Urban-Scale Material Flow Analysis in a South African Context

A Cape Town Feasibility Study

By

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Minor Dissertation
presented in partial fulfilment of the requirements for the degree of
Master of Philosophy

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University of Cape Town
May 2015
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The financial assistance of the National Research Foundation (NRF) towards this research is hereby acknowledged. Opinions expressed and conclusions arrived at, are those of the author and are not necessarily to be attributed to the NRF.

Plagiarism Declaration

I know the meaning of plagiarism and declare that all of the work in the dissertation, save for that which is properly acknowledged, is my own.

Feb 23, 2015

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Abstract

Urban-scale Material Flow Analyses (MFAs) in the global south provide unique challenges compared to national MFAs and to urban MFAs in the north. In order to determine the feasibility of undertaking an urban-scale MFA in the global south, this dissertation sets out to undertake an MFA on Cape Town, and thoroughly analyze the data collection process, document the challenges, and interpret data quantity and quality.

Data were found for nearly all flows defined in the Eurostat methodology, but only for the most recent of three consecutive years under study. Data quality is challenged by high variance in reliability of sources, difficulty in obtaining documents, additional work required to process the data, lack of data on informal or illegal flows, and the scattered distribution of sources.

Data collection took 345 hours during a period of 22 weeks and involved interaction with a total of 325 contacts and 86 documents. The principal activities were related to contacting and interacting with people. Most time was spent on e-mailing and meeting people, and significant time was furthermore spent on transportation to and from meetings. Not all time was spent effectively and efficiently. Chasing unreliable data and unproductive cross-checking were the principal culprits.

Despite the challenges, the quantity and quality of data are of a sufficient level to provide interesting insights into the urban metabolism for Cape Town, and undertaking this kind of urban-scale MFA is thus deemed feasible.

Once a time-consuming, initial MFA has identified valuable and reliable sources, periodic repetition should be relatively uncomplicated. Through government involvement or industry cooperation, data collection and data sharing with a few key stakeholders can make regular urban MFA reporting a feasible reality. This work shows who those key stakeholders are and how researchers and government can undertake and improve future urban MFA studies - not only on Cape Town but also on other regions and cities in South Africa.

This MFA feasibility study furthermore provided useful insight into the metabolism of Cape Town. For 2013, local extraction was 1.53 t per capita, mostly consisting of non-metallic minerals mined within the borders of Cape Town. Wild fish catch is half of the biomass extraction. Imports and exports were 4.04 t and 2.15 t per capita, respectively, with food and fossil fuels weighing heavily on the imports. The exports are dominated by processed foods and products from the manufacturing industry. Emissions to air can be contrasted with the results from Gasson (2007). Significant per-capita emission increases are seen for CO_2, coupled with decreases for most other emissions to air. Compared to other Eurostat-based urban studies on cities in Western Europe, Cape Town resource flows are significantly lower on a per-capita basis.

Acknowledgements

While working on the undertaking of a Material Flow Analysis, my life has revolved around reading, interpreting, and producing spreadsheets, tables, and databases. In an attempt to explain what I have been doing in a simple one-liner, I often say "I basically try to make one big spreadsheet with numbers about materials". It therefore only seems appropriate to summarize my gratitude in the form of a table.

Who?	**Why?**	**Details**
Harro von Blottnitz	Guidance and supervision.	Harro's guidance was always a nudge and never a push. But these nudges in the right direction made a great impact. Harro's dedication was inspiring and hugely appreciated.
Fran	Motivation, inspiration and support.	Motivation and inspiration for this journey - and many others - came from my accomplice and companion. There is no greater relief than knowing I can always turn to Fran for support.
Ellie	Unquestionable loyalty.	Ellie was always there for me.
325 contacts	Time, patience, and data.	Assistance ranged from a quick e-mail to hour-long meetings, and from on-site tours to going the extra mile, just so that I could get a step closer in finding data. This work would only have been marginally interesting if it were not for the time, effort, and patience provided by so many contacts. I am hugely grateful to all contacts for making my quest for data interesting, entertaining, and productive.
NRF	Funding.	The National Research Foundation helped fund this research.

Chapter 1

Introduction

In today's world, the interconnectedness between regions can be observed on different levels. Countries depend on other countries for inputs like food or fossil fuels, while others import processed products rather than raw materials. Similarly, cities often depend on a more productive hinterland to facilitate material resources. In order to understand the level of sustainability of a system (for instance, a country or a city), it is therefore of great importance to take a holistic approach.

Understanding the environmental implications of extraction, production, consumption, and disposal can only be achieved by applying standardized and economy-wide studies in all of the related regions (Weisz and Schandl 2008). Metabolic studies like Material Flow Analyses are a useful tool for this purpose. However, application of such tools is currently not done systematically on a regional scale nor in many developing countries. For this to change, current challenges should be better understood and overcome.

Material Flow Analysis (MFA) is an evaluation method which assesses the efficiency of use of physical materials as inputs, building blocks, or outputs within a system (Eurostat 2002). Three different material users are defined in MFA: the human population, built environment, and livestock and other domestic animals.

Through analysis of consumption profiles, waste and emission data, and export statistics, MFA can provide information about amounts and kinds of physical flows through socioeconomic systems (Fischer-Kowalski *et al.* 2011). The results of an MFA can be checked by comparing inputs, stocks, and outputs of processes, which makes it an attractive tool in decision making (Brunner and Rechberger 2004). Studies can be used to generate sustainability indicators, as inputs to greenhouse gas accounting, to develop dynamic mathematical models for policy analysis, or to develop urban design tools (Kennedy *et al.* 2011). More recently, MFA has been recognized as a useful tool to decide on specific steps to take in order to achieve decoupling of economic growth and resource use (UNEP 2013).

There has been a growing interest in applying MFAs on an urban scale. This is done using adjustments to methods created for nationwide studies. Most prominent in this regards, in studies to date, are urban variations of the Eurostat (2001) method. Since studies have focused mostly on cities in OECD countries (Kennedy *et al.* 2011), there is much to be gained from applying urban

scale MFAs in other parts of the world.

1.1 Problem Statement

Researchers undertaking MFA studies on a regional level in OECD countries already face a set of challenges around the collection of data (Robinson *et al.* 2013; Hammer *et al.* 2003a, p. 43).

In the context of a rapidly growing urban population and increasing wealth in developing countries, challenges to urban sustainability are particularly important in these regions. There are both opportunities as well as challenges for urban metabolism in this context (Ferrão and Fernández 2013). To better inform city governments in shaping their policies around resource management, more urban metablism studies should be undertaken in developing countries.

In order for MFA studies to become more commonplace in cities located in developing countries, it is useful to better understand the specific challenges that are faced when undertaking these studies.

1.2 Aims & Objectives

My research attempts to provide more insights into the process of undertaking an urban scale MFA study in South Africa. This case study attempts to identify the challenges that exist and to propose ways in which these challenges can be overcome. By shifting the focus from the outcome of an MFA (the data and indicators) to the process (time investment breakdown, fruitful and unfruitful approaches, principal hurdles, and data quality), future MFA researchers are hopefully provided with a useful guide to better understand and prepare for these kinds of studies.

The research question of my study is thus the following:

What are the challenges to applying an Economy-Wide Material Flow Analysis (EW-MFA) in a South African urban context, and how can these challenges be overcome?

There are three principal objectives:

- To gain an understanding of different tasks involved, and their effectiveness and efficiency in the process.
- To identify the main challenges of performing such an MFA in an urban context.
- To provide suggestions on how challenges can be overcome

This dissertation aims to achieve these three objectives by attempting to perform an urban-scale MFA in South Africa based on the Eurostat method.

1.3 Limitations

In an ideal scenario this work is a truly representative case study and can be predictably reproduced in other cities in South Africa and beyond. However, in reality this work has several limitations that impact representativeness and ease of reproduction. While I would encourage others to undertake

related research in other (South African) cities based on my findings, it is important to take into account several factors. In this section personal limitations that affected the study are discussed first, followed by more methodological limitations of this work.

Due to its heritage of racial segregation during the years of apartheid, inequality based on race and gender strongly persist in South African society. It is therefore important to acknowledge the fact that I am a white male operating in such an environment. My fieldwork has mostly been concerned with access to data, which translates to access to information, people, and organizations. To which degree race and gender affected my fieldwork is hard to say, but it is not unlikely that I have at times had easier or better access to people because of it. It is also possible that my lack of speaking other languages than English or the fact that I am not originally from South Africa negatively affected access to people.

Another factor that may have affected access to people and information comes from the strong position of the University of Cape Town as an academic institution in the city. Not only was it very easy for me to contact a variety of lecturers and professors at the university, but these contacts also gave me easier access to government and even private companies. The vast network of contacts that my supervisor has is another component to be taken into account when replicating this kind of research. Several times people and other organizations went out of their way because of the role my supervisor has had in their project, which hugely facilitated the data collection process.

These factors could have benefited or at times limited my research and should be taken into account if this kind of work is undertaken in other cities. However, by carefully documenting how I obtained information, I attempt to provide others with sufficient insights into my data collection process, which should enable fellow researchers to gauge which factors may or may not affect their work.

One final limitation of a more methodological nature is the fact that Cape Town is a unique city and possibly not representative for other cities in the country. It is one of the largest cities in South Africa, which poses benefits (many people work for the city, more budget is available for gathering statistical data, lots of research done on the city, etc.), but also drawbacks (difficulties getting hold of people, lots of time spent on transportation, very large number of companies operating in the area). Again I have tried to be very detailed in my overview of activities and sources, and I have also commented on the likelihood of existence (or lack of) sources in other South African cities. Others should not consider my work a perfect template for their own city, but rather a sufficiently detailed piece of work that can be used to predict how this work would play out in their city.

1.4 Structure

This work revolves around the data collection process and challenges encountered while undertaking an MFA. The actual outcome of the MFA is less important, but very interesting nonetheless. In order to separate the work related to undertaking the MFA from the work related to analyzing the MFA, several chapters have been split into two versions. The methodology and results chapters feature one version that relates to the actual MFA, and another version that describes the analysis of the challenges.

The chapters can be read in the same order as they appear in this document, but it is also possible to first read the chapters on the MFA, and then the chapters on the challenges. Even though understanding the challenges is considered more important, the MFA chapters come first because

they are a logical predecessor (first I describe what is being researched, and then I describe the challenges that were encountered during this research).

The following conventions are used to decide how to separate information between these two parts.

MFA: this part is concerned with obtaining the **numbers on material flows**. It is only concerned with the outcome of the Material Flow Analysis itself. It includes reporting on the quality of the numbers, calculating the relevant indicators and other ratios, and contrasting these numbers with other MFA studies.

Understanding challenges: this part includes all information about **understanding the process and related challenges**. It is in no way concerned with the actual numbers, but rather analyzes how these numbers were obtained, how easy this was, and what kind of activities were involved in the data gathering process.

Chapter 2: Literature Review The literature review provides an academic background to this work. This chapter details how MFAs fit in to the larger group of metabolism studies, and how these studies have evolved over time. The Eurostat framework is explained, and seminal studies are described. Special attention is given to other urban and regional studies that have been undertaken throughout the world.

Chapter 3: Methods (MFA) This chapter provides more details on the Eurostat methodology and the adaptations that had to be made to make it work for this Cape Town study.

Chapter 4: Methods (Understanding challenges) This chapter explains the kind of data that were collected and how data quality was assessed. Custom-made software was created for this purpose, and this chapter provides more information on how this fits in with the research.

Chapter 5: Results (MFA) The final numbers that were obtained are presented, and the relevant indicators are calculated. Industry profiles accompany the data and describe the metabolic profiles of principal industries present in Cape Town.

Chapter 6: Results (Understanding challenges) This results chapter provides insights into the challenges. It features a breakdown of time spent on different activities, as well as an analysis of the data quality and the principal hurdles encountered.

Chapter 7: Conclusion Final conclusion and recommendations.

Chapter 1	**Introduction**	
Chapter 2	**Literature Review**	
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Chapter 7	**Conclusion**	

1.5 Writing Style

I have chosen to write this dissertation using a first-person perspective. By using "I" rather than "the author", I feel that this work becomes less anonymous and more personal in nature, which I believe is appropriate for such a personal research project. While perhaps uncommon in past decades, using a first-person narrative has become a more common habit in recent times in the field of industrial ecology.

Due to my own background, this dissertation is furthermore written in American English (with the exception of any verbatim quotations which are reproduced in their original spelling). Although this is slightly different from South African English used normally at the University of Cape Town, most journals and research publications in the field of industrial ecology are published in American English and language use in this dissertation is therefore in line with these bodies of research.

Chapter 2

Literature Review

2.1 Introduction

This review analyzes the emergence of MFA. Related tools and concepts that helped shape this method are put in a historical perspective, and the shifting paradigm observed in academic research is also discussed. Lastly, different methods that exist are reviewed, before discussing the usefulness of application of MFA.

2.2 Urban Metabolism

Urban metabolism conceives the city as an organism. Material inputs are transformed into useful energy, physical structure, and waste. Industrial metabolism, industrial ecology, and regional metabolism are related fields of study (Decker *et al.* 2000).

Studies that discuss the influence of energy input and output and that reflect on the consumption balance of other resources within society date back to the 1860s (Fischer-Kowalski 1998). These publications, however, did not yet define the concept of urban metabolism itself. A renowned study by Wolman (1965) has been termed "seminal" in this field (Hermanowicz and Asano 1999). Wolman described material input, storage, and output for a hypothetical U.S. city with 1 million inhabitants. Inputs included water, food, and fuel. Outputs included wastewater, solid waste, and air pollutants. Only a few years later, R. U. Ayres and Kneese (1969) published another influential report describing the role of material flows in the national economy of the United States (Fischer-Kowalski *et al.* 2011).

The concept of urban metabolism is often discussed using Material Flow Accounting which quantifies the physical inputs and outputs of an economy. Urban metabolism gained traction as a field of research in the 1970s, but disappeared mostly from the academic agenda during the 1980s. It was not until the 1990s that urban metabolism resurfaced, with a large number of studies on nations and cities published around the turn of the century (Daniels and Moore 2001; Kennedy *et al.* 2011).

One of the larger city-scale studies from this period was undertaken by Decker *et al.* (2000) who reviewed energy and material flows through the world's 25 largest cities. Kennedy *et al.* (2007) compared data from eight cities between 1965 and 2000 and reflected on the changes in metabolism that were observed.

Over the years, different approaches were developed to measure and analyze urban metabolism. A recent review by Zhang (2013) lists three main accounting methods:

- Material flow analysis: takes into account mass fluxes to express the physical quantities that move into and out of a city.
- Emergy (energy flow) analysis: mainly based on the work by Odum (1983). This approach uses energy equivalents, expressed in joule. This approach has not become mainstream, but there have been repeated studies using this method (Kennedy *et al.* 2011). Helmut Haberl summarized different energy-equivalent approaches and proposed a method for energy-based MFAs (Haberl 2001a; Haberl 2001b).
- Ecological footprint analysis: expresses the material requirements of a city in terms of surface area required to provide the inputs and process the outputs of a city.

Each of these approaches have benefits and drawbacks, and there is no single standardized methodology. However, to date most of the urban metabolism studies continue to focus on mass fluxes (using several variations of material flow analyses), rather than energy-equivalents or ecological footprint analyses (Zhang 2013).

2.3 Material Flow Analysis

2.3.1 Introduction

Interest in and usage of MFA was encouraged by the politically agreed to goal of achieving environmental sustainability, as captured for instance in the 7th goal of the Millennium Development Goals. Rather than a focus on the final output as a measure for sustainability, the focus moved to a more complete understanding of national growth and productivity (Eurostat 2002). Frameworks and methodologies for MFAs that were developed in the 1990s were reviewed in a series of two studies by Peter Daniels. He remarked that the wide range of approaches hindered comparative and systematic studies, and called for a more structured and overarching framework (Daniels and Moore 2001; Daniels 2002).

One of the most influential frameworks for measuring economy-wide material flow was published in the early 2000s by the Statistical Office of the European Communities (Eurostat 2001). This same framework was applied by Eurostat to all member states for the period 1980-2000, and the results were presented one year after the framework was published (Eurostat 2002).

The economy-wide material balancing scheme from Eurostat (excluding air and water flows) accounts for fossil fuels, minerals, and biomass as its main inputs. Emissions to air, waste landfilled, emissions to water, and dissipative flows are the principal outflows to nature. This method was reused on a large variety of other economies and regions. A visual representation of the Eurostat method is shown in figure 2.1.

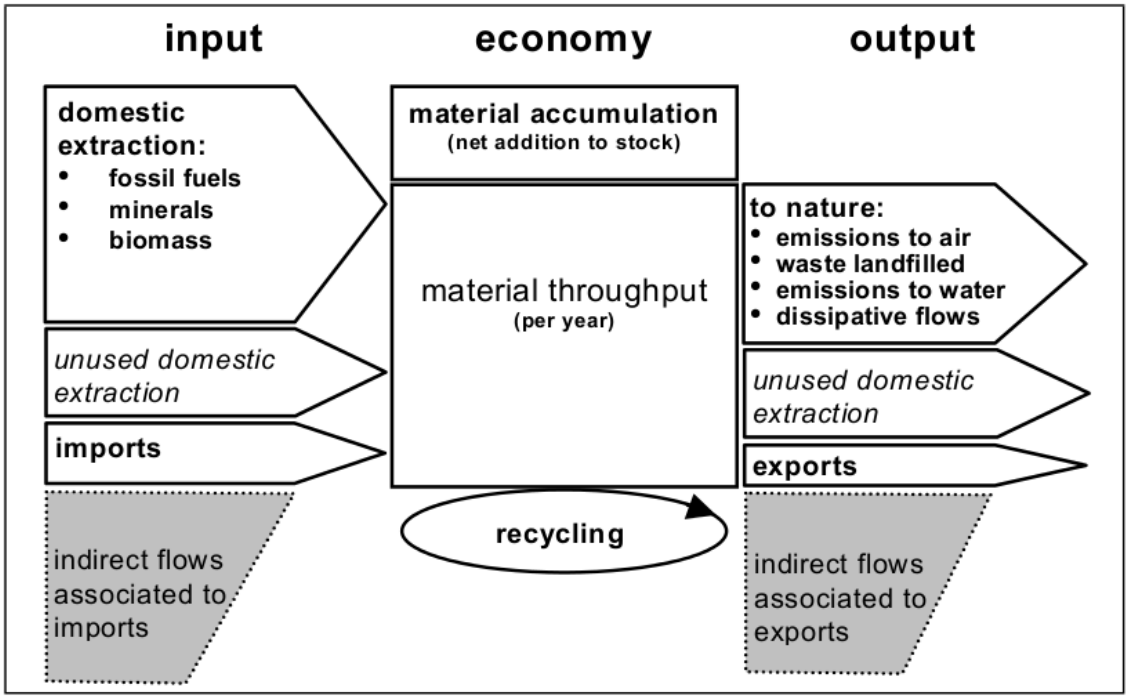


Figure 2.1: Economy-wide material balance scheme (Eurostat 2001)

Ten years after its inception, Fischer-Kowalski *et al.* (2011) reviewed research done with the Eurostat methodology, and conclude that economy-wide MFAs have matured as a methodological framework tool and reached high levels of confidence.

Several practical guides and handbooks exist with regards to the application of MFAs. One of the most complete books in the industry is the *Handbook of Industrial Ecology* (R. U. Ayres and L. Ayres 2002), which covers MFAs but also many of the other tools in the industry. Purely focused on MFAs is the *Practical Handbook of Material Flow Analysis* (Brunner and Rechberger 2004). Both of these books describe general MFA approaches but are not exclusively focused on one methodology. There are two principal guides that are centered around the Eurostat methodology: the official Eurostat (2001) *Methodological Guide*, and the *Guide for beginners* (Eisenmenger *et al.* 2006).

MFAs are not without drawbacks and limitations. Hammer *et al.* (2003a) discuss several limitations, most of which are centered around the fact that MFA studies focus on weight, without taking into account large differences in toxicity or environmental impact of different materials, and without linking this to the economic usefulness of materials or the principal actors that drive material flows.

Only recently has the inclusion of uncertainty in MFA studies become more commonplace, although far from standardized. Several authors argue that systematic approaches for selecting appropriate uncertainty tools should be introduced in the next phase in MFA research (Rechberger *et al.* 2014; Laner *et al.* 2014). Several tools have been identified and evaluated in recent work (Rechberger *et al.* 2014; Feketitsch *et al.* 2013), including tools using ratings, confidence intervals, and sensititivy analysis, among others.

2.4 Urban Scale MFAs

This section provides an overview of the most relevant international MFA studies, followed by an overview of work undertaken in South Africa. The last section discussed challenges encountered when performing MFAs on a regional or urban level.

