the enterprise architecture on the specific influence factor. We show this architecture in Figure 23. According to the interviews the most impactful information technology for strength or weakness of information systems are the overall data-layer. This determines if your information system performs well and if all the data-based information technologies are manageable. Another good influence on strength of information systems is the risk profiling solution, which is also based on a well-organised overall data layer. Two other IT applications that score good on this influencing factor are the exchange of external data and prefilled tax returns.

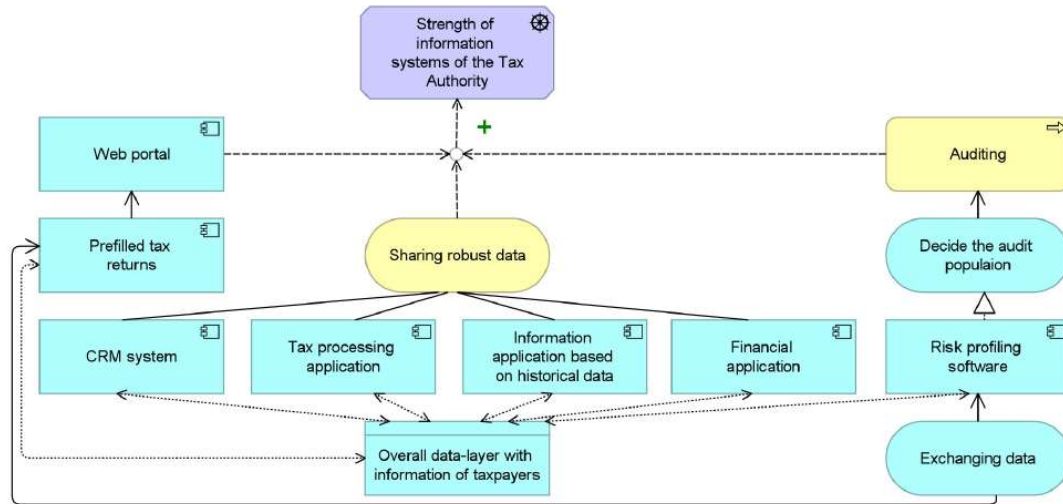


Figure 23: The enterprise architecture that influences the factor 'strength of information systems'

8.7 Results information technologies and influencing factors on tax compliance

We use recursive abstraction for analysing the qualitative data from the interviews. According to (Oun & Bach, 2014) this method of analysing data is slightly different than coding. It is a simple method that is mainly based on summarizing the data in steps. It starts by summarizing a set of data, then summarizing the summarized portion and so on until we end up with a focused and very compact summary that is both accurate and distinct. In (Hershkowitz, Schwarz, & Dreyfus, 2001) recursive abstraction is defined as “The development of abstraction proceeds from analysis, at the initial stage of the abstraction, to synthesis. It ends with a consistent and elaborate final form.”.

In the last step we summarized the data from the interviews to the positive effect of the Information Technologies on tax compliance and all influencing factors of tax compliance according our redesign of the enterprise architecture.

In Table 3 we show the results of the number of experts that mention a positive impact between the proposed information technologies and tax compliance. Furthermore, we show the results of the number of experts that relate a positive impact between the proposed information technologies and the specific influencing factors of tax compliance. The integer score varies from 0 to 8, because we conduct eight expert interviews to validate our redesigns. We take neither negative, nor relative scoring into account. The values are the absolute total of experts that agree with a positive relation between the both aspects.

Table 3: The number of experts that confirm the positive relation between the information technologies on tax compliance and the positive relation between the information technologies on the influencing factors of tax compliance.

Information technology:	Tax compliance	Audit Probability	Tax Knowledge	Quality of Service	Easiness of retrieving tax	Perception of Fairness	Strength of Information Services
Overall data-layer	8	8		7	8	6	7
Prefilled tax returns	7			7	7	4	5
Online platform	7		4	7	6	2	2
Mobile application	5		1	3	5		
Risk profiling	8	8				5	7
Tax knowledge engineering	7		8 ¹	4		1	2
External data exchange	8	8			6		6

¹⁾ This value (8) turns out higher than the value for the information technology (7) because Mr. Logmans' expert opinion about the implementation of tax knowledge means the increase of tax knowledge and decrease the fairness. For that reason, he did not agree with an increasing tax compliance.

Part IV: Discussion and Conclusions

9. Contributions

In this chapter we discuss the contributions of our research.

As stated in paragraph 2.2 the purpose of this research is to design and redesign an enterprise architecture (EA) for the tax return process with the application of Information Technologies to improve the tax compliance in Caribbean countries.