2.4.1 Overview of Urban MFA Studies

Application of MFAs on a smaller scale has received increasing interest from policy makers and academia alike, and new frameworks have been developed in the past years (Hodson *et al.* 2012). Several studies have focused on Western Europe, including case studies on the city of Vienna and the Swiss lowlands (Hendriks *et al.* 2000), Hamburg (Hammer *et al.* 2003b), Paris (Barles 2009), and York (Barrett *et al.* 2002), among others. Although mass-flux accounting was used in most studies, the exact application and goals of the different studies varied significantly.

Rather than limiting the scope to the city borders, Barles (2009) modified the Eurostat method and conducted a study on three different levels: Paris, Paris and its suburbs, and the entire region. This approach illustrated the interactions between an urban region and its surrounding area.

Browne *et al.* (2012) compared the results from three different methodologies, applied to an Irish city-region. The authors contrasted Energy Flow Accounting, Energy Flow Metabolism Ratio Analysis, and Ecological Footprinting and concluded that using a combination of methods might provide additional clarity for sustainability measurement.

In their study of Hamburg, Hammer *et al.* (2003b) show how the city is characterized by both large imports and exports, demonstrating the role of Hamburg as an international harbor city.

Following up a call from Kennedy *et al.* (2007), Saldivar-Sali (2010) set out to document and compare 155 globally representative cities. These cities, which included Cape Town and Johannesburg, were classified in groups using four predictor variables: population, population density, climate, and city GDP per capita. Resource flow comparison was undertaken for total energy, electricity, fossil fuels, industrial minerals and ores, construction minerals, biomass, water, and total materials. Analyzing these data sets, a total of 15 metabolic profiles were defined and used to classify each city. The goal of this study was to assist comparison and prediction, and ultimately inform policy design targeted to optimize resource efficiency. Implementation of standardized classification schemes has yet to take place, but Weisz and Steinberger (2010) have also made a case for developing a typology of cities in order to assist analysis and decision making processes.

2.4.2 MFA Research in South Africa

In South Africa, only a limited number of economy-wide MFA studies have been undertaken on a national or urban level. In 2011, there were initial attempts towards estimating material flows of the Gauteng City-Region (Musango 2011). The study only reached the point of collecting data and quantitative analyses were not undertaken. This was due to the lack of capacity when the leading researcher was no longer with the institution undertaking the study. On a national level, South Africa's first economy-wide MFA is currently being finished as part of a PhD dissertation and is expected to be published later this year. Results are currently under consideration for publication (Beyers 2015).

Studies done on Cape Town involve the calculation of the city's ecological footprint (Gasson 2002) and a metabolism study on Cape Town's stocks and flows (Gasson 2007). Gasson (2014) noted that these studies were merely an initial attempt at a full metabolism study and that several flows were estimates with high uncertainty. Data for metabolic inputs and outputs furthermore came from a variety of dated sources ranging from 1991-1999 (Gasson 2007, p. 6). Royden-Turner (2012) undertook an MFA study on a small informal settlement in Cape Town (2,217 households) as part of a larger descriptive study of urban informal ecosystems.

Other MFA-related studies done on Cape Town include several substance-specific studies. Studies involved nickel-cadmium batteries (Mason-Jones and Von Blottnitz 2010) and wood (Nissing and Von Blottnitz 2007), as well as investigations of zinc and copper stocks in the city (Van Beers and Graedel 2004; Van Beers and Graedel 2003).

2.4.3 Challenges and Data Sources

Hammer *et al.* (2003a) reviewed the principal challenges and possible solutions that are encountered when undertaking regional MFAs. Most of the challenges relate to the difficulties in obtaining reliable data on a regional scale.

In most cities, "domestic extraction" (primary economic activities such as agriculture and mining) is very limited and imports thus form the major source for material input into the urban areas. To provide a richer analysis of the material resource consumption of cities, the underlying resource

consumption of these imports can be calculated. However, this calculation is complex and will vary depending on the origin of the product. The German Wuppertal Institute for Climate, Environment and Energy has been an important player in standardizing MFA methodologies and calculated so-called "rucksack factors" [1] for the German economy (Hammer *et al.* 2003a). These factors can be applied to imports of processed products and help estimate the raw material input associated with these imports.

Within the field of Material Flow Analysis, it is common for urban level studies to provide the results with a description of data sources and potential limitations (Barles 2009; Hammer *et al.* 2003b), as a consequence of the lack of standardization of urban scale data collection throughout the world and even within nations. Statistics are generally provided on a national scale and urban data are often incomplete and incomparable (Weisz and Steinberger 2010). In fact, uncertainty and lack of data reliability have been identified as an important issue in economy-wide material flow accounting in a review by Fischer-Kowalski *et al.* (2011) (mostly for mineral materials).

Maclaren (1996) defines one of the requirements for a good sustainability indicator that it is based on data that is comparable over time, understandable and unambiguous. The importance of reliable data can therefore not be overstated.

2.5 Usefulness and Application of MFA

Hammer *et al.* (2003a) consider MFA-derived indicators to be important because they provide a more comprehensive image of human impact on the ecosphere. They also consider these indicators useful to grasp environmental damages related to material flows that can be difficult to capture using other methods.

The goal of analyzing resource efficiency through MFAs has recently been related to the concept of resource decoupling. The OECD (2001) refers to decoupling as breaking the link between environmental pressures and economic growth.

The United Nations Environment Programme (UNEP) distinguishes two forms of decoupling: **resource decoupling** means reducing the rate of (primary) use of resources per unit of economic activity and **impact decoupling** requires increasing economic output while reducing negative environmental impacts (UNEP 2011, p. 4).

The UNEP (2013) assessed progress toward decoupling on a city level in a recent publication, and presented 30 case studies that highlight how MFA and decoupling can guide urban transitions towards sustainable cities.

Hodson *et al.* (2012) look at the role of Material Flow Analysis within the discipline of industrial ecology. Reflecting on past research results, they argue that city-regional scale MFAs provide an opportunity to relate cities with their ecological services and associated resource extraction. They consider it important to increase related comparative and systematic research in order to transition urban infrastructure and accelerate decoupling. The authors call for more MFAs to be done using the approach pioneered by Barles (2009).

[1] This German term translates to "backpack factors" and is used to refer to the material flows that are required to produce a product (throughout its whole life-cycle, including used and unused flows). These material requirements are not necessarily seen directly in the product but they are associated with it, hence the "backpack" reference.

Browne *et al.* (2012), Hodson *et al.* (2012), and Pincetl *et al.* (2012) argue that MFAs are tools that can be valuable additions to other methods. Sustainability analysis becomes more holistic and more informed policy decisions can be made by combining MFA with other tools, they suggest.

MFAs have already been used to compare and contrast cities. Niza *et al.* (2009) found, for instance, that construction in London might be less material-intensive than construction is Lisbon. Domestic material input (DMI) per capita has been related to mobility and the role of public and private transportation within a city (Hodson *et al.* 2012). Domestic material consumption (DMC) per capita has been shown to vary significantly between different cities, due to a variety of factors (Weisz and Steinberger 2010).

The usefulness and significance of these and other indicators will increase by promoting the undertaking of MFAs in areas that have received relatively little attention, including developing countries and regions where Eurostat data is unavailable. As several authors have indicated, an increased availability in MFA data is likely to benefit decision makers, researchers, and legislators (Weisz and Steinberger 2010; Hodson *et al.* 2012; Kennedy *et al.* 2011).

2.6 Conclusion

This literature review placed the evolving field of urban metabolism studies in historical perspective, and provided an overview of the most important studies that have been undertaken in this discipline. While the field is still evaluating and improving different methodologies, it is clear that undertaking more urban-scale metabolism research will benefit the academic society and all other stakeholders involved.

The low number of urban MFA studies undertaken in South Africa (and the global south) limits research in this part of the world. Not only would more research be useful, but perhaps even more useful would be to have a better insight into the requirements, possibilities, and limitations of urban-scale MFA research. A feasibility study that attempts to undertake an urban MFA while thoroughly documenting the process and the outcomes could assist other researchers and enable a more efficient growth of MFA research in South Africa.

Chapter 3

Methods: MFA

3.1 Introduction

Eisenmenger *et al.* (2006) argue that the future value of MFA studies largely depends on internal consistency and international comparability, among other things. Applying the well-documented and often-used Eurostat framework helps both assure internal consistency and increases international comparability. Other advantages of using the Eurostat framework for this study include the potential for cross-checking with and completion of national MFAs (Hammer *et al.* 2003a). National MFAs can also help estimate regional values, if no other sources are available.

The results of a nationwide Eurostat-based MFA of South Africa will soon be published (Beyers 2015). The aforementioned linkages between national and regional MFAs strengthen the case for using the same methodology as used in the national MFA.

Eurostat (2001) has thoroughly documented the MFA framework in the *Methodological Guide* published. In addition to this detailed explanation of the framework, Eurostat also publishes annual Compilation Guides that provide more hands-on instructions for the MFA practitioner. My work was done using the most recent version of the *Compilation Guide* (Eurostat 2013) as instruction manual. This document recommends particular data gathering approaches, potential data sources, conversion factors for particular materials, and provides other practical instructions.

In order to successfully undertake an MFA, Eisenmenger *et al.* (2006) argue that five requirements should be met with regards to the data:

- Data must comply with the system boundary
- Measured in or converted to tons
- Free of double counts
- Must be comprehensive
- Data must be of sufficient quality (often considered the most difficult part)

These requirements were taken into consideration when analyzing the feasibility of this type of study.

3.2 Eurostat Data Tables

The Eurostat MFA questionnaire consists of several spreadsheet tables that break down the different material groups. A brief overview is provided in the upcoming sections.

3.2.1 Table A - Domestic Extraction Used

This table includes the following headings:

- Biomass
- Metal ores
- Non-metallic minerals
- Fossil energy materials/carriers

In the Eurostat questionnaire, *unused* extraction is not included. This kind of extraction includes, for instance, soil that is excavated (but not used) for mining, or unused by-catch in fishery. Following the Eurostat framework, I did not aim to include unused extraction either.

3.2.2 Table B, C, D, and E - Imports and Exports

These four tables are all structured in the same way and similar to Table A. However, they also include processed products in addition to raw materials. The principal headings are:

- Biomass and biomass products
- Metal ores and concentrates, raw and processed
- Non-metallic minerals, raw and processed
- Fossil energy materials/carriers, raw and processed
- Other products
- Waste imported/exported for final treatment and disposal

Eurostat uses two tables for trade with countries outside the European Union, and two tables for total imports and exports. This allows for a distinction between imports and exports that effectively enter and leave the European Union as a whole, and imports and exports that only move between member countries. This distinction is generally not made on an urban level in MFA studies. However, Hammer *et al.* (2003a, p. 16) discuss regional MFAs and the impact of important harbors that generate imports and exports because of their role as a centralized transit hub (the "Rotterdam effect" They recommend to show direct transit as a different category and to leave these flows out when compiling indicators. Therefore, where data allowed for it I tried to distinguish between throughput (Cape Town imports and exports that have not originated in and are neither destined for Cape Town), and imports and exports that are originated in or destined for Cape Town.

In the older *Methodological Guide*, Eurostat (2001, p. 18) allowed the practitioners to choose how waste is reported. Waste landfilled could be considered an output to the environment, but it could also be seen as part of the socio-economic system (if properly landfilled) and only leaching materials

and gaseous emissions to air from the landfill site would be counted as output to nature. However, in the more recent *Compilation Guide*, Eurostat (2013, p. 75) does not allow for the data collectors to select the preferred method but instructs that controlled waste should be considered part of the socio-economic system. Only uncontrolled waste (wild dumping) is considered output to nature, plus the emissions to air and water caused by the landfill site.

3.2.3 Table F - Domestic Processed Output

This table comprises of the following main groups:

- Emissions to air
- Waste landfilled
- Emissions to water
- Dissipative use of products
- Dissipative losses

Because of the importance in global warming potential of CO_2 and the large share in weight of CO_2 in total emissions, Eurostat (2013, p. 72) recommends to concentrate most efforts on the CO_2 account. Other gasses included in emissions to air are methane, nitrous oxides, sulphur dioxides, and particulate matter, among others.

Waste landfilled only includes uncontrolled waste (wild dumping). Even within the European Union, obtaining these numbers is reported to be a challenging task (Eurostat 2013, p. 76). If no data are available, consultation with national experts is recommended. Eurostat (2013, p. 77) also allows for using rough estimates for emissions to water in the context of a full material balance, because it represents such a small fraction of total output to nature. In my fieldwork I prioritized material flows using these Eurostat recommendations.

Dissipative use of products include those products that are deliberately spread or dissipated within the system (this should be inherent to its way of use or application). Examples are fertilizers, seeds, and salt or other thawing materials spread on roads during frost. National statistics rarely report these numbers, and Eurostat (2013, pp. 79-82) provides detailed instructions for approaches that can be used to estimate these flows. Because Eurostat already considers alternative ways to calculate these flows, I dedicated less time to this category and rather focused on other flows.

Dissipative losses are unintentional outputs to nature resulting from abrasion, corrosion, erosion, and from leakages or accidents during the transport of goods (Eurostat 2013, p. 82). International data sources are confined to a few specialist studies and estimates, and no comprehensive approach exists to estimate these flows. I therefore did not dedicate any time to calculating these numbers. After all, lacking these numbers, a Cape Town MFA can still be of comparable quality when contrasted with international studies.

3.2.4 Table G - Balancing Items

This table is used to make sure the MFA - which is ultimately a mass balance exercise - balances. These items include:

- Balancing items on the input side (oxygen for combustion or respiration, and nitrogen for Haber-Bosch process)
- Balancing items on the output side (water vapor for combustion and gases from respiration)

All these flows are memorandum items and do not form part of most of the indicators (only "Net additions to stock" requires balancing items). I prioritized flows that can be used to calculate indicators and I did therefore not focus on these balancing items.

3.2.5 Table H - Indicators

This table features eight indicators. The first four are nothing more than the sums of single tables, and the other four are sums or ratios of different flows.

- Domestic extraction (used) (DE)
- Imports
- Exports
- Domestic processed output (DPO)
- Direct material input (DMI)
- Domestic material consumption (DMC)
- Physical trade balance (PTB)
- Net additions to stock (NAS)

Direct material input (DMI) is the sum of domestic extraction and imports, and it indicates total material resources that enter the system, independent from the origin.

Domestic material consumption (DMC) takes DMI but subtracts exports. This provides more insight into the actual consumption of a socio-economic system. Systems with a strong trade or export character feature a much lower DMC in comparison to the DMI.

The **physical trade balance (PTB)** subtracts imports from exports to indicate whether the system of study is a net importer or exporter.

Net additions to stock (NAS) measures the physical growth of the economy. It takes domestic extraction, imports, and balancing items on the input side, and subtracts exports, domestic processed output, and balancing outputs on the output side. I did not aim to calculate this indicator because low priority was given to balancing items.

These indicators are useful as total volumes, but also on a per-capita basis, which makes comparing them with other cities and regions much more useful. One other indicator that is not listed in the Eurostat documentation is the **Direct Material Output (DMO)**, which sums DPO and exports to indicate the total flows that leaves the system. This indicator is used in other studies and I therefore included it in my calculations.

3.3 Procedure of Undertaking an MFA

According to Brunner and Rechberger (2004), these are the five steps of undertaking an MFA:

1. Definition of the scope and purpose of the study
2. System description
3. Data collection
4. Material balances, modelling, and scenario building
5. Interpretation of the results

Each of these steps is described below.

3.3.1 Scope and Purpose

The system boundary should be established for each MFA individually and depends on the objective of the project (Brunner and Rechberger 2004). The purpose of this study is to better understand the feasibility and the challenges of undertaking an urban MFA in South Africa. If proven feasible, the outcome can be used by city-level policy makers and other researchers doing studies on the city of Cape Town.

Following the administrative boundaries is most practical as it fits well with the purpose of this study. The scope of the study is therefore defined as the City of Cape Town Metropolitan Municipality. [1]

Most urban metabolism studies are undertaken for a specific calendar year, at times comparing one base year with a more current period (Kennedy *et al.* 2011). The strong focus on the feasibility aspect of the MFA made it less important to compare different years. The study focused at one recent year (2012). However, data for consecutive years is often published in the same reports, which made it easy to collect data for different years. An attempt was therefore made to gather data one year before and one year after the target year (2011-2013).

3.3.2 System Description

Cape Town is one of eight Metropolitan Municipalities in South Africa, and it is the second largest in population after Johannesburg (Stats SA 2011). Metropolitan municipalities were created in the 1998 Municipal Structures Act, based on so-called "Category A" municipalities defined in the 1996 Constitution. These municipalities have exclusive executive and legislative authority in their areas, and they must be regarded, among other things, as *a conurbation featuring areas of high population density; an intense movement of people, goods, and services; extensive development; and multiple business districts and industrial areas* (Municipal Structures Act, No 117 of 1998). Interestingly, as defined in this Act, the intense movement of goods is a prerequisite for municipalities to be classified as metropolitan municipalities.

[1] Throughout this study, unless otherwise specified "Cape Town" will refer to the area of study, to the City of Cape Town Metropolitan Municipality.

Figure 3.1: Outline of the area of study. Source: www.openstreetmaps.org

The shape and governing structure of Cape Town have strongly fluctuated over time. Post-apartheid legislation attempted to undo the impact on urban form and governance left by the segregation-driven policy from the past. Metropolitan areas were to include areas formerly zoned as black and white in a single city government. Autonomous suburban areas were also included in this process of municipal restructuring (CoCT 2014). The City of Cape Town Metropolitan Municipality

transformed into a very large municipality, measuring 2,461 km² (CoCT 2012b). A map of the current municipal borders is shown in figure 3.1. As can be seen in the most recent Census, Cape Town's layout still consists of separated zones strongly demarcated with regards to race, income class, and population density (Frith 2014). The transition from one area to another is often sudden and still includes physical barriers like highways, railroads, or empty space.

The Urban Governance chapter in the most recent *State of the City Report* (CoCT 2014, p. 208) provides an interesting historic overview of some of the administrative changes throughout time:

The Cape Town Municipality was established in 1840. In 1900, there were 11 local authorities, and by 1913, eight of these had merged into Cape Town. By 1994, prior to the first democratic local government elections held in May 1996, greater Cape Town had 39 local authorities and 19 separate administrations. On the eve of the 1996 local government elections, the 58 administrations and local authorities that made up metropolitan Cape Town were merged and replaced by a two-tier local government system comprised of seven councils: the municipalities of Blaauwberg, Cape Town, Helderberg, Oostenberg, South Peninsula, Tygerberg and the umbrella Cape Metropolitan Council.

In accordance with the Municipal Structures Act, a single Unicity Council replaced the two-tier structure after the local government elections in November 2000. The seven councils were dissolved and their employees, assets and commitments transferred to the new Unicity Council.

Figure 3.2 provides a visual representation of the transition in Cape Town's administrative areas. At present, the Cape Town Metropolitan Municipality includes all of the interim Councils from the 1996-2000 period, but to this day many of the individual local authorities from the pre-1996 period can still be recognized as individual areas with own identities and demographics.

The *State of the City Report* (CoCT 2014) provides detailed insight into the development status of the city. It includes chapters on the social situation, the economy, natural wealth, urban growth and form, and urban governance. A brief overview of some of the key features of Cape Town is provided below. All numbers in the rest of this section (including figures related to Cape Town's economy, natural assets, air quality, energy requirements, water quality, and transportation) are based on information in the *State of the City Report* (CoCT 2014) report.

Cape Town's principal economic sectors are finance, community services, trade, manufacturing, and transport. Compared to national averages, mining and agriculture rank very low. The informal sector is an important component, providing 8.7% of total employment. Cape Town is also a key hub for for international imports and exports, with the Port of Cape Town handling 19% of all containers that come in through South Africa's ports. In 2014 the City had a total budget of R31.59 billion and employed just over 25,000 employees.

There are important natural assets in and around the city. The Table Mountain National Park is a large, protected area situated in the city. Furthermore, the Cape Floristic Kingdom is a global biodiversity hot spot, and Cape Town is located within this hot spot. This floral kingdom boasts 9,600 plant species, with the majority of them being endangered. Within Cape Town, there are six endemic vegetation types.

Air quality is occasionally a problem, mostly during winter months in specific areas. Khayelitsha frequently experiences PM_{10} levels far above the United Kingdom guidelines, although if measured against the lower South African standards the situation has shown no exceedances since 2011.

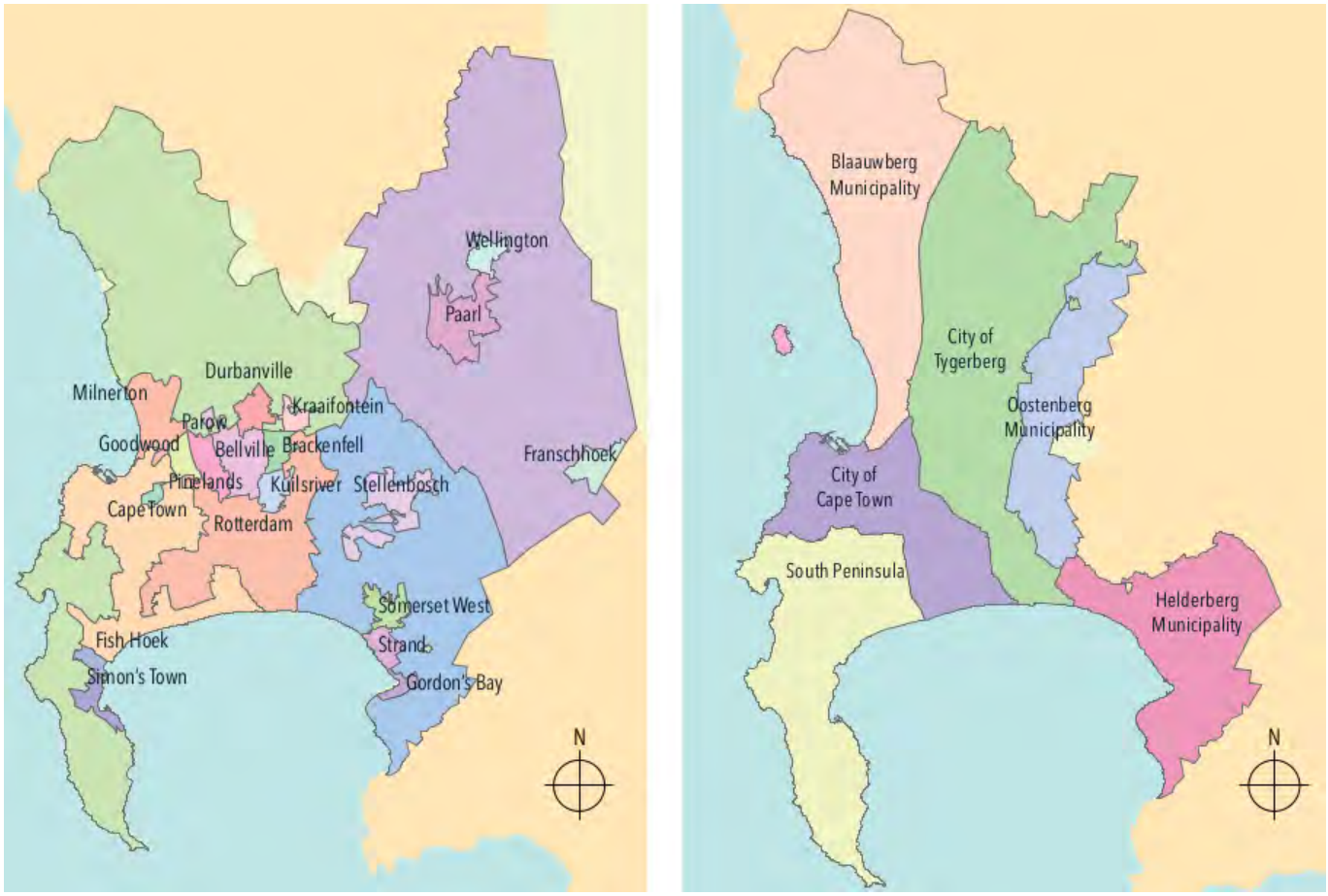


Figure 3.2: Maps of pre-1996 administrations and local governments (left), and 1996-2000 interim Councils (CoCT 2014)

Total energy consumption in 2007 (the most recent year available) [2] in Cape Town was 128 million gigajoule. Electricity use accounts for 64% of the carbon footprint in Cape own. Per-capita emissions in 2007 were 7.8 tons of CO_2. For water consumption and solid waste generation, recent data is more readily available. Per-capita water consumption was just over 200 liters per day in 2013. Three waste disposal sites within Cape Town received just over 2 million tons of solid waste in 2013.

Phosphorus concentrations in inland aquatic systems are a concern. However, drinking water quality has been consistently high and Cape Town was awarded the Blue Drop certificate from the Department of Water Affairs since the launch of this program in 2009.

Approximately 376 informal settlements contain 146,488 informal dwellings (20.5% of the total).

[2]Both the most recent *State of the City Report* (CoCT 2014) and the *State of Energy and Energy Futures Report* (CoCT 2011) report energy consumption for 2007 as the most recent year.

Low-income townships are often located at the margins of the city, with residents paying high costs for transport to work. The City is introducing new options for public transportation, including bus rapid transit services. The most popular mode of transport to and from work is through private/company vehicles. Use of private/company vehicles for commuting has increased from 38% in 2009 to 42% in 2012).

3.3.3 Data Collection

As described in section 3.2, the following data tables exist in the Eurostat framework:

- Table A - Domestic Extraction Used
- Table B, C, D, and E - Imports and Exports
- Table F - Domestic Processed Output
- Table G - Balancing Items
- Table H - Indicators

The tables of interest for data collection are tables A, B, C, D, E, and F. Table G is not prioritized (see section 3.2.4), and table H is concerned with estimating balances and indicators (see section 3.3.4).

Data were collected through fieldwork. This consisted of visiting government offices, companies, and universities, among others. I contacted academics, government officials, and people in the private sector to locate potential sources of information, and I read through documents, websites, and statistical publications to find data on material flows. For each substantial flow it was my goal to find the most reliable source of information and to then extract the information in the right format for my research.

3.3.4 Estimating Material Balances and Indicators

Key indicators as described in Table H of the Eurostat framework can facilitate policy makers with concrete and comparable numbers that can assist in better understanding the city and its resource consumption and throughput pattern. Material balances were calculated for all the material groups, and all the associated indicators were calculated.

3.3.5 Interpretation

The data were contrasted with data from other cities and regions, and also with previous metabolism studies on Cape Town. Furthermore, different material flows were put in perspective and linked back to the related economic sectors.

Chapter 4

Methods: Understanding Challenges

4.1 Introduction

Undertaking an MFA is a different activity than analyzing the process of undertaking an MFA. Therefore, the method used for analyzing the MFA process is described in this chapter, separate from the MFA methodology.

The backbone of this methodology was to track everything: from how time was spent to which documents were read, and from tracing contact referrals to logging kilometers traveled. Detailed logs were also kept of time spent before and after the data collection process, but throughout this document the principal focus will be on the activities related to the data collection process.

Software available for administering MFAs was mostly focused on data entry and creation of visual representations of the results. For instance, STAN (short for subSTance flow ANalysis) was developed by the Vienna University of Technology and provides a useful tool for entering relevant data, calculating the outcome, and presenting the results in the form of a sankey diagram (Cencic and Rechberger 2008). In the *Practical Handbook of Material Flow Analysis*, Brunner and Rechberger (2004) describe three software programs that can be used for MFAs (Microsoft Excel, Umberto, and GaBi), but indicate that none was actually made for this purpose and none of them is therefore best suited for undertaking an MFA.

For my research it was important to have software available that would not only be suitable for entering the data points and calculating the outcome of the MFA, but that would also assist in administering back-office activities. Unable to find suitable software, I developed a website-based tool that was specifically tailored to my own needs, while still being useful to others who want to undertake similar MFA research.

I named the software OMAT (short for Online Material flow Analysis Tool), and set up a publicly available website (http://mfa-tools.net) to allow others to use this as well. The website was set up using PHP as a programming language, and MySQL as the database system that contains the MFA

information. The source code was licensed as open source software, and all files were uploaded as a public repository to the code sharing website Github. I notified a variety of experts in the field of industrial ecology about the existence of this website, and several provided positive feedback and constructive criticism. OMAT was used by me, but at the same time also by a group of students working on an urban MFA in Barcelona as part of a class taught by associate professor Gara Villalba in the JEMES-CiSu masters program at Universitat Autònoma de Barcelona. Feedback from Gara Villalba and her group of students helped improve the software and made it more usable for other MFA researchers as well.

The software was able to keep track of the back-office activities, in addition to providing options for entering and processing the actual MFA data points. Distinction was made between contacts, documents and activities, and databases were set up for each. The following sections detail each of these functionalities and further explain how OMAT was used.

4.2 Contacts

Contacts include both people and organizations. Each contact person was classified under an organization, and each organization was classified under a particular sector. A profile was made for each individual contact. This profile includes the following information:

- Name
- Type (organization or person)
- Creation date
- Referral (name of contact or document that made mention to this contact)
- Parent (organization or sector this contact belongs to)
- Website
- Industry
- Notes (text field for internal notes)
- Tags (optional labels that were used to mark specific features like “High-priority contacts”
- Contact nature (this indicates the main reason this contact was created, e.g. for “Acquiring data” or “Obtaining referrals” - this optional field was only used if the reason for adding the contact was very clear)

4.3 Documents

Documents are any type of source providing data or other information. The following information was saved in each profile:

- Name
- Creation date

- Referral (name of contact or document that made mention to this contact)
- Owner (the contact that created or otherwise holds principal ownership of this document)
- Notes (text field for internal notes)
- Tags (optional labels that were used to mark specific features like "High-priority documents"

Different files can be uploaded or added to each document profile. Each of these files can contain a name, an optional website link, and the file itself. As a rule, all documents would have only one entry in the database, even though different editions or versions exist. For instance, the biennial *State of Cape Town Report* would have only one entry. The 2012 and 2014 editions were added as two separate files within this document. This ensures that documents that have many different versions or separate publication forms are not double counted.

Rather than recording the author I classified documents based on ownership. On occasion documents were written by independently hired firms or consultants, but they were owned and distributed by the paying organization (for instance, the City of Cape Town). In terms of access it was more important to understand ownership rather than authorship, which is why I prioritized this in the database structure.

4.4 Activities

Activities are the different types of work and other interactions related to contacts or documents. An activity log was kept for each of the contacts and documents, including start and end time of this activity.

For contacts, the following activities were defined:

- Holding a meeting
- Engaging in transport
- Placing a phone call
- Sending an e-mail
- Background research

For transportation I measured each leg of the trip individually and I logged the route, time spent, distance traveled, and the mode of transportation. Attempting to limit my impact on the *Imports* and *Domestic Processed Output* of Cape Town, I prioritized travel by bicycle over motorized transit. I cycled to any meeting located within a reasonable biking distance (roughly 15 km), with exceptions made for bad weather or practical reasons.

Background research included mostly internet browsing to find contact information of people and organizations, or to read more about particular contacts in preparation of a meeting or before getting in touch.

For documents, the following activities were defined:

- Reading
- Calculating

Calculating included all the work related to the extraction of useful numbers. This could be changing the values from other measurements to tons, or trying to figure out which numbers to add up to get information for Cape Town from a larger dataset.

4.5 Managining Tasks, Relationships and Referrals

The software also served as a project management tool, providing options to keep track of which documents were pending, which contacts required follow-up action, and similar status indications. Discarded contacts (either unwilling or unable to provide more information) and processed contacts were flagged to easily identify those contacts pending further action.

The system furthermore provided options to cluster contacts and to keep track of referrals and the origins of data points, as explained in more detail below.

4.5.1 Contact Classification

The "classification" field was used to create a hierarchical structure within the contacts database. The following top-level options were created:

- Government (sub divided into national government, provincial government, and city government)
- Academia (including universities and research centers)
- Private sector (including companies, NGOs, and freelancers)

Contacts could be filed directly under these main categories or under a sub category. Sub division was made to better manage the information (especially in the case of larger organizations that have several divisions like the City of Cape Town). People were filed under the organization they work for (freelancers were filed in the relevant top-level classification group and not under a specific organization).

In addition to the classification of contacts, the referral field (present in both contacts and documents) was used to save information about relationships between the different records. Any person that recommended contacting a particular person or organization, or that recommended to review a document, would be listed as a referral. Several contacts can refer to the same contact or document. Similarly, documents that pointed to other documents, or to specific people or organizations, could become referrals.

Becoming a referral was not restricted to the act of actively pointing me in the right direction. When looking for contact information or when searching the internet or other information sources, any mention that led me to consider a new contact or document could make someone or something a referral. For instance, when trying to locate the e-mail address of someone (say, a university professor) I would often find interesting leads while searching the internet for this information (say, a link to a research group this professor chaired in past years). I would then mark the newly obtained contact as if it was referred by the contact I was looking for, because it led me to this new contact - even though this was not done actively by this contact.

4.5.2 Tracing Origins

The different Eurostat material groups were loaded in the system and whenever data points were found they were entered. Upon entering they were linked to a particular document. This way, it was possible to track the origin of each data point.

By linking data points to documents, and documents to contacts, it was possible to get more insight into how direct (or indirect) the "route to success" was. Had the data point been obtained after one quick visit to a government website followed by reviewing a statistical publication, or did it take many e-mails, multiple meetings with different people, and a lot of time to gain access to the final document?

In addition to understanding how data points were gathered, this system also made it possible to visualize the efficiency of the overall process. All time was logged and could be broken down by type of activity. By analyzing time spent on different sectors, types of contacts, and types of activities, it was possible to dissect the process and better understand what paths were and what paths weren't efficient.

By tracing the origins of each contact and each document, it was also possible to pinpoint "assists" These assists are those people or documents that referred me directly to any of the sources that contained data points. In other words, assists are the second-last step in locating data, and without them it would not have been possible to obtain the data points.

4.6 Data Quality

The bulk of any MFA revolves around the data. Similarly, the principal work done as part of the feasibility study centered around data quality and availability.

The Eurostat method is based on data supplied to the Statistical Office of the European Communities. In South Africa, the same statistics are not necessarily available, or not with the required depth or precision. Earlier attempts by Barrie Gasson to calculate the ecological footprint of Cape Town (Gasson 2002) and to identify the material flows within this city (Gasson 2007) have demonstrated the difficulty in obtaining reliable data.

Because of these challenges it was necessary to document the data limitations that apply to South African cities, and to describe methods to identify suitable proxies. This study takes a structural approach to analyze the data quality and subsequently provide strong arguments in favor of, or against, the undertaking of an MFA.

Although the MFA sector lacks standardized approaches to the issue of varying data quality, different methodologies have been used and evaluated by MFA researchers (Rechberger *et al.* 2014; Feketitsch *et al.* 2013). For this study, statistical approaches were discarded because they often required complex modeling or estimates of uncertainty, which did not match my purpose of understanding research challenges. Data classification approaches were more appropriate, because this allowed for defining important characteristics (indicators) and evaluating them one by one.

The methodology and indicators from a tool, developed for the Life Cycle Assessment industry but also used for MFA research, was in line with the purpose of my study. This tool, by Weidema and

Wesnæs (1996), uses a "pedigree matrix" to characterize the different uncertainties, and has been further reviewed and slightly modified by the same authors (Weidema 1998).

Data Quality Indicators

Data quality indicators can be used to establish the relative quality of the data that was obtained, and are at the heart of the Weidema and Wesnæs (1996) methodology.

Weidema and Wesnæs use a pedigree matrix with 5 quality indicators:

Reliability	Independent from the data quality goals, this indicator relates to the sources, acquisition methods, and verification procedures.
Completeness	Indicates how representative the sample is.
Temporal correlation	Represents the time correlation between the year of study and the year of the obtained data.
Geographical correlation	Represents the geographical correlation between the defined area and the obtained data.
Further technological correlation	All other aspects of correlation other than temporal and geographical considerations.

Each of the indicators is given a score from 1 to 5 (1 being the best score). This system provides useful insight into the quality of the data.

Some changes were made to the different data quality indicators. These changes were based on the list of challenges identified by Robinson *et al.* (2013), and included the following:

- The rating scale for **temporal correlation** was adjusted. In LCAs there is quite some flexibility (less than three years difference still makes for a top indicator). Stricter parameters were used for the purpose of undertaking an MFA (a similarly sensitive indicator has been proposed by Strömberg (1997) for LCAs in the pulp and paper industry).
- **Access** was added as a new indicator. This indicator relates to the ease (or difficulty) of obtaining access to the data into the right format. The investment in time and effort to obtain data is not only important for this study, but also for possible future MFA studies in South Africa, and was therefore taken into consideration.
- **Additional steps** is used to indicate how many extra calculations or conversions are required to get the data in the right format.
- **Frequency** provides information about how often the particular dataset is expected to be renewed in the future. This is useful to take into account for future studies.
- **Informality and illegality** covers to which extent informal or illegal flows exist and are measured.
- **Further technological correlation** was removed because the additional indicators covered all important aspects and made this indicator redundant.

The adjusted pedigree matrix used to analyze the data quality is presented in table 4.1. Similar to its application in LCA, the pedigree scores are "semi-quantitative" and serve only as identification numbers. They should not be aggregated, but rather only be used as a reference to better understand the quality of the different data sources.

Indicator Score	1	2	3	4	5
Reliability	Verified data based on measurements	Verified data partly based on assumptions or non-verified data based on measurements	Non-verified data partly based on assumptions	Qualified estimate (e.g. by industrial expert)	Non-qualified estimate or unknown origin
Completeness	Representative data from a sufficient sample of sites over an adequate period to even out normal fluctuations	Representative data from a smaller number of sites but for adequate periods	Representative data from an adequate number of sites but from shorter periods	Representative data but from a smaller number of sites and shorter periods or incomplete data from an adequate number of sites and periods	Representativeness unknown or incomplete data from a smaller number of sites and/or from shorter periods
Temporal correlation	Time period is equal to the period of study	Less than one year of difference to year of study	Less than three years of difference to year of study	Less than five years of difference to year of study	Age of data unknown or more than five years of difference
Geographical correlation	Data from area under study	Average date from larger area in which the area under study is included	Data from area with similar production conditions	Data from area with slightly similar production conditions	Data from unknown area or area with very different production conditions
Access	Publicly and readily available data	Data are not publicly available but can be easily obtained by anyone	Specific effort required to obtain data (e.g. only through formal requests, granted on a per-case basis)	Data are only accessible to very specific users (e.g. government or partner organizations)	Data are only accessible to the organization holding the data
Additional steps	No additional steps involved	Simple calculations or conversion required (easy to repeat)	Simple calculations or conversion required (difficult to repeat)	Complex calculations or conversion required (easy to repeat)	Complex calculations or conversion required (difficult to repeat)
Frequency	New data collected on an annual basis	New data collected every 2-3 years	New data collected every 4-5 years	New data collected every 6+ years	No scheduled data collection interval
Informality and illegality	No illegal or informal flows, or they are fully included	Illegal or informal flows estimated at no more than 5%	Illegal or informal flows estimated at 5%-15%	Illegal or informal flows estimated at 15%-30%	Illegal or informal flows estimated at more than 30% or impossible to quantify

Table 4.1: Pedigree matrix data quality indicators

Chapter 5

Results: MFA

5.1 Introduction

Data on the different material flows were not available for all years initially targeted (2011-2013). Most data were available for 2013, which is therefore taken as a base year for the results of the MFA. More meta information with regards to the data is provided in the next chapter.

This chapter starts with an overview of the different principal sectors that were identified in Cape Town as being relevant to material flows. A brief overview is given of each of these sectors, including a sector description, information on the principal companies, and comments on the different flows in the sector. This section is followed by an overview of the data that were obtained. The different flows are presented one by one (Domestic Material Extraction, Imports, Exports, and Output to Nature), and the indicators are provided. The chapter concludes with an interpretation of the results.

5.2 Industry Profiles

5.2.1 Mining

Within Cape Town, there are some 30 operating mines. These mines mostly supply local building and construction projects rather than moving the mined commodity out of Cape Town. Commodities include sand, clay, and stone aggregate (DMR 2013b).

Despite being surrounded by the ocean, experts predict a lack of construction sand in a few decades (Cole 2014). Only older dunes can be used for mining construction sand (in younger sand the salt content is too high). Suitable construction sand is available in Cape Town (mostly in the Cape Flats), but houses built on top make this resource inaccessible. In addition to construction sand, another type of very fine sand (silica sand) is also found in Cape Town. This sand is used for the production of glass and for foundry purposes. Silica sand fields in Philippi are large and of high

grade, and have been exploited since 1925 (Cole 2003). Fields near Atlantis are used in nearby foundry activities.

Several types of clay are mined in the area. Kaolin is used for ceramics and paper industries (although recently the importance of koalin in the paper industry has been decreasing). Brick clay is mined and used by the construction industry. Plastic clay is used as a supplement in the brick making process (adding plasticity to the bricks).

Stone aggregate is mined from several locations in Cape Town. Principally, granite mines supply road construction works in the area.