The most important contribution of this research is our redesign of the enterprise architecture that can be used for making decisions related to the implementation of Information Technologies to improve the tax compliance rate in a Caribbean country. In our redesign we clearly find the relation between influencing factors of tax compliance and the application of IT in the taxation process. For Caribbean authorities this results in better insights for strategic decisions related to improving the taxation system in the next years.

Furthermore, the design and redesign can be used as the basis for other research related to enterprise architecture for taxation processes, because the design is a generalized situation of the taxation business process in combination with IT application concepts. Both the business and the application layer design are on high organisational level, which provides a broad perspective on the influence as an organisation without making the taxation process detailed and complex.

The research also contributes in the insights of the relation between Information Technologies and tax compliance, in especially the Caribbean area. Our research provides a clear view on the impact of implementing IT in the Caribbean to improve influencing factors of tax compliance.

Because all conducted interviews confirmed the strong positive impact of one overall data-layer we find strong proof of the realisation of a well-structured overall data-layer has a strong positive impact.

For BearingPoint Caribbean this design and redesign can be used to explain the positive impact of their IT solutions. The design and redesign give a visualization of changes by applying specific Information Technologies in the taxation process. Furthermore, the design and redesign enable BearingPoint Caribbean to explain better what the potential extra gains and costs are of such an implementation.

10. Limitations

In this chapter we discuss the limitations of the results of our research.

Because of using the recursive abstraction method, we find that summarizing the summarized data in iterative steps could lead to the danger of having bad concluded data because of poor initial summarization. This might result in conclusions that are based on inaccurate information. To prevent on this risk, researchers consider having very specified documentation during the summarizing step to define which data are, and which data are not included in the summarized data.

Our research does not consider the technical layer of the enterprise architecture, which is relevant for further implementation of the IT applications. Before starting the implementation phase the technological layer needs to be included in the design and redesign of the Caribbean taxation process. A timeline for the implementation of IT solutions is also not included in this research. Since our research does not focus on the implementation we chose to exclude the timeline as well. However, to achieve the result of improved compliance we need to include a timeline as part in the implementation plan to determines on what term we implement which IT application.

In our redesigned enterprise architecture, we find a positive result on tax compliance by the implementation of proposed Information Technologies. This result is based on the six influencing factors that our research discusses. However, quantitative research need to be commissioned to exclude any potential negative effects on tax compliance among the other influencing factors. Furthermore, quantitative analysis need to be performed to validate the impact of all individual variables that we assess in our research. The correlation between these six (and other) variables are lacking. A well-defined quantitative analysis on the variables gives a more significant insight about the positive effects on tax compliance by implementation the information technologies proposed in this research.

Our current research is useful to determine an occurring improvement in tax compliance due the implementation of the proposed information technologies for the tax authorities in the Caribbean. However, our research does not pay attention to the implementation cost and the specific potential extra revenues that are generated due to the improved tax compliance. To measure the added-value of the implementation of proposed IT applications we need to estimate the total cost of ownership and the total estimated added tax revenues according to the increasing tax compliance.

The results in the Chapter 8 show us a differentiation in expert opinion related to the impact of the proposed IT applications on the different influencing factors of tax compliance. After our eight validation interviews we assume that the IT applications with at least half of the experts that agree on the positive impact are having positive effects on the tax compliance. The reason for this assumption is that during some interviews the experts did not agree with positive influence, because the experts were doubting about the positive impact. Despite we tried to explain exactly what we meant with the IT applications, we see difference in the interpretations of the experts on the implications of several IT applications.

During the validation of the redesign results no validation interviews are conducted in with the tax authorities in the Caribbean, because the Caribbean cannot evaluate the effects of the IT applications that are proposed in the redesigned enterprise architecture. However, from cultural perspective the validation can have other results if validation interviews were conducted with the local tax authorities.

We conducted eight validation interviews to demonstrate and evaluate the value of the redesign. During the last interview no additional changes were shared related to the design and redesign. From this perspective we assumed that the redesign is valid. For stronger validation, more interviews need to be evaluated.

11. Conclusions

In this part we state the conclusions of this research. First, we repeat the main question, which is *“How do we redesign the tax return process in an enterprise architecture by applying information technologies to improve the tax compliance rate in the Caribbean areas?”*. After that we explain our conclusion related to this research question.

To answer our main question, we conclude that we can improve the tax compliance rate by redesigning the application of the IT applications proposed in our enterprise architectures of the tax return process of the Caribbean. We conclude that using TOGAF in combination with the modelling language ArchiMate enables us to design and redesign this enterprise architecture. The combination of both tools provides a structured approach to design the problem definition and redesign it into the new situation with Information Technologies that we proposed in this research. In addition, we conclude that the implementation of all IT applications that we include in our redesign will improve tax compliance in the Caribbean.