5.2.2 Agriculture: Production

Within Cape Town a variety of agricultural areas exist. The most well known is the Philippi Horticultural Area, which is a large, open agricultural area uniquely situated within a residential area in a South African city (Battersby-Lennard and Haysom 2012). However, the Philippi Horticultural Area is only a small part of all agricultural land within municipal boundaries. In 2013, the Western Cape Department of Agriculture Aerial Survey (Elsenburg 2013) identified just over 41,000 hectares of agricultural areas within Cape Town.

In addition to the Philippi Horticultural Area there are 11 other principal areas of production identified in the Agricultural Land Review (CoCT 2008). These areas include Helderberg, Botfontein, Mamre, and Constantia, among others.

Within the urban sections of the city there are also a few small-scale urban agriculture projects. The Oranjezicht City Farm and the urban farming at the Company Gardens are examples of such projects.

A total of 56 different types of crops and other agricultural uses were identified in the aerial survey (Elsenburg 2013), mostly related to the production of cereals, vegetables, and fruits, but also related to livestock raising (e.g. grazing or lucerne used for the production of hay).

The most important agricultural products in terms of hectares planted in Cape Town in 2013 were the following (Elsenburg 2013):

1. Wheat (9,795 ha)
2. Lucerne (7,706 ha)
3. Wine Grapes (5,766 ha)
4. Planted Pastures Perennial (5,143 ha)
5. Canola (3,058 ha)

These five crop types represent 76% of the total area planted.

5.2.3 Agriculture: Trade and Retail

Cape Town is a major hub in the region for agricultural trade. The Western Cape is an important producer of food - principally fruit and cereals - and Cape Town serves as an important hub that connects both international markets and national destinations.

Like other major cities in the country, Cape Town features a fresh produce market. The Cape Town Fresh Produce Market (CTFPM) is located in Epping and turns over around 300 kt of food on an annual basis. The most important products are: (DAFF 2012)

- Potatoes
- Onions
- Tomatoes

The Epping market provides an important role in connecting suppliers and traders from different regions. Producers often transport their produce to the markets that provide the best price, especially if shelf life is not a stressing factor. On a field visit I noticed a large truck offloading onions, which the driver explained came all the way from Mpumalanga, some 1,700 km away.

Local producers sell directly to retailers and other large direct buyers, and use the CTFPM as alternative sales channel. The CTFPM provides a key platform for informal traders, and plays an important role in bringing together the formal and informal sectors (Jackson 2010).

Cape Town's role as a regional hub is seen in the large throughput of agricultural products through the port of Cape Town. In terms of throughput (products that only entered Cape Town without any stop within the city itself), almost 1,700 kt was imported through the port in 2013, and almost 2,500 kt was exported through the port in that same year (GAIN 2014).

The principal throughput imports were: (GAIN 2014)

- Processed foods
- Soy bean products
- Beverages
- Wheat

The principal throughput exports were: (GAIN 2014)

- Fruits
- Beverages
- Processed foods

The formal retail sector in Cape Town - and in South Africa - is dominated by the so called 'big four'. These are four large supermarket chains that are present throughout the country and that account for the vast majority of supermarket sales. These four are:

- Shoprite (also operating Checkers)
- Pick 'n Pay
- Spar
- Woolworth's

Centralized distribution centers are increasingly used to supply the supermarkets. Specific locations of these distribution centers and their coverage can alter material flow patterns in the city.

5.2.4 Agriculture: Processing

The processing of food and beverages is an important economic activity in Cape Town. Activities are diverse and include anything from packaging food to producing beer, and from baking bread to making wine. There are over 500 licensed food processors in Cape Town (Haysom 2014). These include large national and international companies like Simba, Tiger Brands and the Pioneer Food Group, as well as small shops and micro-entrepreneurs.

The food processing industry make food flow accounting in Cape Town a difficult process. There are many products that come into the city as raw materials (for instance as wheat or grapes), but that leave the city in a different shape (for instance as bread or wine). Often, many ingredients are combined and the production process could involve multiple steps in different locations, spanning multiple cities and sometimes several countries. This makes calculation of local household consumption of food based on imports, exports, and local agricultural production near impossible.

Not taking into account throughput of processed foods, Cape Town imports 1,800 kt and exports 3,100 kt of processed food (GAIN 2014). This shows that at least 1,300 kt of processed food is generated in the city, and likely more (as part of it will be consumed within the city boundaries and not appear in freight statistics).

5.2.5 Fisheries

The ocean around Cape Town has traditionally provided important fishing grounds. Commercial fisheries still exist in Cape Town, operating either in deep water far out in the ocean using large commercial vessels, or from the shore using more small-scale, traditional fishing techniques.

Cape town is part of FAO Zone 47, area 1.6. This area also includes Saldhana Bay and Hermanus, among other ports. Fish catch, based on data from the *Fishing Industry Handbook* (Chandler 2013) is reported for this whole region and not further broken down. Expert estimates were used to calculate the Cape Town share in the total catch. Expert estimates were obtained only for the top 10, representing 96% of the total catch (based on mass) in this zone. The top 4 are by far the most important ones, representing 85% of the total.

Top 4 fish species caught in FAO Zone 47.1.6, grouped by fishing method (Chandler 2013):

1. Anchovy (307 kt; Cape Town catch 154 kt)
2. Hake - Deepsea Trawl (115 kt; Cape Town catch 69 kt)
3. Sardine (83 kt; Cape Town catch 42 kt)
4. Round Herring (68 kt; Cape Town catch 34 kt)

Total estimated 2012 catch in Cape Town was 363 kt.

5.2.6 Fossil Fuels

Fossil fuels are one of the largest import flows into Cape Town. Nearly all of these imports originate from international destinations. Year after year, the import of fossil fuels ranks highest in terms of monetary value of imports into the province and city (CoCT 2013b).

Some fuels are brought in as finished product (petrol, diesel, etc.), but the largest flow is crude oil that is refined at the Chevron Refinery, located in the Milnerton industrial area. Crude oil is brought into the city via two different routes. The principal route is through the port of Saldhana, located 120 km north of the refinery. Crude oil is piped directly to the refinery. Alternatively, crude oil lands at the port of Cape Town and is pumped to the depot in Montague Gardens. From here there is a pipeline directly to the refinery as well. The crude oil import split between Saldhana and the Cape Town Port is about 90/10.

At the refinery, crude oil is refined to a variety of different products. The principal products are petrol (gasoline), diesel, fuel oil, and jet fuel (kerosene). Table 5.1 details the total imports, exports, production, and consumption in Cape Town. Imports and exports are based on the data provided by the Growth and Intelligence Network (GAIN), developers of two major national freight flow models (further described as a principal data source in Chapter 5). Production is calculated using the nameplate capacity of the refinery and fuel production breakdown as listed in the study by the CPUT Energy Institute (2014), and using the same split between different products to calculate total production based on crude oil imports. Consumption is calculated by taking the difference between imports plus production minus the exports.

Product	Imports	Refinery Input	Refinery Output	Exports	Consumption
Crude oil	3,929	3,929			
Petrol	469		1,202	576	1,094
Diesel	520		1,174	377	1,317
Jet Fuel	19		482	257	244
Other	134		896	332	697

Table 5.1: Imports, refinery input and output, exports, and consumption of fossil fuels in Cape Town

Year: 2013. Values in kt.

5.2.7 Emissions

Air pollution is an important topic in Cape Town. The City and the general public have long been preoccupied with the air quality in the city. One of the reasons is the occurrence of a blanket of smog on calm days during winter months. This phenomenon, known as the Brown Haze, is caused principally by particulate matters (Walton 2005).

In Cape Town, emissions are caused by the following principal sectors:

- Transportation (vehicles, ships, and airplanes)
- Industry (using heavy oils, coal, gas, and paraffin)
- Households (mainly by using paraffin, gas and wood for heating)
- Power generation (using diesel and kerosene)
- Waste (mainly methane emissions from organic waste)

Name	Owner	Fuel	Installed Capacity (MW)
Koeberg	Eskom	Uranium	1,910
Ankerlig	Eskom	Diesel	1,338
Acacia	Eskom	Kerosene	171
Roggebaai	City of Cape Town	Kerosene	40
Athlone	City of Cape Town	Kerosene	36

Table 5.2: Power plants in Cape Town

Eskom, the national electricity supplier, has been facing great difficulty meeting electricity demand. Widespread power cuts took place in 2010 and again in 2014. These difficulties have forced Eskom to employ backup (peak) power plants for prolonged periods of time. The largest peak power plant in the country is the Ankerlig Power Plant, located in Atlantis in the northern part of Cape Town (Eskom 2014b). Ankerlig has seen significant increases in use in the past years (Eskom 2015). Subsequently, diesel consumption in Cape Town has gone up as well. In addition to the Ankerlig Power Plant there are two other operating power plants situated in Cape Town.

Fuel burning emits several pollutants. These are the pollutants for which information is available: CO_2, SO_2, NO_x, VOCs, and particulate matters (PM_{10} and $PM_{2.5}$). Total emissions were calculated by taking the total quantity of fuel burned, and multiplying it with the relevant emission factors. The results are shown in table 5.3. Emission factors were provided by the Cape Town Air Quality Management Division (see Appendix A for the relevant factors and calculations).

Residential	**Quantity**	**SO_2**	**NO_x**	**VOCs**	**PM_{10}**	**$PM_{2.5}$**	**CO_2**
Paraffin	55,373,336 l	470,673,356	83,060,004	4,983,600	11,074,667	11,074,667	141,866,486,832
LPG	43,634,344 l	436,343	61,088,082	21,817,172	3,054,404	3,054,404	70,600,368,592
Wood	Unknown						
Commerce and Industry							
Coal	168,000,000 kg	3,192,000,000	1,260,000,000	4,200,000	655,200,000	268,800,000	441,000,000,000
Paraffin	16,540,087 l	140,590,740	24,810,131	396,962	1,984,810	1,984,810	42,375,702,894
HFO	33,048,176 l	2,082,035,088	188,374,603	1,123,638	122,278,251	109,058,981	97,591,263,728
LPG	53,330,865 l	449,045,883	62,930,421	N/A	86,396,001	28,905,329	86,289,339,570
Transport							
Petrol	1,286,014,060 l	2,186,223,902	23,148,253,080	46,296,506,160	771,608,436	643,007,030	2,911,535,831,840
Diesel	712,629,743 l	6,627,456,610	4,347,041,432	3,563,148,715	4,703,356,304	4,347,041,432	1,914,836,119,441
Marine fuel	Exported						
Kerosene	Exported						
Power generation							
Ankerlig - diesel	663,582,942 l	560,727,700	2,567,000,000	N/A	4,419,462,394	2,501,707,691	1,783,992,195,000
Acacia - kerosene	11,061,533						
Athlone - kerosene	Insignificant						
Roggebaai - kerosene	Insignificant						
Total g		15,737,193,502	31,742,557,752	49,892,176,247	10,774,415,268	7,914,634,345	7,490,087,307,897
Total kt		16	32	50	11	8	7,490

Table 5.3: Emissions broken down by fuel type and fuel use (2013)

5.2.8 Waste

Waste from the city is mostly landfilled within municipal boundaries. This flow is not taken into consideration in this MFA, as per the Eurostat guidelines. Waste flows of interest are the following:

- Waste from outside Cape Town that is brought into Cape Town for landfilling, composting, or recycling (imports)
- Waste from Cape Town that is taken outside of Cape Town for landfilling, composting, or recycling (exports)
- Illegal dumping (output to nature)

Some waste crosses municipal boundaries because of practical reasons. Because of the size of Cape Town, a landfill in another municipality could very well be situated nearer than Vissershok, and construction companies or other private waste companies could therefore decide to take the load across municipal boundaries. The opposite is also true, causing imports of waste into Cape Town.

Other neighboring municipalities often have no or only limited capacity for landfilling hazardous waste. This waste is brought to Cape Town. In terms of volume, these flows are relatively small. The same applies to recyclable waste. Stellenbosch, for instance, currently exports waste to Kraaifontein in Cape Town for recycling, as the municipality lacks its own recycling facilities. In past years, including much of 2013, another reason for waste crossing municipal boundaries was the difference in tariffs between Cape Town and Stellenbosch. As Stellenbosch offered cheaper landfilling, lots of waste was diverted from Cape Town to Stellenbosch (Haider 2014).

Because there are many different companies involved in waste collection, disposal, and recycling, and because the origin of waste is not known when it it landfilled, it is not possible to reliably quantify these flows. Neighboring municipalities often have less control over their landfill sites than Cape Town. In Stellenbosch, there was no weigh bridge and there were few controls present at the landfill site, making data up until that point very unreliable, for instance (Haider 2014).

5.3 Data Tables

Three data tables present the flows for Domestic Extraction Used, Domestic Processed Output, and Imports & Exports. Where possible, row numbering conventions have been copied from the Eurostat methodology. Whenever there is no data available for a particular listing used in the Eurostat tables, then this row is not shown.

Material Group	Quantity (kt)
1. Biomass	**551**
1.1. Crops (excluding fodder crops)	163
1.1.01. Cereals	35
1.1.02. Roots, tubers	5
1.1.07. Vegetables	48
1.1.08. Fruits	75
1.2. Crop residues (used), fodder crops and grazed biomass	104
1.4. Wild fish catch	284
2. Non metalic minerals	**5,171**
2.1. Aggregate	2,496
2.2. Brickmaking materials	222
2.3. Industrial minerals	213
2.4. Sand	2,240
Total	**5,723**

Table 5.4: Domestic Extraction Used

Material Group	Quantity (kt)
1. Emissions to air	**7,606**
1.01. Carbon dioxide (CO_2)	7,490
1.04. Nitrous oxides (NO_x)	32
1.09. Non-methane volatile organic compounds (NMVOC)	50
1.10. Sulfur dioxide (SO_2)	16
1.14.1 PM_{10}	11
1.14.2 $PM_{2.5}$	8
Total	**7,606**

Table 5.5: Domestic Processed Output

Material group	Imports	Exports	Imports: throughput	Exports: throughput	Total Imports	Total Exports	Trade Balance
1. Biomass and biomass products	**7,071**	**4,433**	**1,677**	**2,463**	**11,211**	**8,573**	**-2,638**
1.1. Crops, raw and processed	1,036	144	250	1,254	2,540	1,647	-892
1.2. Crop residues and fodder crops	0	0	0	0	0	0	0
1.3. Wood and wood products	1,035	612	344	65	1,444	1,021	-423
1.4. Fish and seafood	28	57	71	62	161	190	28
1.5. Live animals other than in 1.4., and animal products	365	28	63	0	429	91	-337
1.6. Products mainly from biomass	4,606	3,592	950	1,081	6,637	5,624	-1,013
2. Metal ores and concentrates, raw and processed	**416**	**512**	**296**	**414**	**1,127**	**1,223**	**96**
2.1. Iron ores and concentrates, iron and steel, raw and processed	24	0	47	30	101	77	-24
2.2. Non-ferrous metal ores and concentrates, raw and processed	9	0	0	2	11	2	-9
2.3. Products mainly from metals	383	512	249	382	1,014	1,143	129
3. Non-metallic minerals, raw and processed	**2,281**	**1,107**	**560**	**110**	**2,951**	**1,777**	**-1,174**
3.01. Marble, granite, sandstone…	467	581	1	1	469	583	114
3.04. Chemical and fertilizer minerals	659	417	452	22	1,133	892	-242
3.05. Salt	19	17	24	4	48	45	-3
3.06.1. Gypsum	83	8	0	0	83	8	-76
3.06.2. Limestone	147	0	0	0	147	0	-147
3.09. Other non-metallic minerals n.e.c.	44	49	9	47	100	105	5
3.11.1. Bricks	34	35	0	0	34	35	1
3.11.2. Cement	827	0	73	36	936	109	-827
4. Fossil energy materials/carriers, raw and processed	**4,986**	**1,005**	**536**	**1**	**5,524**	**1,543**	**-3,981**
4.1. Coal and other solid energy products, raw and processed	454	0	0	0	454	0	-454
4.2.1. Crude oil, condensate and natural gas liquids (NGL)	3,929	0	0	0	3,929	0	-3,929
4.2.2. Gas	7	0	0	0	7	0	-7
4.2.4. Petrol	172	280	297	0	469	576	108
4.2.5. Diesel	328	185	191	1	520	377	-143
4.2.6. Jet fuel	0	238	19	0	19	257	238
4.2.7. Other Petroleum Products	97	303	30	0	127	332	205
5. Other products	**827**	**1,172**	**470**	**53**	**1,351**	**1,695**	**344**
5.1. Textile Products	120	180	103	13	236	297	61
5.2. Pharmaceutical Products	29	121	18	3	51	143	91
5.3. Other Manufacturing Industries	678	870	349	37	1,064	1,256	192
Total	**15,582**	**8,229**	**3,540**	**3,042**	**22,163**	**14,810**	**-7,353**

Table 5.6: Imports and exports

5.4 Balances and Indicators

Data were obtained for most of the material groups, but data on some specific flows have not been acquired (for instance, several domestic processed output flows). However, in overall mass these flows are expected to be negligible and indicators calculated based on the available data are likely a good representation of the material flow pattern of Cape Town.

Table 5.7 provides a list of balances and indicators based on the gathered data.

	Excluding throughput		*Including throughput*	
Indicator	**Value (kt)**	**Per capita (t)**	**Value (kt)**	**Per capita (t)**
Domestic Extraction Used	5,889	1.53		
Imports	15,582	4.04	22,163	5.75
Exports	8,278	2.15	14,860	3.86
Domestic Processed Output	7,606	1.97		
Direct Material Input	21,471	5.57		
Domestic Material Consumption	13,193	3.42		
Physical Trade Balance	−7,304	−1.90		
Direct Material Output	15,884	4.12	22,466	5.83

Table 5.7: Balances and indicators for Cape Town

5.5 Interpretation

The Cape Town MFA yields a variety of interesting results that can be contrasted with other cities, and that can provide insight into resource flows that exist in the city. This section will interpret the results, discuss what they mean, and where possible draw conclusions about the sustainability of the city.

5.5.1 Principal Material Flows

The different flows in Cape Town paint the picture of a unique city. Significant commercial and trade flows are combined with mining and agricultural activity within the city boundaries. Even though in terms of mass the volume of agricultural extraction is dwarfed by mineral extraction, the production of crops (158 kt) make up 18% of the total crop consumption (892 kt), and 6% of the total biomass consumption (2,638 kt) in Cape Town[1]. Interestingly, the actual surface area used for the production of fruits and vegetables is just over half the size of that of cereals (6,128 ha versus 11,048 ha), yet the production is over twice the quantity compared to that of cereals. This highlights the importance of using the top-level MFA balances to understand main metabolism

[1] In these calculations, I am taking the trade balance as the equivalent of consumption, which may not be exactly right (especially for materials that are being recycled, in which case consumption would be higher than just the trade balance). However, it is the best estimate available with my data and likely for many flows a reliable proxy.

flows, while also analyzing the underlying data. The strength of quantifying resource flows into a single column of numbers comes at the expense of losing nuances that underly the dataset, but a thorough and standardized approach to collecting and presenting data makes it also possible to explore and understand these equally important details.

Exports of fish and seafood amount to 57 kt, which is around 20% of the total catch. The remainder is split between local consumption and further processing (after which the fish and seafood would be classified as "Products mainly from biomass").

Processed foods are the largest export group, amounting to 3,120 kt (38% of all exports). Textile and other manufacturing exports total 1,050 kt (13% of all exports). This demonstrates the importance of Cape Town as a place where products are further processed and produced from raw materials and semi-processed products.

The resource patterns for non-metallic minerals show the importance of cement for Cape Town in terms of imports. Importing an annual 827 kt, this is more than half of all non-metallic mineral imports. Together with the large local extraction of aggregate and sand, the dominant driver seems to originate from the construction industry and the production of concrete. For metallic minerals the flows are much smaller. However, it is interesting to note that Cape Town is a net exporter of products made mainly from metal. The reason for this is found in the large quantity of scrap metal exports (233 kt), offsetting the net imports of other metal groups.

Fossil fuels are the second largest import category. Crude oil imports are the principal import in this category, but Cape Town also imports processed product. Cape Town is the distribution center for fossil fuels in a large area in the Western Cape, which explains why there are net exports out of Cape Town for several products (petrol, jet fuel, other products). Net diesel imports are a result of the increasing demand from the Ankerlig Power Station (Eskom 2015).

Emissions to air are dominated by CO_2 emissions, which is common in other MFA studies (Eurostat 2013, p. 72). Even though CO_2 emissions dwarf other gas emissions, this does not mean these other outflows should be ignored. In the latest IPCC Direct Global Warming Potentials, the 100 year global warming potential of methane is calculated to be 21 times that of CO_2. Nitrous oxides is 310 times as potent, and some compounds have an impact thousands of times larger than CO_2 (Hartmann *et al.* 2013). In addition to global warming, particulate matters are a direct threat to human health, and contribute strongly in Cape Town to the brown haze. This again demonstrates the importance of a nuanced interpretation of the material flows.

5.5.2 Comparisons with Other Studies

In this section, the results of this Cape Town MFA are compared with similar studies. To make comparison possible, Eurostat-based MFA studies have been selected from the large variety of urban metabolism studies. One of the most detailed urban Eurostat MFA studies is the one undertaken by Barles (2009) on Paris and its regions. The data is furthermore compared with material consumption measured in the study of Hammer *et al.* (2003b) on Hamburg, Vienna, and Leipzig[2]. Finally, partial

[2]Rather than comparing the municipality of Cape Town with the urban core of Paris, my data is contrasted with Paris and its dense urban *Petite couronne suburbs*, or PPC, in Barles' study), which are a better match in profile and area to my study area. The same applies to the data on Hamburg, Vienna, and Leipzig, where indicators were calculated on several levels. The comparison is made with the "urban area" rather than the city center. Data is replicated in the same form as presented by Barles (2009).

	Hamburg	Vienna	Leipzig	Paris	Cape Town
Year	2001	2001	2001	2003	2013
Total population (million)	3.26	2.12	1.09	6.32	3.85
Total km^2	8,616	4,596	4,386	762	2,461
Density (capita/km^2)	379	461	249	8,295	1,564
Domestic Material Consumption	11.4	8.8	25.3	4.6	3.4
Domestic Extraction Used				0.0	1.5
Imports				11.0	4.0
Exports				7.9	2.2
Domestic Processed Output				4.3	2.0
Physical Trade Balance				-3.1	-1.9
Domestic Material Output				12.2	4.1
Domestic Material Input				11.0	5.6

Table 5.8: Comparison between Cape Town, Paris, Hamburg, Vienna and Leipzig. All indicators are t/cap.

results from two other studies are also contrasted with my data: the analysis of stocks and flows in Cape Town by Gasson (2007), and the urban metabolism study on Bogotá (Alfonso Piña and Pardo Martínez 2014). It is important to note that the other Eurostat studies included more material flows than my study. Although all major flows are included, the Cape Town flows exclude several minor flows (especially those emitted to nature).

Most figures are lower for Cape Town than they are for Paris. Domestic Material Consumption (DMC) in Cape Town is significantly lower at 3.4 t per capita (versus 4.6 t in Paris). Whereas there is no domestic extraction in Paris, Cape Town extracts 1.5 t per capita. Despite its role as a harbor city, Cape Town imports and exports are half of those in Paris, and exports are 2.2 t per capita in Cape Town versus 7.9 t in Paris. The significantly higher material flows in Paris likely result from a structural difference in the metabolism of a strongly developed and industrialized city in comparison to a city in a developing country. When DMC is compared to the other cities (Hamburg, Vienna, and Leipzig), the contrast is even starker.

CO_2 emissions in Cape Town have strongly increased since the Gasson study, and are 2 times higher than per-capita CO_2 emissions in Bogotá. However, if the impact of the Ankerlig Power Station is taken out, per-capita emissions are 1,481 kg per capita for 2013, which is 15% lower than the Gasson study. Compared to Bogotá, emissions are still significantly higher, even without the impact of Ankerlig. Alfonso Piña and Pardo Martínez (2014, p. 36) report that substitution of coal by natural gas descreased the impact of emissions in Bogotá, which could partially explain the difference. There is a very large difference between NO_x emissions in Bogotá (287.8 kg per capita) and both Cape Town studies (9.5 kg and 8.2 kg per capita), which should be further explored. Most emissions in both cities are caused by transportation, which could imply that Bogotá enjoys a larger use of public transportation or non-motorized transit, less kilometers traveled per vehicle, or a combination of these factors.

	Bogotá	Cape Town	Cape Town	Cape Town Difference
	2010	1996	2013	2013 vs 1996
CO_2	897.2	1,736.3	1,944.4	12%
CO	174.2	N/A	N/A	N/A
NO_x	287.8	9.5	8.2	-13%
SO_2	4.6	10.7	4.1	-62%
PM_{10}	2.5	3.9	2.8	-28%
$PM_{2.5}$	N/A	2.0	2.1	1%
VOC	N/A	18.4	13.0	-30%
Total	**1,366.3**	**1,780.9**	**1,974.5**	**11%**

Table 5.9: Comparison of emissions between Bogotá and Cape Town (kg per capita)

5.5.3 Sustainability of Cape Town's Metabolism

Barles (2009, p. 911) notes that DMC in highly developed urban centers (in contrast to the wider urban sprawl) are relatively low because *material saturation* takes place: the built environment simply does not allow for much additional construction within the urban system. This implies that cities in developing countries undergo a pattern of increasing material consumption as they develop and expand, which is then followed by a decrease in material consumption. If Cape Town is still in its developing phase, then a strong increase in material consumption could be expected in the years to come. This trend is already evident from the strong growth in per-capita food consumption and oil imports since the Gasson (2007) study [3].

While increased food consumption could be seen in a positive light if it means malnourished segments of the population consume more food, increased fossil fuel consumption and emissions should undoubtedly be of concern to the City of Cape Town. The important role of the Ankerlig Power Station in fuel consumption and emissions makes it clear that the electricity crisis in South Africa strongly affects material resource patterns in Cape Town. However, while scaling down use of this peak power plant would benefit Cape Town's consumption and emission profile, a structural reduction of nationwide electricity generation emissions can only be achieved if a significant change is made to the electricity generation mix (currently most of Eskom's base load power stations run on coal (Eskom 2014b)).

To truly understand material consumption and better grasp the level of sustainability in Cape Town, trends need to be observed over a period of several years. Furthermore, related studies in nearby regions will enhance the understanding of the Western Cape as a whole rather than just Cape Town. More comparative studies should be undertaken in developing cities, using the same methodology, to allow for proper comparisons. Understanding the reasons behind material flow data is equally important, as particular factors (like abnormally high diesel consumption by one power plant in the area) could have a strong impact on the indicators.

[3] It is important to note that all numbers from the Gasson study were based on data that is over a decade old and a different methodology was used. These numbers should be considered interesting for an initial comparison, but true comparisons should be made with recent studies using the same methodology.

Chapter 6

Results: Understanding Challenges

6.1 Introduction

This chapter describes the process behind the MFA, and specifically behind the data collection phase. These results provide insight into how time was spent, how the data quality indicators rank for the different data sources, and what other challenges were encountered.

The first section provides an insight into time spent from different angles. The global overview provides a high-level overview, distinguishing between different types of contacts (government, academia, and the private sector), and the different activities (communication, reading, calculating, etc.). This is followed by an in-depth view of each of the data quality indicators. The main time sinks are described one by one in the third section. The last two sections reflect on what I did right, and what I did wrong, ending the chapter with two boxes that outline challenges surrounding data availability.

6.2 The Data Collection Process

The data collection process started after I read the related literature and I examined the Eurostat framework. At that point, aside from superficially scoping Cape Town data, I had not yet made a serious attempt to collect any information. The only work done was consultation of official government publications to look for urban scale material flow data - which I soon concluded were not available.

Basic functionality of the OMAT (Online Material flow Analysis Tool) software was developed before I started collecting data (as I would use OMAT to track all the activities). Throughout the data collection process, I expanded and improved OMAT in accordance with my needs and wishes.

At the onset, I scheduled 8 weeks for collecting data. This, however, was not nearly enough time. I ended up spending 22 weeks on the data collection process, continuing even during the write-up of this work. There are several reasons for this extended time frame:

- Barely any data could be directly obtained from public documents. Human interaction in the form of meetings, e-mail exchanges and phone calls were fundamental in acquiring data. Locating the right people and engaging in these conversations takes a lot of time.
- It was not possible to use all my time efficiently. Most people I met were engaged in full time jobs and had limited available time. It was therefore important to be flexible with regards to scheduling meetings, and I also considered it important to pad meetings with enough time for possible extensions or transportation delays. This strategy was useful to maximize the meeting output, but it came at a productivity cost. I generally work best if I have large blocks of undisturbed time that can be dedicated to a specific task. Being subjected to last-minute calendar changes and fragmenting my work days were the price I (gladly) paid for meeting with valuable contacts.
- External engagements made for work weeks of less than 40 hours. In part this was because of my own (other) priorities. However, even if I had fewer other engagements I am not sure if increasing the amount of time collecting data would have been productive. The fragmented nature of the work and the high variety of tasks involved made it quite taxing, so a longer, part-time process instead of shorter, full-time engagement may actually have been a good strategy. Moments of reflection also sparked new ideas and the longer time period helped foster better relationship with contacts.
- After having collected the principal material flow statistics, I spent several weeks on cross-checking these numbers. This could arguably be called "data checking" rather than "data collecting". It often involved contacting experts and requesting them to review the numbers. I originally planned to suspend all data collection activities after a specific period of time, but I felt it would be best to continue these data verification efforts, especially because the time spent on this was relatively little and the added value was high.

The full period between the official start of the formal data collection process and the last step of data verification extended from August 26, 2014 until February 21, 2015. The two weeks around New Year I barely spent time on data collection, nor did I spend significant time during two other weeks early 2015, so even though this period covers 26 weeks, it effectively included a period of 22 weeks.

During the data collection, a total of 1676 separate activities were logged. Each individual session was logged, with hugely varying times spent on each session. For instance, a quick "Thank you" e-mail could take less than a minute, whereas reading through a long report or meeting with a contact person could take over an hour. The large number of individually registered activities makes it possible to get useful average times, as illustrated in figure 6.1.

A total number of 663 contacts and 222 documents were added to the database. However, the number of contacts and documents I followed up on in any way were less than half of this (325 and 86, respectively). This was mostly due to prioritization of the most promising leads.

Prioritization of leads was done based on several parameters. If any (or several) of these parameters were met, then I would prioritize that particular lead. The following factors encouraged prioritization:

- Multiple referrals: if several people recommended me to contact someone, then this person would be prioritized.

- High-level insights: any lead that could potentially provide data or insight into a whole industry or a large range of materials would be prioritized over people with expertise in a particular niche or single material.
- Variety: I attempted to increase variety of my contacts, so I would prioritize people from organizations or divisions that I had not yet contacted.
- MFA experience: there were not too many people with experience in undertaking MFA-related studies on Cape Town. I would therefore automatically prioritize those that did have experience undertaking similar research.

Time: **344:40 h** | Contacts: **324** | Sources: **86** | Assists: **14** + **4** (contacts + sources)

Activity	Time	Quantity	Average time
E-mails	70:22 h	944	4 min
Meetings	58:15 h	68	51 min
Transportation	46:43 h	76	36 min
Reading	46:23 h	119	23 min
Background research	42:55 h	217	11 min
Calculating	39:36 h	62	38 min
Admin	36:12 h	122	17 min
Phone calls	4:14 h	68	3 min

Nature of work	Time
Acquiring data	98:42 h
Unspecified	79:15 h
Obtaining referrals	60:03 h
Cross-checking data	57:50 h
Understanding industry	48:50 h

Figure 6.1: Breakdown of activities

6.2.1 Engaging in Conversation

By far most time was spent engaging in direct conversation with people through e-mail communication, meetings, and phone calls. E-mail was my principal method of contacting people. I sent a total of 944 e-mails, which took about the same amount of time as the 68 meetings I had.

E-mail was used for several purposes:

- Discussing data: asking for data or asking if someone knew where I could find more information was very useful to do via e-mail.
- Locating the right person: I would often e-mail an organization (or a specific person in the organization) and check exactly whom I should contact to discuss a particular topic.

Mode	Total distance	Total time	Average speed	Number of journeys
Car	1,052.7 km	22:56 h	45.9 km/h	32
Bicycle	370.6 km	21:56 h	16.9 km/h	42
Train	32.0 km	1:51 h	17.3 km/h	2

Table 6.1: Transportation distance and time

- Arranging meetings: checking availability and discussing logistics with regards to meetings.

I found e-mail very suitable for these activities as it allowed the people involved to answer my questions when it suited them. There was also minimal active waiting time for me (i.e. while waiting for an answer I could do other things, unlike a phone call where you wait on the line while people get hold of the right person). I could also send out similar e-mail requests to many different recipients using a template I minimally adjusted each time it was sent.

Phone calls were generally not an efficient way of contacting people. I used this mostly as a last resort if the person I tried to contact did not answer e-mail, or if it seemed to be the easiest way to obtain a particular name or other piece of information. I made several attempts to request data from companies over the phone, but this soon turned out to be less efficient and effective than e-mail.

I set up meetings with people for several reasons. In the beginning of the process I tried having meetings with people who were well-connected. One of these people used the term "data broker" to make it clear that he himself could not directly provide me with data but he should rather be seen as a middleman; as someone who could tell me where data could possibly be found (Cartwright 2014). This term was quite appropriate for most of the people I met at the beginning. Through the "data brokers" I scoped the different fields and industries and better understood where information could (and could not) be found.

A significant amount of time was spent on the road. Transportation to and from meetings took 46:43 h. Table 6.1 sumarizes the total number of journeys per transportation mode.

6.2.2 Interacting with Documents

The data points were most likely to be found in publications, statistical reports, or in spreadsheets. Not only for that reason, but also because there were many leads to be found in documents, did I download and collect lots of reading material.

Each reading or calculation session was individually recorded, which is why there are more individual reading and calculation sessions (119 and 62 respectively) than there are documents (86 in total). The average time of sitting down and doing calculations was significantly longer than each reading session (38 min versus 23 min).

The documents I came across were rather varied. Some of the most interesting documents included a field study on how "bush doctors" harvest wild medicine at Table Mountain National Park, technical fact sheets of power plants, instructions on how to produce hay from lucerne (alfalfa), and a presentation on the process of converting coal to liquid fuels. In terms of size the documents also

varied hugely: from one-page documents to books or PDF files with hundreds of pages. As time went by I became more efficient in skipping the unrelated parts and heading straight to the relevant sections. However, deviating from the straight route to potentially relevant tables and figures also has its value. I often found new leads and sources I had not thought of using because I was reading introductory chapters or sections only remotely related to what I was looking for.

Large repositories were often difficult to navigate, especially those lacking a centralized index. Just finding out which documents exist, and how to obtain them, could be surprisingly difficult (as illustrated in Box I).

Box I: Surprisingly Difficult: Locating City of Cape Town Documents

Locating documents at the City of Cape Town was a challenge. The lack of a central repository, or at least a centrally held register with all City documents, made it very difficult to grasp which documents were available, and how to get hold of them. The most logical place for such a repository would be the website of the city (http://www.capetown.gov.za). However, at the time of my research this website was not kept up to date and did not include a logical or centralized place for the city's documents. The "City documents" section of the website featured a "Reports" section where such reports would logically be stored. However, other than financial reports this section only contained outdated information (the most recent publications in "Transport/Traffic reports" and "Other reports" dated back to 2005).

It was more productive to review each division's website and to look for downloads, to use an internet search engine and search for the document title, or as a last resort to request it directly from the division. One very useful but hard-to-locate publication was the *Economic Performance Indicators for Cape Town* (EPIC) report series, produced by the Economic Information and Research Unit within the Department of Economic Development.

The search for this document unfolded as follows. After locating the website of the Department of Economic Development, I found a section dedicated to Publications. Unfortunately, in November 2014 the most recent publication was the Q3 2013 edition of the *State of the Cape Town Economy* (this is the predecessor of the EPIC report series). The EPIC report was not mentioned whatsoever in the Publication section of this department (much less in the central Reports section of the City's website).

A search within the website of the City of Cape Town with the keywords "Economic Performance Indicators" yielded five results. There were three media releases, one speech, and one published report that all referenced recent EPIC reports. Unfortunately, none of them provided a link to this report. Interestingly, one of the media releases makes mention to two different EPIC projects. One is the reference to the "Economic Performance Indicators for Cape Town" report I was looking for, but the other referred to a "flagship technology programme" called "Emergency Policing and Incident Command" or "EPIC" in short. Naming conventions also do not seem to be centralized at the City of Cape Town.

Through internet search engines I was ultimately able to locate several editions of the EPIC report. The actual files were accessible through third party websites, and not through the official City of Cape Town website. However, the Q3 2013 report proved impossible to locate online, despite several references to this same document. I resorted to e-mailing the relevant division. Within 12 minutes of having sent this e-mail, I received the requested report plus a newer edition, and I was signed up to a mailing list that the Department of Economic Development has in place to alert people of new publications. When Q2 2014 was published, I promptly received this document in my e-mail.

There did not seem to be a lack of willingness or capacity at the City to distribute documents. However, there does seem to be a lack of coordinated effort in managing and distributing these documents, with the principal point of weakness being the official website of the City. Contacts I spoke to at the City were also aware of this issue, and reported that a website reconstruction is underway (Davison 2014).

6.2.3 Admin and Background Research

Not all of the work was directly related to getting the numbers I was looking for. Administrative work and background research are the two activities not directly linked to finding relevant information. However, time spent on this was not insignificant (36:12 h on admin and 42:55 h on background research), and these activities were an important part of the process.

Background research consisted in part of improving industry knowledge: trying to figure how each industry worked in terms of major players, important material flows, and interaction within the industry. This work took about 13 hours and was very useful in better understanding each industry and identifying gaps in my knowledge about it. It also included finding out more details about people or organizations before I would be in touch with them. Locating names, e-mail addresses, and phone numbers was part of this work. Often I was recommended people or organizations to contact, and finding out who exactly they were was an important step in estimating their relevance to my work. It also allowed me to ask more useful questions or to contact the right people from the start.

Admin tasks can be split in two main activities: planning and data entry. Planning activities included going over the contacts each day and revising those marked as high priority or awaiting responses. Data entry involved dedicated periods to enter information into the system. On a daily basis I would enter information as I would meet people, read documents, and collect data. On a daily basis I would *not* record the time investment of logging information about how I spent my time (there is little added value in registering this marginal overhead time investment). However, at several moments I restructured the databases and decided to introduce a new tag or a new structure of classifying contacts. This would require me to go over hundreds of contacts to review their information and possibly re-enter some data. These longer, dedicated blocks of "data entry" are the ones that I did monitor, and they amounted to about 4 hours within the administrative activities. Time spent on setting up the OMAT system was more substantial but arguably not part of the actual data collection process and therefore excluded from this section. Details of development time can be found in appendix H.

6.2.4 Overview by Contact Group

This section summarizes engagement with the five main contact groups (academia, private sector, and three governmental groups). Time spent on and results obtained from the different sectors varied strongly. For instance, the City of Cape Town yielded more assists than academia, but at a fraction of time invested. The City was therefore a very efficient source for referrals, despite the lack of actual data available from the City. Industry understanding came mostly from academia and the private sector, and most time spent on national government was used for calculating (which unfortunately did not yield productive results).

Figure 6.2 provides a breakdown of the different activities, split by contact group.

Table 6.2 provides an overview of the main contacts in each group, as well as a summary of the principal findings or characteristics of that group. A more detailed report can be found in Appendix D.

Sector & Principal Contacts	Summary
Academia: Top 3 organizations: • University of Cape Town (UCT) • University of Stellenbosch • Council Scientific & Industrial Research (CSIR) Principal university departments: • Environmental and Geographical Sciences • Transportation • Economics • Chemical Engineering • Architecture, Planning and Geomatics • Engineering and the Built Environment	• Significant time was spent on meetings and reading. • Meetings were a bit shorter than average and easy to arrange, especially at UCT. • Mostly useful for referrals to people at the City and other academics. • Referrals were made mostly within the same discipline or field of work. • CSIR was useful to connect with the private sector. • Browsing South African journals was useful to scope the private sector obtain new leads.
City of Cape Town: Divisions I interacted with included the following: • Air Quality Management • Development Information and Geographic Information Systems • Economic Development Department • Energy, Environmental & Spatial Planning • Environmental Resource Management Department • Metropolitan Spatial Planning • Solid Waste Management • Transport Planning and Policy	• Transportation and reading were relatively high time investments. • City government is scattered: both in office distribution and in organization and production of information. • Official documents were lengthy, and meetings hard to arrange. • Understanding what information exists, where it is, and which division is responsible for it was the biggest challenge. • The City had no actual data but was nonetheless instrumental in understanding Cape Town and linking with data providers.
Provincial Government: • Department of Agriculture (Elsenburg) • Department of Economic Development & Tourism (DEDAT) • Department of Environmental Affairs and Development Planning (EADP) • Department of Transport and Public Works • Department of the Premier • GreenCape • Provincial Treasury	• In general, provincial government was very responsive via e-mail and available for meetings. • GreenCape is undertaking related resource flow research projects was key in identifying and connecting with data providers. • Elsenburg had by far the most useful data about agriculture in Cape Town, in addition to a great disposition to assist.