Our conclusion regarding the definition of tax compliance is that tax compliance for tax returns is related to the following four rules:

- The taxpayer needs to report the exact tax base to the tax authorities.
- The taxpayer needs to compute the correct tax liability.
- The taxpayer needs to file the tax return on time.
- The taxpayer pays the correct amount of tax due on time.

From the two main pillars, which are the power (enforced compliance) and trust (voluntary compliance) we conclude that the most impact in our research results from the voluntary compliance. This impact we conduct from the impact of the IT applications like risk profiling that have a large impact on audit probability as in fairness. Although risk profiling seems to be directly related to enforcement we also find a strong influence from risk profiling on voluntary compliance factors as fairness.

To sum up, the most important factors that influence tax compliance in our research, and which are improvable by IT applications, are perception of fairness, perception of audit probability, strength of IS systems, easiness of retrieving tax information, taxpayers' tax knowledge, and quality of services. In all six factors we conclude that the potential opportunity exists to increase the tax compliance by using the proposed IT solutions.

Furthermore, we conclude that especially implementing a well-structured overall data-layer, that exchanges both internal and external data in a uniform structure, results in increasing tax compliance. The application of the overall data-layer results in an improvement in perception of audit probability, strength of information systems, easiness of retrieving tax related data, quality of services, and perception of fairness. In combination with this overall data-layer applying a well-structured risk profiling system to terminate audits has a positive impact on tax compliance. Furthermore, we conclude that the implementation of prefilled tax returns, an online portal, mobile application, and tax knowledge engineering also have a positive impact on tax compliance.

Furthermore, we conclude that using the first two steps of TOGAF ADM is an effective approach to create the enterprise architecture to design the current and improved situation for the taxation process in the Caribbean area. The approach gives good insight about improvements in the tax compliance and contributes a structured approach to iterate the design and redesign steps for our enterprise architecture with a business and application layer. In combination with TOGAF, we conclude that using ArchiMate as the standard modelling language to translate the business, applications and relations to the design and redesign contribute effective in this approach. It provides all the relations and actors that are necessary in the Caribbean taxation service process.

As result of our eight expert interviews we conclude that our design and redesign provide a well-modelled visualisation with the relevant elements in an enterprise architecture of the taxation process of the Caribbean. The designs of our enterprise architecture are a good approach to validate this improvement by conducting interviews with experts in the field taxation and enterprise architecture. Implementing these IT applications will result in an improved tax compliance rate. We finalize our conclusion with the statement that implementing all proposed IT application in our research contribute to improving the tax compliance rate.

12. Recommendations and Future research

In this part we provide recommendations related to our research.

As our conclusions suggest the implementation of the information technologies have a positive effect on the tax compliance. We recommend start estimating the total cost of ownership and the further progress in the quantitative estimation model for extra tax revenues due to the improvement of tax compliance.

Before starting the implementation, we recommend doing technological research which is relevant for the technological function and coherence between all the application services and business processes.

As result of this research the first implementation would start with designing an overall data-layer. This implementation has positive effects on almost all the other proposed IT applications. We suggest that the tax authorities in the Caribbean start with creating a uniform structure of an overall data-layer. Among institutions, organisations and countries a standard in data-format is a good starting point.

We recommend doing further research on the impact of tax compliance by all variables that influence tax compliance. We recommend developing and validate a quantitative correlation model between all influencing factors. This correlation model need to be based on quantitative data among the countries that are in the interest of this improvement in tax compliance.

In addition to the previous recommendation we suggest doing further research on the quantitative effects from all influencing factors on tax compliance and what type of mathematical relation exists per influencing factors, other influencing factors and tax compliance. Despite of the huge number of different influencing factors on tax compliance and the diversity in these factors, the added value is huge by realising just a piece of the impact in better tax compliance strategies for all tax authorities in the world.

Finally, we also recommend researching the opportunities and threats in regulation of the country before starting with developing and implementing solutions based on this research. Especially related to an overall data layer and data exchange we can think about restrictions according local laws.

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Appendix A: Questions interviews

Interview 1: Causes & Effect

1. What are the most elementary causes for being compliant for a taxpayer?
2. What are the effect on tax compliance of being more transparent as a government/tax authority?
3. What are the effect on tax compliance of operating more accurate as a government/tax authority?
4. What are the effect on tax compliance of working more effective as a government/tax authority?
5. What are the effect on tax compliance of working more efficient as a government/tax authority?
6. What are the effect on tax compliance of making it easier for a taxpayer?
7. What are the effect on tax compliance of making it more accessible for a taxpayer?
8. What other factors do affect these elementary causes to become more compliant?
9. What is the effect that these other factors have as a government/tax authority?
10. What is the effect that these other factors have for a taxpayer?