National Government: • Department of Agriculture, Forestry and Fisheries (DAFF) • Department of Energy (DoE) • Department of Environmental Affairs • Department of Mineral Resources (DMR) • Department of Trade and Industry (dti) • Eskom • Transnet • National Energy Regulator of South Africa (NERSA) • South African Revenue Service (SARS) • Statistics South Africa (Stats SA)	• Large time investments in calculations, reading, and background research. • Most time was spent on the SARS dataset and DoE fuel sales volumes - both presenting reliability challenges. • Responsiveness varied greatly between institutions (SARS and DAFF very responsive; Stats SA and NERSA unresponsive, for instance).
Private Sector: • Consultancy firms • Non-governmental organizations (NGOs) • Public sector related organizations • Data repositories • Industry associations • Industry leaders in specific sectors	• Consultancy firms were great for industry understanding and referrals (Sustainable Energy Africa and The Green House). • NGOs were useful for specific niche expertise (Sustainable Livelihood Foundation and Ndifuna Ukwazi) • Most industry associations provided industry statistics. • Government-linked organizations yielded useful referrals (WCEPD and Wesgro).[1] • Data agreggators offered expensive datasets with little added value (Quantec). • Bottom-up verification of private sector imports and exports proved ineffective.

Table 6.2: List of principal contacts divided by contact group

[1]Some of these organizations are funded by government but operate as independent companies, blurring the line between public and private sector. These organizations were classified as private sector organizations.

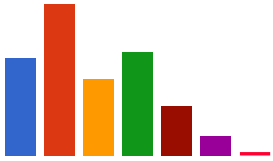
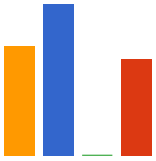
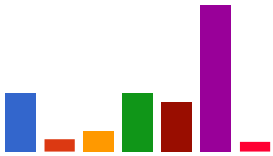
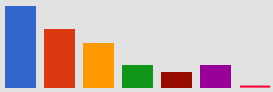
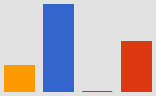
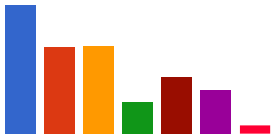
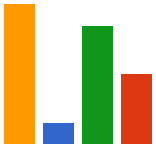
Sector	Total time	Activities	Assists: people	Assists: documents	Nature of work
Academia	85:28 h		3	2	
City of Cape Town	32:08 h		5	2	
National Government	60:42 h		1	0	
Provincial Government	43:18 h		2	0	
Private Sector	75:14 h		3	0	

Figure 6.2: Detailed breakdown of activities

Legend: Activities

- E-mails
- Meetings
- Transportation
- Reading
- Calculating
- Background research
- Phone calls

Legend: Nature of work

- Acquiring data
- Obtaining referrals
- Cross-checking data
- Understanding the industry

6.3 Analysis of Data Quality Indicators

This section will analyze the quality of the five principal data sources. The sources are grouped by type of flow (domestic extraction, imports & exports, and domestic processed output). For each source a short profile will be followed by a discussion of the eight different data quality indicators, accompanied by a score (shown on the right hand side) for each indicator. Ratings range from 1 (indicating high quality) to 5 (indicating poor quality). See table 4.1 for a full description of the ratings. The section finishes with a conclusion that summarizes these findings.

6.3.1 Domestic Extraction

Elsenburg Aerial Agricultural Survey

This survey done in 2013 by Elsenburg was the first one of its kind. An aerial survey of the whole of the Western Cape was undertaken, mapping all agricultural production in the area. The data was gathered for several purposes, mainly related to rural development spatial development frameworks (Wallace 2015). The results were made available on a website called the Cape Farm Mapper [2], which allows users to explore agricultural land use within the Western Cape using online GIS software.

Reliability	The aerial survey is based on measurements. However, data is not fully verified (some crops could be misidentified as no ground checks are done). Furthermore, agricultural extraction in terms of mass are based on various assumptions about yields and grazing activities that may not be fully accurate.	3
Completeness	This is just one snapshot in time (on the day the photos were taken), which is why this survey scores low in completeness.	3
Temporal corr.	The survey was done in 2013.	1
Geographical correlation	The full scope of the dataset is the Western Cape. Because the data are logged using GIS software, Elsenburg could provide a dataset matching municipal borders.	1
Access	Although the GIS maps were publicly available, the underlying data were not publicly available. However, this information was provided by Elsenburg promptly after the first request, and upon request the data would be provided in a similar format to others as well (Wallace 2015).	2

[2] URL: http://www.elsenburg.com/gis/apps/cfm/

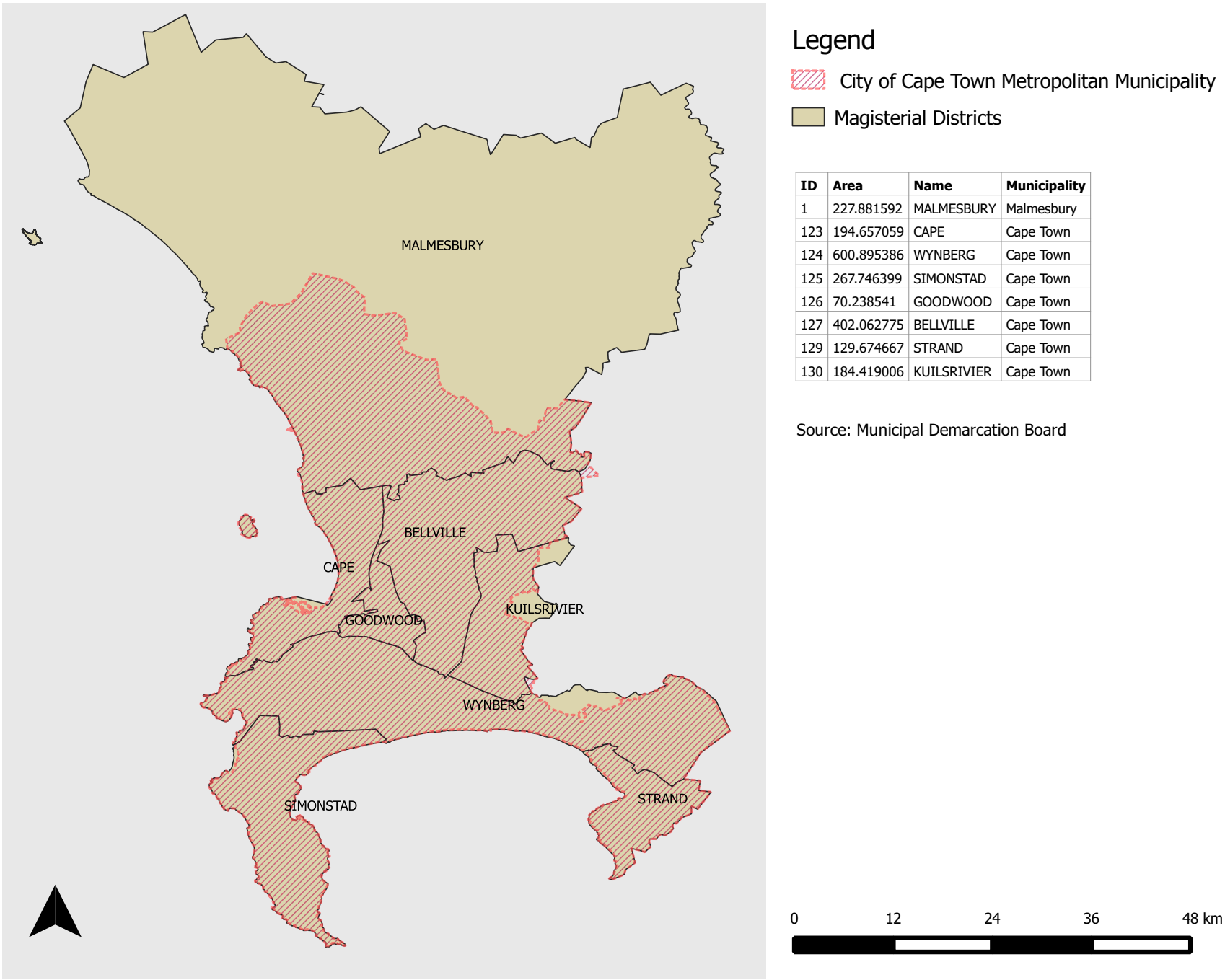
Additional steps	The dataset consisted of a spreadsheet with total hectares planted for each identified crop type. In order to convert these values into material extraction, I had to find corresponding yields for each of the crops. This turned out to be a time-consuming activity. Yield information had to be acquired from many different sources including industry associations, government publications (DAFF provided yields on some crops), and industry experts. There were 56 different crop types and agricultural uses identified within Cape Town, which was too much to handle within the scope of my research. I therefore focused on the top 25 products, representing 99% of the total area and cut my work in less than half. Through industry associations I could find yields for most of the fruits and wheats, but vegetables required expert insight. Other difficult yields were the ones for grazing or livestock-related agricultural fields. Again, industry experts were used to estimate the total production (most of these experts were from Elsenburg, as they were better informed about the situation in the Western Cape than national experts). Because yields vary every year, and many of these yields are not published but require personal communication, it will be a time-consuming process to repeat.	5
Frequency	It is proposed to repeat this exercise every 4-5 years, budget permitting (Wallace 2015).	3
Informality and illegality	Small, informal farmers are difficult to include, especially if their plots are not of a substantial size and do not border other agricultural plots (e.g. urban vegetable farming). The areas that are not mapped are not expected to exceed 5% of the total area (Wallace 2015).	2

Department of Mineral Resources Statistics

All legally operating mines in South Africa report their annual production to the Department of Mineral Resources (DMR). National data is published every year and in the Mineral Statistical Tables data is broken down by province. However, data is not published on any level below provincial level, so a special request had to be made to acquire data for Cape Town.

Reliability	Mines are under a legal obligation to measure and report extraction of resources. DMR staff evaluates and validates the data received (DMR 2013a). On occasion mines could report incorrect numbers, but I consider the data in general reliable.	1
Completeness	Data covers all mines and takes into account production throughout the whole year.	1
Temporal corr.	Data were provided for 2013.	1

Geographical correlation	DMR groups mines by magisterial district, which do not fully overlap with municipal boundaries. I was asked to indicate exactly what to include, so I reviewed the location of all the mines in Malmesbury (which is the magisterial district located partially inside Cape Town), and came to the conclusion that there were three mines that did belong to the municipality of Cape Town. My data request included all magisterial districts that are located within Cape Town, plus these three mines.	1
Access	I initially tried to obtain information on municipal level by e-mailing DMR directly and requesting this information. To protect confidentiality of individual mines, no data was provided. After further engagement with DMR the specific gatekeeper was identified, and a more formal request was submitted. This request was then granted, and the data were extracted after the monthly DMR batch run during which mining data are processed.	3
Additional steps	To ensure full geographical correlation, I had to obtain addresses or GPS locations of different mines. This proved cumbersome, as many addresses were rather vague and not understood by regular mapping software (for instance, only the Erf number was provided). Furthermore, to guarantee confidentiality of individual mines, DMR aggregated statistics of particular commodities that only one or a few mines produce. This also made it necessary to revise the commodity groupings used for my MFA. Overall, these steps took quite some time. However, over the years only minor changes can be expected in the location of mines and commodities mined, which makes it easy to repeat the exercise.	4
Frequency	Data are collected on an annual basis.	1
Informality and illegality	Some mining takes place within Cape Town without permits. Principally, sand is taken from public areas and sold to the construction industry. Compared to the formal mining activities, this is a minor flow (Purves 2014).	2



ID	Area	Name	Municipality
1	227.881592	MALMESBURY	Malmesbury
123	194.657059	CAPE	Cape Town
124	600.895386	WYNBERG	Cape Town
125	267.746399	SIMONSTAD	Cape Town
126	70.238541	GOODWOOD	Cape Town
127	402.062775	BELLVILLE	Cape Town
129	129.674667	STRAND	Cape Town
130	184.419006	KUILSRIVIER	Cape Town

Figure 6.3: Mismatching municipal borders and magisterial district borders
(GIS map made using shapefiles provided by the UCT GIS Lab)

Fisheries Data

The *Fishing Industry Handbook* (Chandler 2013) is an annual publication by George Warman Publications. It has been published for over 40 years and includes a large variety of fishing industry data including fish catch, imports and exports, fishing vessel details, and fishing company listings. The book can be obtained by purchasing the book and the CD, at a listed price of R1,290 (George Warman Publications 2015).

Fish catch is listed by FAO Area. Cape Town forms part of the Cape of Good Hope Area (47.1.6), so the total fish catch for this area was extracted from the handbook. These numbers were then combined with estimates from local fisheries experts (Serge Raemaekers (2014) from UCT and Tim Reddell (2015) from the Viking Fishing Group), who estimated which share of each fish species was landed in Cape Town. This was done for the top 10 species, representing 96 % of total catch (see more details of the calculations in Appendix C).

Reliability	Data is not fully verified for each landed vessel. Furthermore, not all fishing vessels measure total catch in mass, so part of the data are based on assumptions.	3
Completeness	Fish catch is measured throughout the year and attempts are made to include all fish catch.	1
Temporal corr.	The latest data available to me dated from 2012.	2
Geographical correlation	Fishing Area 47.1.6 also includes Saldhana Bay and Hermanus, among other ports.	2
Access	Data are not publicly available but require a payment.	2
Additional steps	Estimating landing percentages for Cape Town was the only required additional step. Two different experts were consulted (Serge Raemaekers (2014) and Tim Reddell (2015)) to get a first estimate for the top 10 species. These percentages may vary over time, but likely only slightly. Repetition is easy and entails only an annual confirmation of the landing split by an industry expert.	2
Frequency	Data are collected on an annual basis.	1
Informality and illegality	There is lots of illegal fishing happening in Cape Town. Abalone is the principal target of poachers, but crayfish, line fish, shell fish, and bait animals are also illegally caught. A PhD study on informal extraction in the Table Mountain National Park is available, which has information on confiscated catch (Brill 2012). However, no quantitative studies has been done and the exact extent of poaching and informal extraction is extremely difficult.	5

6.3.2 Imports and Exports

GAIN Freight Dataset

The Growth and Intelligence Network (GAIN) develops two important freight flow models: the National Freight Flow Model (NFFM) and the Freight Demand Model (FDM). The NFFM uses freight measurements (like vehicle counts or rail data) to estimate freight flows (Havenga and Pienaar 2012), whereas the FDM, sponsored by Transnet, considers demand and supply to model freight flows (CSIR 2012).

GAIN has a strong focus on facilitating the transportation industry with detailed freight statistics which is used to inform transport infrastructure investments and policy development. The detailed commodity breakdown is necessary in order to plan for appropriate rail, ship, and road infrastructure expansion projects (Havenga 2013). Data is broken down by magisterial district as well as some additional places featuring large freight flows, like ports. The detailed breakdown and the depth of information make the data very suitable for urban metabolism research. I was surprised to find out that there was no previous experience of collaboration between GAIN and the urban metabolism researchers in Stellenbosch and Cape Town. According to Jan Havenga (2014), this is likely due to lack of knowledge about the overlapping interests and could be improved by making time to explore these interests.

The GAIN freight data provides insight into flows into (as in destined for), out of (as in originating in), and through (nor destined for or originating in, but just flowing through) for each of the districts. Calculating freight that in any way came into or out of any of the districts of Cape Town required GAIN to write a specific filter to be applied to the dataset.

The final dataset included total flows for 2013, and featured imports, exports, and throughput for 83 different commodities.

GAIN registers data on a magisterial district level, which does not completely overlap with municipal boundaries.

Reliability	Data are generated by requesting statistical information from a large variety of sources. Most information is cross-checked, but this is not possible for all industries (for instance, transport by ship and rail are easier to verify, as are freight movements in industries with strong industry associations or with few companies). Because of the variance per transport mode and industry, this indicator is represented as a range.	2-3
Completeness	All physical flows that are of significance are mapped by GAIN.	1
Temporal corr.	Data were provided for 2013.	1
Geographical correlation	Magisterial districts are used by GAIN. Because the Malmesbury district is mainly located outside of Cape Town, and because there is very little freight taking place in Malmesbury, this district was excluded from the dataset.	2

Access	GAIN operates as an independent research unit. GAIN's principle researchers (Jan Havenga, Zane Simpson and Anneke de Bod) are also full time employees of the Stellenbosch University. Even though the two entities are completely independent their research work has gained a significant academic footprint through integration in curricula, around 30 academic peer reviewed articles, and inclusions in the proceedings of international peer reviewed conferences. Similar to Quantec and other data firms, GAIN normally provides data to interested parties at a cost. However, there are two principal differences between GAIN and Quantec. Firstly, GAIN does much more than aggregating public numbers. Its main activity is gathering data from a large variety of industries, by building relationships with large companies and industry associations. Each year these organizations are contacted to provide information on their freight flows, which are then added to the model. Secondly, after establishing a meeting and describing the purpose of my study, I was provided the data without any cost. Quantec immediately suggested UCT subscribe to their services when discussing data availability. By providing feedback on my own findings within Cape Town to GAIN, benefits of this cooperation went both ways.	3
Additional steps	The 84 commodity groups are based on a particular grouping of Harmonized System product codes. However, these groupings differ from the Eurostat classification, so a one-time remapping effort was necessary to more closely match the Eurostat material groups.	2
Frequency	Data are collected on an annual basis.	1
Informality and illegality	This also strongly varies per industry. Some sectors are highly regulated (e.g. fossil fuels) or only involve a few large companies (e.g. the cement industry), whereas others are much more fragmented and more open to informality (e.g. the food trade or processing industry). This score is therefore also represented as a range.	2-3

6.3.3 Domestic Processed Output

Department of Energy Fuel Sales Volume

The Department of Energy collects information on fossil fuel sales throughout South Africa. In the past, fossil fuel sales data was much more accessible and could be directly obtained from the oil industry (Barnes 2014; Gasson 2014). Nowadays secrecy around sales volumes is the norm, and only the Department of Energy publishes detailed industry figures.

At present, sales volumes are available for jet fuel, aviation gasoline, diesel, furnace oil, LPG, paraffin, and petrol. Data are provided on magisterial district level, but if these districts overlap municipal boundaries then the data is similarly split up (for instance, Malmesbury has two entries: south of 33o30' latitude and north of the 33o30' latitude). This was one of the few datasets I found that made this distinction. It makes the dataset pleasantly compatible with municipal boundaries.

Fossil fuel sales are at best a remote proxy for emissions to air, and several operations were necessary to convert these numbers. However, this dataset provided the base numbers that were used to calculate and refine emissions. The Data quality indicators describe the quality of this dataset as being representative of the consumption of fossil fuels in Cape Town.

Reliability	Sales data is reported by the seven oil companies operating in South Africa. Data is self-reported and not fully verified by the Department of Energy (Nembahe 2015). Sales of wholesalers and traders are not included (which prevents double counting) so for this study it is assumed that no significant quantities of fuel cross municipal borders in the reselling process.	3
Completeness	Several aspects make this dataset incomplete. No information is provided on coal or firewood sales (these industries are not regulated like the other fuels). The unexplained fluctuations on an urban level that strongly vary from national trends (further detailed in Appendix A) made me conclude that the representativeness of this data is unknown.	5
Temporal corr.	Data were provided for 2013.	1
Geographical correlation	Data were filtered to perfectly match the municipal boundaries thanks to the split in multi-municipal magisterial districts.	1
Access	The dataset was obtained easily after e-mailing the Department of Energy.	2
Additional steps	Multiple additional pieces of data and calculations were required. Appendix A provides a detailed overview. While these calculations were complex and lengthy, replicating this effort is relatively easy now that all data providers and calculation steps are known.	4
Frequency	Data are collected on an annual basis.	1
Informality and illegality	Most of the fossil fuel sectors is highly regulated and dominated by large companies. However, this does not exclude illegal activity to take place. Africa's oil and energy sector is reportedly severely challenged by fraud and corruption (PwC 2014; UNECA 2014), and fraud incidents in South Africa have been reported very recently as well (Paton 2014). Tax evasion and fraud could affect the accuracy of the sales figures, or they could result in logistical movements that create a mismatch between sales and consumption. Quantifying these flows is very difficult (Lloyd 2015).	5

6.3.4 Conclusion

The overview of indicator scores shown in table 6.3 highlights some common quality features between the different sources. High scores are consistently obtained for temporal correlation, geographical correlation, and frequency. Reliability of the data is less consistent, although none of the sources obtained the lowest score. Completeness is good for most of the sources, with the exception of the snapshot nature of the aerial survey and strong doubts around completeness of fuel sales volumes. Access to data varied slightly, commonly requiring individual requests before data were released.

Data Source	Rel.	Comp.	Temp.	Geo.	Access	Steps	Freq.	Inf.
Elsenburg Aerial Survey	3	3	1	1	2	5	3	2
DMR Data	1	1	1	1	3	4	1	2
Fisheries Data	3	2	2	2	1	2	1	5
GAIN Freight Data	2-3	1	1	2	3	2	1	2-3
DoE Fuel Sales Volume	3	5	1	1	2	4	1	5

Rel. = Reliability | Comp. = Completeness | Temp. = Temporal correlation | Geo. = Geographical correlation | Steps = Additional steps | Freq. = Frequency | Inf. = Informality and illegality

Table 6.3: Data quality indicators for the main sources used

Two of the sources normally charge for access to data. Additional calculations and other steps to organize the data in the right format were necessary to some degree for every source. Three of the five sources required complex and time-consuming calculations. However, for all but one source the additional steps are simple to repeat for future studies. The indicator around informal and illegal flows was most difficult to establish. All of the sources showed some degree of uncertainty around this topic, with two of them being assigned the highest score to indicate the highest degree of uncertainty.

6.4 The Time Sinks

This section describes the major time sinks encountered during data collection. Some of these time investments were useful and unavoidable, but others would have been better invested elsewhere. The five principal time sinks are discussed below, and Box II describes an example of another time sink that was relatively small but rather unexpected.

6.4.1 Fuel Sales Volume

Time spent: **42:04 h** | Useful: **Yes, albeit with high uncertainty**

Sustainable Energy Africa provided the City of Cape Town, as well as other cities and municipalities in South Africa, with energy and emissions data. This organization has provided many *State of Energy* documents (Urban Energy Support 2015) and has many years of experience compiling these numbers on an urban level or municipal level. Calculations were intricate and involved acquiring numbers from a variety of sources, but by replicating the 2012 work done by Sustainable Energy Africa I imagined it would be a straightforward exercise. This was not the case.

Locating the best source for different emission factors, attempting to acquire reliable data on Eskom's fuel consumption and emissions, understanding and acquiring data on logistics and production at the Chevron refinery, locating and understanding fossil fuel sales statistics, and validating these sales statistics were very time-consuming activities.

When Eskom published fuel consumption figures for the Cape Town power plants, and I could compare them with total municipal consumption figures from the Department of Energy, inconsistencies in the dataset became apparent and deciding which route to take involved communication with Sustainable Energy Africa, Eskom, PetroSA, and the Department of Energy. Information was often conflicting and incomplete, and this was a frustrating challenge. Ultimately, emissions data was based on fuel sales volume from the Department of Energy, coupled with several other pieces of data to verify the data and complete the calculations. Details of this work are found in Appendix A.

The fuel sales volume data released by the Department of Energy lacks a standardized format, contains different types of fuels for different years, and most importantly it shows huge fluctuations for particular fuels that can not be explained by changes in real sales. These characteristics will likely make interpretation of fuels data a time consuming activity until reliability of this dataset is improved.

6.4.2 Identifying, Locating, and Understanding Freight Data

Time spent: **28:16 h** | Useful: **Yes**

Various sources use freight information provided by GAIN, including the *State of Logistics Survey for South Africa*, the *Transnet Long Term Planning Framework*, and the *Integrated Transport Plan for the City of Cape Town*. However, the underlying dataset is proprietary and unpublished, and for long it was unclear to me exactly where freight flow information came from and how I could obtain it.

Once the source was identified, obtaining data and understanding how data were collected was the next step. This involved two meetings and several e-mail conversations to discuss the underlying sources and to interpret the data.

In this case nearly all of the time invested is a once-off effort that does not need to be repeated for future MFA studies.

6.4.3 SARS Trade Statistics

Time spent: **25:08 h** | Useful: **No**

The single most important reason why national government received such a large time investment (60:42 h) has to do with the South African Revenue Service (SARS). Through Customs and Excise, SARS monitors imports and exports into and out of South Africa. From the start of my field work, this kind of data was of high interest to me. However, public SARS publications never distinguished between individual cities or ports of entry, and data was most commonly published on a national scale. Visits to Customs and Excise at the Cape Town Airport were unproductive, but after contacting the Trade Statistics division in Pretoria, I was provided large spreadsheets with very detailed statistics. These spreadsheets contained raw data: each line contained total imports or exports to or from a particular destination for a specific product type (based on the Harmonized Systems classification) for each individual month. Millions of rows of data were provided, with separate tables to look up the product name. These tables also contained weight, which made them especially interesting because they had the potential to provide detailed insight into movements in

and out of the city (international imports and exports are an important part of all imports and exports of Cape Town). Motivated by this potential, I set about to decipher this list and turn it into an aggregated list of total traded volumes, grouped by the same classification as the classification required in the Eurostat framework. Grouping the data in this way turned out to be a complicated and time-consuming effort. When done, several data inconsistencies were found and I could not use the data without having more clarity about where these inconsistencies came from. After meeting people at SARS in Cape Town, it was clear why the numbers did not always match reality. I also found that there were important caveats that I had not realized before. Data inconsistencies were caused, among other things, by changes in the SARS reporting system that resulted in anomalies, incorrectly declared products to avoid taxes, and incorrectly declared quantities to lower taxes.

Not much later, I acquired the import and export data from GAIN, which included more accurate international import and export flows than SARS data, so all effort was ultimately in vain when it came to obtaining usable data. Nonetheless, there were lessons learned from this exercise, and the system I made to analyze the SARS data was useful to other parties as well, so there were some side benefits from this exercise.

6.4.4 Agricultural Production

Time spent: **25:33 h** | Useful: **Yes**

Finding average yields for 25 different crops was a challenge. Most industry publications provided average yields on a national scale. Provincial-level yields for 2013 were available for only a few crops. For the other crops I had to get in touch with the relevant industry association to see if they could provide this localized, recent yield figure.

Particularly challenging were the yields for grazing-related pastures. This required several meetings (at Elsenburg, 50 km from Cape Town) to decide on the most suitable sources, and then further communication to discuss those yields with experts.

Unlike fruits, most vegetables did not have a related industry association, and for those expert opinion was also required.

Yields can fluctuate strongly every year, so a similarly time-consuming data gathering process would be necessary for future studies. Some time can be saved by contacting the right people straight away.

6.4.5 Bottom-up Data Verification

Time spent: **22:18 h** | Useful: **No**

For each major industry, leaders were identified through industry associations, reports, or expert advice. To cross-check freight data from GAIN, I set out to request information on imports and exports of physical materials into Cape Town. I targeted the agricultural sector (food processors and sites of trade), the chemical, paper, textile, cement, and clothing industries, retailers, and oil companies. Whenever I had a specific contact person, I would try contacting this person directly. Lacking this, I used the company's corporate site and write the general e-mail address listed there. At first I also attempted calling the companies, but as discussed earlier phone calls yielded poor

results. This e-mail campaign led to the large number of e-mails sent to the private sector (337 in total).

The results of this campaign can be summarized as follows:

- A large part of the 72 companies that were e-mailed sent an (often automated) acknowledgement of e-mail receipt.
- About a quarter of the companies actively engaged with me around this topic.
- Most of them indicated that data was unavailable. Main reasons were that this kind of data is not recorded by the company or that it could not be facilitated.
- Some indicated that this was possible but it would require some time.
- This e-mail campaign led to 3 meetings to further discuss the topic.
- Only 2 companies were ultimately able to provide actual data on Cape Town imports and exports.

Because of the sheer number of companies I could not actively pursue data extraction. However, based on willingness by part of the companies I consider it possible to get better results if more time is spent reminding people and companies through different channels. However, a large part of the companies does not seem to be willing (or able) to provide material flow data. The usefulness of this cross-checking exercise is therefore limited.

Box II: Surprisingly Difficult: Cape Town Population

A surprisingly difficult number to obtain was the Cape Town 2013 population. My first port of call was Stats SA. On their website, I went to "Find Statistics" and browsed statistics by theme. Unfortunately, under "People" I could find nothing more than the total 2011 population of South Africa. The only additional information was one paragraph on the population, the male/female split, and sub-themes around causes of death and work (Stats SA 2015b). Alternatively, I browsed the statistics by place. After locating the City of Cape Town I found the total population of 3,740,026 (Stats SA 2015a). Unfortunately, this was again a 2011 figure (latest Census data). Next up was the search engine within the Stats SA website. I used the keyword "Population" and found Publication *P0302 - Mid-year population estimates* (Stats SA 2014c). However, this document did not provide details on a municipal level. Under "Additional downloads" for this statistical publication I noticed the *Mid-year Population Estimates 2014 Tables* (Stats SA 2014d), which included 15 tables and 3 figures, but unfortunately no breakdown by municipality.

The last option I deemed feasible through the Stats SA website was a link in the footer called "Public Data Explorer" leading to the Google Public Data website. Here, I found a section with Population Estimates, which looked promising. I could activate the Western Cape and within the province I could activate just Cape Town. Excitement was short-lived as the most recent data for Cape Town was from 2010 (Google 2015).

The website of the City of Cape Town was my next option. The "City statistics" page provided a set of summary statistics, including the population. Unfortunately, the listed population size of 3,740,025 dated from 2011 (City of Cape Town 2015). Wikipedia listed a population of 3,740,026, yet again citing the 2011 Census (Wikipedia 2015).

Finally, I decided to e-mail the Strategic Development Information and Geographic Information System Department at the City. In 9 minutes I received the population estimates for 2011, 2012, 2013, and 2014 for Cape Town. After inquiring I learned that this data actually came from the Stats SA Mid-year Population Estimates (Small 2015). Municipal breakdown, it turns out, was available under "Additional downloads", in a zip file titled *District Council projection by sex and age (2002-2014)*. (Stats SA 2014a). By summing up the 17 male age groups and the 17 female age groups, I was able to confirm the estimated mid-year population estimate of 3,852,187.

6.5 What Did I Do Wrong?

From the outset of my data collection process I focused on contacting as many people as I could, hoping that this rapidly expanding web of contacts would ultimately result in access to data. Unfortunately, this was not the case. It was not until I sat down and decided to first understand the different industries and their players that I got a much better idea where to look for data, whom to ask for it, and how to check it. My initial priority should have been to first understand the industry, then contact a few well-informed industry experts, followed by a much more narrowly targeted campaign to track down the right data sources.

Part of my work consisted of a bottom-up intent to gather data on different industries. The only benefit of this effort was that I could substantiate discarding this approach. However, I could likely have concluded as much by discussing this strategy with experts or by doing a smaller try-out with one industry.

Several flows in my data collection process received a disproportionate amount of attention. These flows were not of higher environmental or economic significance, and they were not particularly large flows. Rather, friendliness and disposition of people involved in these industries affected my focus.

6.6 What Did I Do Right?

Throughout the data collection process I have made sure to connect with a number of different disciplines. My contacts come from a wide variety of academic departments, governmental divisions, and private industries. I read through a large variety of different documents. Different disciplines have all had different contributions to my work, often leading to unexpected connections that were of great value. Sticking to a few disciplines would likely have limited my success in collecting data.

The industry profiles I made - despite making them too late in the process - were of great use. They forced me to think of Cape Town as a system with a set of limited but interrelated industries. They also forced me to take a more structured and analytical approach in my data collection, and they put different flows in perspective. Roughly estimating principal material inputs and outputs, identifying major companies, and describing the sectors themselves from a flows perspective greatly improved understanding.

Finally, I offered added value to several of my data sources. Providing feedback on their data (based on my other findings and cross-checking) was valuable to several of my data providers. Similarly, sharing my findings with people and organizations that have helped me throughout the process is also appreciated by those contacts. I believe that this kind of cooperation helped all parties involved, and is of great use when gathering data.

Box III: Embargoed, Confidential & Unpublished

At times, I was given access to documents only if I promised not to reference them. These documents were embargoed, confidential, or otherwise unpublished sources, that were often somehow related to politics. They were highly relevant to my work and contained interesting research or other data that I would normally have referenced in this work.

Given the circumstances, I could only use the information from these documents as guidance, and pick up ideas for methodologies and sources, instead of using earlier findings published in these pieces of research.

There were six documents flagged as "confidential" in my database, and most of them were highly relevant. Most of the limitations seem to be politically motivated, or a result of restrictive policies around sharing information by governmental institutions. It is unfortunate to see that this lack of openness hampers studies like mine. I am the more grateful towards the people who decided to share these documents with me. Despite the limitations, it was of great use to have access to some of them and to learn from work that was previously done by others.

Box IV: Governmental Restrictions Around Data

A variety of industry associations and organizations refrain from collecting or publicly disseminating industry statistics, as a result of concerns raised by the Competition Commission. Examples are widespread and range, for instance, from the South African Petroleum Industry Association (SAPIA 2012, p. 21) to the National Chamber of Milling (NCM 2015). The question is whether the limited transparency of sectoral data really benefits the general public. Undoubtedly, the reluctance of many organizations to publish or provide data hampers studies like this one.

Furthermore, policies of governmental organizations and government-owned companies around data access are often very restrictive. While there are at times good reasons for partial restrictions, a more nuanced view towards making particular data fully accessible would be a useful change.

Chapter 7

Conclusion

7.1 Overview

This research set out to answer the following question:

What are the challenges to applying a Eurostat-based urban scale Material Flow Analysis in a South African context, and how can these challenges be overcome?

There were three principal objectives:

- To gain an understanding of different tasks involved, and their effectiveness and efficiency in the process.
- To identify the main challenges of performing such an MFA.
- To provide suggestions on how challenges can be overcome

In this chapter I will address the first two objectives as part of the Conclusions in section 7.3, and the third objective will be addressed in the final Recommendations section. These three objectives of the dissertation were to be achieved by attempting a Eurostat type MFA for Cape Town. This was largely achieved, as presented in Chapter 5. The main features of Cape Town's urban metabolism are concluded on in section 7.2.

7.2 Cape Town Metabolism

This MFA has provided useful insight into the metabolism of Cape Town. For 2013, local extraction was 1.53 t per capita, mostly consisting of non-metallic minerals mined within the borders of Cape Town. Wild fish catch is half of the biomass extraction. Imports and exports were 4.04 t and 2.15 t per capita, respectively, with food and fossil fuels weighing heavily on the imports. The exports are dominated by processed foods and products from the manufacturing industry. Emissions to air can be contrasted with the results from Gasson (2007). Significant per-capita emission increases are

seen for CO_2, coupled with decreases for most other emissions to air. Compared to other Eurostat-based urban studies, Cape Town resource flows are significantly lower on a per-capita basis. This is likely a result of the different levels of industrialization and per-capita income between Cape Town and the (Western European) cities of comparison.

7.3 Conclusions

Undertaking an urban Eurostat-based MFA required a total of 445 hours of data collection. Although lacking data on a few minor flows, data on all major flows was successfully collected in this time span. Understanding the different industries that impact material flows in the city was an important component of the work, as was figuring out which sources provide the most complete and reliable information, and who the gatekeepers of the data are. This MFA shows that contacting and interacting with people is essential in obtaining information. E-mailing and meeting people were the activities most time was spent on, and significant time was furthermore spent on transportation to and from meetings. Different sectors contributed in different ways to the data collection process.

Not all time was spent effectively and efficiently. Chasing unreliable data and unproductive cross-checking were the principal culprits. Other major but more productive time sinks were the verification of fossil fuel consumption, identifying, locating, and understanding freight statistics, and obtaining agricultural yields.

The principal challenges of undertaking an urban-scale MFA in a South African context are the following:

- **Variable reliability of sources.** The open nature of an urban system often causes incomplete and inaccurate statistical coverage. Uncertainty varies for each data source.
- **Difficulty acquiring documents.** Data are often not publicly available and must be specifically requested or somehow obtained from the data provider.
- **Additional work required to process the data.** Information is often provided in a format that requires extensive calculations and conversions before it can be used in MFA studies.
- **Absence of informal or illegal flows.** Exact volumes are often difficult to establish, and most data sources do not include informal flows.
- **Data sources are scattered and difficult to identify.** It takes time and effort to locate the best possible source for information. For each of the different flows a different set of sources has to be analyzed.

These challenges can be overcome by appropriate action on behalf of government or researchers. Responses to each of these challenges are discussed under Recommendations.

7.4 Recommendations

7.4.1 Responding to Challenges

This section lists each of the principal challenges, and recommends action on behalf of researchers or government to overcome these challenges.

Variable reliability of sources

Suggested researcher responses:

- Fully understand the data collection process of each source and always question the methods.
- Use industry experts to verify data reliability.
- Accept a certain degree of uncertainty but document the shortcomings of each source.

Suggested government responses:

- Improve cross-checking of data and prioritize data reliability when compiling statistics.
- Include details of known uncertainty in data.

Difficulty acquiring documents

Suggested researcher responses:

- Offer added value (provide feedback, share results, etc.) to data providers.
- Establish and foster professional relationships with data providers.
- Make data provider aware of the value of the study.
- Use contacts at other organizations to gain access to key people at data providing organizations.

Suggested government responses:

- Share data more openly if confidentiality is no issue (sharing full datasets including raw or "unformatted" data, and preferably placing the information on official websites requiring no login and granting open data licenses to the public for using and reproducing the information).
- Actively revise confidentiality of datasets and selectively publish data that can be easily made anonymous.
- Consider a more nuanced approach towards restricting industry sharing and publishing of data.

Additional work required to process the data

Suggested researcher responses:

- Ensure each dataset is the best possible source before initiating time-consuming calculations.

- Thoroughly document each step taken to convert the data in order to facilitate future studies.
- Computerize the calculations and share this work with researchers in other cities.

Suggested government responses:

- Resolve compatibility issues arising from mismatching borders of magisterial districts and municipalities (either by reporting on a municipal level instead, by aligning the municipal and magisterial district borders, or by splitting out numbers from mismatched magisterial districts).
- Provide data in raw or "unformatted" form and allow easy access, which would facilitate automated downloading and processing of data (for instance through an 'application programming interface' (API) which makes data machine-readable and allows programmers to develop tools that can easily download or exchange data).

Absence of informal or illegal flows

Suggested researcher responses:

- Always document potentially excluded flows.
- Use research, proxies, or expert opinion to estimate size of flows.

Suggested government responses:

- When applicable, acknowledge informal or illegal flows in statistics, even if the size is unknown.

Data sources are scattered and difficult to identify

Suggested researcher responses:

- Allot sufficient time to explore, discover, and select suitable sources.
- Learn from experience of others (either other MFA researchers in the same city or country, or from industry experts).
- Attempt to bring together the few data providers once they have been identified to ease recurring studies.
- Focus on consulting a widespread mix of contacts (from academia, the private sectors, different levels of government, etc.) and acknowledge the value that insight from different disciplines brings.

Suggested government responses:

- Assign one responsible party to collect and distribute this type of information. Statistics South Africa could provide a pivotal role on national level. Within the city this could be in hands of the Department of Development Information and Geographic Information Systems as department responsible for statistical information. At provincial level it could be an organization like GreenCape, given their expertise and experience in this field.
- Improve information about datasets and reports available (by providing a catalog and other meta information on the website of each Department or other governmental body).

7.4.2 Future Urban MFA Studies in South Africa

Despite challenges in the data collection process, this exercise has demonstrated that urban-scale data on the majority of material flows can be obtained for Cape Town. There is room for improvement, but data reliability does hold up when compared to other international urban-scale MFAs. This allows for contrasting resource indicators on an international level and can provide insight into the metabolism of the city.

This feasibility study can provide a large share of the required data sources and contacts necessary to finish the 2013 Cape Town MFA. The data should be further verified and numbers should be more precisely calculated by taking into account the recommendations for improvement listed in Appendix E. It is recommended to finish these calculations as soon as possible, to take advantage of the current network in place (over time, jobs rotate and priorities of people change).

The data coverage of the principal sources range from provincial to national level. This provides exciting opportunities to expand this study to other cities in the country. It will be necessary to find local experts to make the adjustments to each city, but the total required effort will be strongly diminished by using the findings and sources listed in this study, and also by replicating this study in several other South African cities.

It would furthermore be very worthwhile to consider developing a system (either for Cape Town or for multiple South African cities) that assists practitioners in periodic data gathering and verification process. Due to the frequent updates of most data sources, annual repetition of this kind of study is possible and should be attempted. By providing placeholders for the different data pieces and by automating calculations, annual reproduction of this study can be made relatively uncomplicated. Over time, attention should shift from data gathering to improving the quality of data, which provides benefits to all stakeholders involved. Through government involvement, academic effort, or industry cooperation, data collection and data sharing with a few key stakeholders should be able to make regular urban MFA reporting a feasible reality.