Interview 2: Service process analysis

1. How about the difference between the process of a tax return and tax assessment?
2. A. Can we see the taxation process as a three-phase process with:
 - a. Tax registration & administration
 - b. Tax levy
 - c. Tax collectionB. If not, what phase do we miss in this context?
3. How do you describe these phases in generalised details?
4. Which actors play a relevant role during the taxation process?
5. Which start events occur in the process?
6. Which end events occur in the process?
7. Which decisions need to be made to come from the beginning to the end of the process?
8. Which alternatives are available to come from the beginning to the end of the process?
9. How about exceptions that occur in the taxation process?
10. How important is the effect of the exceptions on the impact of the taxation process?

Interview 3: Enterprise architecture analysis

1. Do you agree with our flowchart of the tax return process in general?
2. How do we transform this flowchart to a ArchiMate architecture with a TOGAF business and application layer?
3. How do we specify this in the current situation of the Caribbean?
4. What is the business process they use on the Caribbean?
5. How do the business processes interfere with other business applications?
6. What applications do they use on the Caribbean?
7. How do these applications interfere with the business process?
8. How do these applications interfere with the other applications?

Interview 4: Enterprise architecture validation

1. Do you agree that the current architecture is a good representation of a tax return process (in the Caribbean)?
2. What do you suggest changing in the architecture to improve the representation?

Next questions:

1. Do you think that an overall database and data exchange as shown in the architecture improves the tax compliance?
2. Do you think that the use of prefilled tax returns as shown in the architecture improves the tax compliance?
3. Do you think that the use of an online platform for filling in tax returns as shown in the architecture improves the tax compliance?
4. Do you think that the use of a mobile application for filling in tax returns as shown in the architecture improves the tax compliance?
5. Do you think that the use of data from Social Media as shown in the architecture improves the tax compliance?
6. Do you think that auditing based on risk profiling by using a huge combined database as shown in the architecture improves the tax compliance?
7. Do you think that engineering tax knowledge in the tax forms as shown in the architecture improves the tax compliance?
8. Do you think that data exchange from other organisations/institutions as shown in the architecture improves the tax compliance?
9. Do you think that automating the process of informing taxpayers as shown in the architecture improves the tax compliance?
10. Do you think that automating the process of registering taxpayers as shown in the architecture improves the tax compliance?

The Influence Matrix (fill in the relation: -/0/+)

Information technology:	AP	TK	QOS	ETRI	POF	SIS
Overall data-layer						
Prefilled tax returns						
Online platform						
Mobile application						
Social Media						
Risk profiling						
Tax knowledge engineering						
Data exchange other institutions						

Questions regarding the enterprise architectures per figure (Figure 18 until Figure 23).

1. Do you agree on the visualization of this figure?
2. Do you agree on the impact of the enterprise architecture on the specific influence factor?
3. Do you agree on the positive impact of the influence factor on tax compliance?
4. Do you agree on the positive impact of this enterprise architecture on tax compliance?
5. What do you think need to be changed in the enterprise architecture to improve the solution or the representation of the solution design?

Appendix B: Interviews

Situation interviews:

Situation interview 1: Menno Vinck (no audio)

(Country Leader Aruba – BearingPoint Caribbean - Aruba)

Situation interview 2: Shadyra Francisca (no audio)

(Country Leader St. Martin – BearingPoint Caribbean – St. Maarten)

Situation interview 3: Ingeborg Boswinkel (audio file 1)

(Product Owner – BearingPoint Caribbean - Curacao)

Situation interview 4: Ben de Kruijf (audio file 2)

(Country Leader Bonaire – BearingPoint Caribbean - Bonaire)

Validation interviews:

Validation interview 1: Ben van Sermond (audio file 3 and 4)

(IT architect in-charge – Dutch Tax Authority))

Validation interview 2: Robbert Jan van Meenen (audio file 5)

(Lead architect – Dutch Tax Authority))

Validation interview 3: Berend de Boer (audio file 6)

(Manager / IT system architect – Dutch Tax Authority))

Validation interview 4: Hugo Logmans (audio file 7)

(Owner – Logmans & Beugelink IT services VOF)

Validation interview 5: Ramzi Barkoudah (audio file 8)

(Senior project manager toelagen – Dutch Tax Authority))

Validation interview 6: Diederik Dulfer (audio file 9)

(Architect business rules management – Tax and Customs Administrations)

Validation interview 7: Ben Malawau (audio file 10)

(Business architect – Dutch Tax Authority)

Validation interview 8: Jaap de Hoog (audio file 11)

(ICT adviser and information management – Dutch Tax Authority)