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Appendix A

Emission Calculations

A variety of steps were required to calculate emissions for Cape Town. An overview is provided below, followed by relevant tables and graphs that offer detailed insight into this complex dataset.

Fossil fuel consumption data were collected Fossil fuel sales volumes are made available by the Department of Energy. Quarterly disaggregated fuel sales volume on magisterial district level (DoE 2014b) were re-aggregated to have 2013 total fuel consumption for the Municipality of Cape Town. This calculation is detailed in table A.1.

Fossil fuel consumption data were evaluated Reliability of the data was evaluated in multiple ways. Consumption patterns of petrol and diesel (by far the most important fuels) in Cape Town were contrasted with the national data obtained from SAPIA (2014). By expressing the consumption of both fuels as a percentage of a base year (2003), the relative change can be easily compared. The first few years show a strong correlation, but for both fuels strange movements are observed around 2010. Cape Town consumption fluctuates strongly, in a direction opposite from the national trend. This pattern of highly fluctuating sales continues from 2010 onwards for both petrol and diesel. A recent Eskom publication provided detailed insight into the Ankerlig diesel consumption (Eskom 2015). These data made it possible to evaluate the exact impact the power plant has on diesel consumption. However, even by excluding the Ankerlig diesel consumption from the Cape Town consumption, diesel figures continue to display strong fluctuations on an urban level. An industry expert was consulted and indicated that Ankerlig is supplied by PetroSA, with diesel being brought in from outside Cape Town (Lloyd 2015). However, PetroSA indicated that even if fuel is imported into the city, it would still be reported within the area of delivery rather than in the district where the fuel originates from. After further discussions with Sustainable Energy Africa (Cilliers 2015) about the challenges of energy data verification, I decided to use the Department of Energy data as a base for the emissions calculations, mostly due to the lack of alternative sources for this information. However, the high degree of uncertainty was clear and represented in the data quality indicators for this source.

Fossil fuels were selected and split between different uses Jet Fuel and Aviation Gasoline were excluded from emission calculations, assuming that the vast majority of these fuels are burned by airplanes outside of Cape Town's airspace. Fuels used by industry have different

emission factors from residential fuel use. It was therefore necessary to estimate the split between residential and industrial/commercial use. This was done by using the same split in 2012 fuel consumption calculated from data provided by Sustainable Energy Africa (Euston-Brown 2014). Coal data was not available from the Department of Energy and the 2012 figure was used, provided by Sustainable Energy Africa (Euston-Brown 2015).

Emission factors were collected Emission factors came from Sustainable Energy Africa and the Division of Air Quality Management at the City of Cape Town.

Emission factors were evaluated By using Eskom emission data, it was possible to double-check some of the emission factors that were provided. Here another discrepancy was found. Very significant differences were observed between the emission factors for NO_2 and SO_2 as reported by Eskom versus the numbers from the City. These differences were discussed with Eskom (Dlulisa 2015) and the City (Filby 2015), but at the time of publication the matter was not yet clarified. The Ankerlig power plant uses a Central Emission Monitoring System that measures several gaseous emissions including Nitrous Oxides (NO_x) (Eskom 2014a). Emission factors were furthermore specifically calculated for this power plant, whereas the emission factors from the city were for generic gas turbines. For this reason, Eskom data were used for power plant emission calculations.

Final calculations were made to estimate emissions The final numbers were calculated using the different factors and fuel consumption data obtained earlier. For diesel the exact split between industry and residential use was calculated using the same method used by Sustainable Energy Africa: Ankerlig consumption was subtracted from the total diesel consumption, and the remainder was assigned to transport.

A.1 Fuel Sales Volume

Year	Petrol Consumption (liters)	Diesel Consumption (liters)	Petrol Indexed (2003 base year)	Diesel Indexed (2003 base year)
2003	1,178,801,907	538,874,615	100%	100%
2004	1,210,495,138	605,894,839	103%	112%
2005	1,227,000,134	667,234,615	104%	124%
2006	1,248,963,833	723,844,550	106%	134%
2007	1,263,614,088	992,329,402	107%	184%
2008	1,210,729,413	944,384,650	103%	175%
2009	1,231,080,047	815,723,248	104%	151%
2010	1,144,668,690	708,895,811	97%	132%
2011	1,484,998,004	1,096,065,655	126%	203%
2012	1,446,992,751	1,206,718,166	123%	224%
2013	1,286,014,060	1,376,212,685	109%	255%

Table A.1: Cape Town petrol and diesel fuel sales volume 2003-2013 (DoE 2014a)

Year	Petrol Consumption (million liters)	Diesel	Petrol Indexed (2003 base year)	Diesel
2003	10,667	7,263	100%	100%
2004	10,985	7,679	103%	106%
2005	11,165	8,115	105%	112%
2006	11,279	8,708	106%	120%
2007	11,558	9,755	108%	134%
2008	11,069	9,762	104%	134%
2009	11,321	9,437	106%	130%
2010	11,455	10,170	107%	140%
2011	11,963	11,225	112%	155%
2012	11,714	11,262	110%	155%
2013	11,153	11,890	105%	164%

Table A.2: South African petrol and diesel fuel sales volume 2003-2013 (SAPIA 2014)

Figure A.1: Diesel sales volume: Cape Town vs South Africa

Figure A.2: Petrol sales volume: Cape Town vs South Africa

Magisterial District	Jet Fuel	Diesel	LPG	Paraffin	Petrol	Aviation Gasoline	Furnace Oil
Bellville	186,111,059	124,424,172	200,771	9,105,024	198,638,607	323,503	573,419
Cape Town	61,013,648	993,155,136	93,035,685	46,843,729	446,766,350	515,756	28,000,785
Cape Town Intl Apt(Shell Oper)	50,873,023	0	0	0	0	0	0
Goodwood	0	49,321,423	129,670	77,717	81,408,504	0	1,096,743
Kuilsrivier	0	41,770,772	14,596	15,751	88,483,308	0	494,216
Malmesbury (south of 33o30' latitude)	0	47,776,733	0	10,000	17,454,777	0	60,000
Mitchells Plain	0	15,789,371	0	44,680	101,777,491	0	0
Simonstown	0	8,155,213	0	800	32,159,648	0	0
Somerset West	0	19,934,895	1,114,987	15,206	53,455,697	0	0
Strand	0	14,195,146	0	1,840	36,457,254	0	0
Wynberg	0	61,689,824	2,469,500	15,798,676	229,412,424	0	2,823,013
Total	**297,997,730**	**1,376,212,685**	**96,965,209**	**71,913,423**	**1,286,014,060**	**839,259**	**33,048,176**

Table A.3: Cape Town fuel sales volume (DoE 2014b)
Year: 2013. Values: liters.

A.2 Emission Factors

Emission factors were obtained from the Air Quality Management division at the City of Cape Town. Table A.4 provides details on the emission factors used for different fossil fuels. Air Quality Management does not have emission factors on CO_2, so those emission factors were obtained from Sustainable Energy Africa.

Fuel	Uncertainty	Units	SO_2	NO_x	VOCs	PM_{10}	$PM_{2.5}$	CO_2
Residential								
Paraffin	Low	g/l	8.50	1.50	0.09	0.20	0.20	2562
LPG	Low	g/kg	0.01	1.40	0.50	0.07	0.07	1618
Industry & commerce								
Coal	Low	g/kg	19.00	7.50	0.03	3.90	1.60	2625
Power paraffin	Low	g/l	8.50	1.50	0.02	0.12	0.12	2562
HFO	Low	g/l	63.00	5.70	0.03	3.70	3.30	2953
LPG/Natural gas	High	g/l	8.42	1.18	0.00	1.62	0.54	1618
Transport								
Petrol vehicles	Medium	g/l	1.70	18.00	36.00	0.60	0.50	2264
Diesel vehicles	Medium	g/l	9.30	6.10	5.00	6.60	6.10	2687
Power generation								
Turbine [1]	High	g/l	6.22	93.50	0.00	6.66	3.77	2687

Table A.4: Emission factors

A.3 Ankerlig Emissions

Year	Diesel (kg)	Diesel (liters)	NO_2	CO_2	SO_2	NO_2	CO_2	SO_2
			Emissions (kg)			Emission factor (g/l)		
2009*	4,190,108	4,958,708	22,419	13,331,109	4,190	4.5	2,688	0.845
2010	29,968,486	35,465,664	166,518	95,346,735	29,968	4.7	2,688	0.845
2011	47,979,841	56,780,877	272,456	152,651,063	47,980	4.8	2,688	0.845
2012	224,640,514	265,846,762	1,054,300	714,708,771	224,641	4.0	2,688	0.845
2013	560,727,586	663,582,942	2,567,000	1,783,992,195	560,728	3.9	2,688	0.845
2014**	235,535,677	278,740,446	1,053,000	749,372,461	235,536	3.8	2,688	0.845

Table A.5: Ankerlig diesel consumption and emissions 2009-2014 (Eskom 2015)
* 2009 data starts in April
** 2014 data ends in March
Density is 0.845 kg/liter

A.4 Fuel Consumption Calculation

Fuel	Reference quantity	Calculation	Final Quantity	Source
Residential				
Paraffin	71,913,423 l	x 0.77	55,373,336 l	DoE (2014b)
LPG	96,965,209 l	x 0.45	43,634,344 l	DoE (2014b)
Commerce and Industry				
Coal	168,000,000 kg		168,000,000 kg	Euston-Brown (2015)
Paraffin	71,913,423 l	x 0.23	16,540,087 l	DoE (2014b)
HFO	33,048,176 l	x 1	33,048,176 l	DoE (2014b)
LPG	96,965,209 l	x 0.55	53,330,865 l	DoE (2014b)
Transport				
Petrol	1,286,014,060 l		1,286,014,060 l	DoE (2014b)
Diesel	1,376,212,685 l	minus Ankerlig	712,629,743 l	DoE (2014b)
Power generation				
Ankerlig - diesel	663,582,942 l		663,582,942 l	Eskom (2015)
Acacia - kerosene	14,001,940 kg	0.79	11,061,533 l	DoE (2013, p. 32)

Table A.6: Fuel consumption calculation

Appendix B

Agricultural Calculations

Table B.1 provides an overview of how the total agricultural production was calculated. The identified crop and number of hectares planted were provided by the aerial census. The next step was to find the most relevant agricultural yield, as shown in the third column. Some of the yields are likely quite accurate, especially if they come from official statistics for the year of study (2013). Expert estimates are likely close but not tailored to the particular production yields of that year.

Due to the fact that yields strongly vary by region, production figures were only used if they were specific to either the Western Cape or the Cape Town region.

Crop	Hectares	Yield (t/ha)	Production (t)	Source	Type of data
Wheat	9,794.52	3.0	29,325	Cereal production statistics, DAFF	official statistics
Lucerne	7,705.62	13.5	104,026	Derick Engelbrecht, Lucerne Trust	expert estimate
Wine Grapes	5,765.51	8.4	48,430	SAWIS	official statistics - 2013
Planted Pastures Perennial	5,143.27	12.0	61,719	Philip Botha, Elsenburg	expert estimate, preliminary
Canola	3,057.59	1.6	4,739	Cereal production statistics, DAFF	official statistics - 2013
Small Grain Grazing	3,054.74	6.0	18,328	Half of planted pastures	initial estimate
Planted Pastures	2,213.42	6.0	13,281	Half of planted pastures	initial estimate
Fallow	725.69	0.0	0		
Natural grazing	553.57	unknown			
Barley	330.06	2.8	924	Cereal production statistics, DAFF	official statistics - 2011
Carrots	287.27	45.0	12,927	Jaques van Zyl, Elsenburg	expert estimate
Olives	260.45	unknown	0		
Cabbage	259.53	70.0	18,167	Jaques van Zyl, Elsenburg	expert estimate
Lupine	242.93	unknown			
Pears	195.52	45.0	8,798	Hortgro	industry association - 2013
Lettuce	175.70	27.0	5,279	Jaques van Zyl, Elsenburg	expert estimate
Cauliflower	168.17	60.0	11,731	Jaques van Zyl, Elsenburg	expert estimate
Vegetable mixed	166.09	unknown			

Continued on next page

Crop	Hectares	Yield (t/ha)	Production (t)	Source	Type of data
Guava	123.25	47.5	4,816	Wiehahn Victor, Guava Producers' Association	expert estimate (45-50 tons/ha)
Apples	101.39	55.0	5,576	Hortgro	industry association - 201
Weeds	95.26	0.0	0		
Plums	88.06	25.0	2,202	Hortgro	industry association - 2013
Potatoes	78.87	60.0	4,732	Jaques van Zyl, Elsenburg	expert estimate
Oats	69.45	1.0	69	Agricultural Abstracts, DAFF	outdated yield from 1999
Sub total	**40,655.93**		**355,071**		
Broccoli	68.94				
Spinach	63.96				
Pomegranate	49.43				
Beetroot	45.25				
Onions	40.24				
Flowers other	28.26				
Proteas	19.91				
Butternut	17.32				
Herbs unknown	15.73				
Table Grapes	14.74				
Mushrooms	14.74				
Lemon	12.50				
Celery	11.59				
Flowers unknown	11.00				
Lavender	9.02				
Grean beans	7.79				
Gemsquash	7.76				

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Crop	Hectares	Yield (t/ha)	Production (t)	Source	Type of data
Vegetable other	7.65				
Small Grain	6.68				
Pumpkin	5.48				
Sweetcorn	5.28				
Crops other	4.25				
Figs	3.31				
Lime	2.59				
Spring Onions	2.56				
Tomatoes	2.34				
Peppers	2.25				
Eggplant	1.73				
Coriander	1.15				
Chillies	0.64				
Radish	0.56				
Mellons	0.36				
Total	**41,140.94**				

Table B.1: Agricultural production in Cape Town

Appendix C

Fish Catch Calculations

The table below provides the top 10 species for the Cape of Good Hope fish landings as reported in the *Fishing Industry Handbook* (Chandler 2013) for the year 2012. Expert estimates of the share of Cape Town landings are shown in the fourth column.

The average share of Cape Town in the Cape of Good Hope zone for the top 10 species is estimated at 54% (349,058.98 / 647,219.73). This same percentage is used to estimate Cape Town landings for the remainder species.

Type of fishing	Species	Quantity (t)	Percentage	Cape Town (t)	Source
Small Pelagics	Anchovy	307,168.00	50%	153,584.00	Serge Raemaekers (2014)
Deepsea Trawl	Hake	115,465.01	60%	69,279.01	Serge Raemaekers (2014)
Small Pelagics	Sardine	83,176.00	50%	41,588.00	Serge Raemaekers (2014)
Small Pelagics	Round Herring	68,254.00	50%	34,127.00	Serge Raemaekers (2014)
Deepsea Trawl	Cape horse mackerel	27,321.52	70%	19,125.06	Tim Reddell (2015)
Midwater Trawl	Cape horse mackerel	17,817.70	100%	17,817.70	Tim Reddell (2015)
Seaweed	Kelp	8,298.57		1,000.00 *	Tim Reddell (2015)
Deepsea Trawl	Monkfish	6,672.66	80%	5,338.13	Tim Reddell (2015)
Hake longline	Hake	6,572.41	80%	5,257.93	Serge Raemaekers (2014)
Linefish	Snoek	6,473.86	30%	1,942.16	Serge Raemaekers (2015)
Subtotal		**647,219.73**		**349,058.98**	
Additional 125 listed species		25,872.22	54%	13,953.42	
Total		**673,091.96**		**363,012.41**	

Table C.1: Fish catch calculations

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* Kelp was estimated at 1,000 tons rather than a percentage of total volume

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Appendix D

Activity by Contact Group

D.1 Academia

Time: **85:28 h** | Contacts: **52** | Sources: **19** | Assists: **3** + **2** (contacts + sources)

Activity	Time	Quantity	Average time
E-mails	16:34 h	226	4 min
Meetings	25:43 h	34	45 min
Transportation	13:05 h	20	39 min
Reading	17:48 h	34	31 min
Background research	8:21 h	43	11 min
Calculating	3:22 h	4	50 min
Phone calls	35 min	5	7 min

Nature of work	Time
Acquiring data	22:39 h
Obtaining referrals	31:23 h
Cross-checking data	7 min
Understanding industry	19:56 h

Figure D.1: Sector activity breakdown: Academia

As an individual contact group the academic sector was the one I spent most time on. My initial contacts all originated from within the University of Cape Town, and from there gradually expanded into other universities and sectors. In total I spent time engaging with 6 different universities (3 from Cape Town and 3 other South African universities). Other contacts that were classified in this group are research centers not directly linked to one specific university. I also spent one afternoon

browsing through South African journals to look for leads (which was another useful activity to pick up new types of contacts and sources).

The single most important department in terms of number of people I engaged with is the department of Environmental and Geographical Sciences at UCT, where I engaged with 12 different people. This is likely mostly a reflection of where I had most contact with people myself (as I study in this same department), rather than it necessarily being the best place for information.

At UCT it was possible for me to knock on people's doors or speak to them in the hallway, unlike at most other organizations. Therefore, relatively much time is spent engaging in meetings and less time sending e-mails. Transportation is also relatively low because it was possible to engage in many UCT meetings without the need to travel.

Meetings with academics were shorter than the average meeting (45 min versus 51 min). Most academics provided plenty of referrals and they were often useful in getting a general understanding of their industry of expertise. However, few academics would refer me to contacts or sources outside their own academic discipline, even though other disciplines would actually operate in very similar and related fields.

D.2 City of Cape Town

Time: **32:08 h** | Contacts: **30** | Sources: **11** | Assists: **5** + **2** (contacts + sources)

Activity	Time	Quantity	Average time
E-mails	8:04 h	107	4 min
Meetings	5:50 h	6	58 min
Transportation	7:40 h	11	41 min
Reading	8:04 h	18	26 min
Background research	2:15 h	20	6 min
Phone calls	15 min	2	7 min

Nature of work	Time
Acquiring data	15:53 h
Obtaining referrals	6:21 h
Cross-checking data	4:03 h
Understanding industry	3:49 h

Figure D.2: Sector activity breakdown: City of Cape Town

Interestingly, between municipal, provincial, and national government, it was the municipal government that I spent the least amount of time on. And rather than spending most time on meetings and e-mail, I spent it on transportation and on reading municipal government documents.

Most contact with people at the City of Cape Town took place in the earlier half of the data

collection process. Many of the people and divisions were initially recommended to me by people in academia, with further expansion of the contacts at the City by referrals from other people working for the City. There was again a large variety of the different divisions I was in contact with.

There were no divisions that stood out in time spent on them. In addition to these eight divisions, there were another seven divisions and four units at the City of Cape Town that I catalogued and considered contacting for more information (some of which I indeed contacted, and others which I discarded). In no other governmental level did I have to look into so many different divisions. This shows the complexity in the City's internal structure. It was quite challenging to understand how the different divisions interact with each other, and which division is responsible for what kind of work. I could not find a way to get an overall view of all divisions and resorted to elaborating an overview myself, step by step as I learned more about this organization.

The fragmented nature of the City's organization could also be seen in the physical location of the different offices. Several offices are located in the Cape Town CBD, but I also had meetings with people in Atlantis, Westlake, and Goodwood (these relatively far-away locations explain the large amount of time spent on traveling).

Documents published by the City were characterized by two common challenges: they were often quite lengthy and they were poorly accessible.

The length of the documents can be seen in the time spent on reading them (time spent on reading was relatively high compared to the other contact groups). The *State of the Environment Report* (CoCT 2012a) was nearly 100 pages, the *State of Cape Town* (CoCT 2014) was over 200 pages long, and the *2013-2018 Comprehensive Integrated Transport Plan* (CoCT 2013a) was a whopping 426 pages!

At the City it was often difficult to arrange a meeting with officials. Similar to other sectors, there were some people who were very willing to meet and they were available on the short term. Several of them helped me obtain information and assisted in contacting colleagues. Others, however, were only available after several meeting requests, and some did not respond at all. This is another reason why the time spent on meetings is relatively low in this contact group. One possible cause for this could be 'research fatigue' on behalf of City officials. Several large universities are present in the city, and student requests were not uncommon for many of the officials I met.

After attending meetings and reading documents, it slowly became clear that in terms of providing data the City did not seem to be a suitable source for my research. I could not locate any concrete data on material flows, and whenever potentially useful numbers were provided in reports, they were often provided by external sources (such as import and export information in the EPIC reports).

Despite the various challenges, the City of Cape Town did play a fundamental role in my data collection process. City officials I spoke to - especially those I met at the beginning of my research - pointed me often in the right direction. They made it clear what kind of activity took place in Cape Town. Even though they did not collect data of the kind I needed, they could say what kind of flows I could be expecting, and where in the city relevant activity took place. This way I learned more about where agricultural production takes within municipal boundaries, how waste moves around in the city, and how freight moves in and out of the city. This knowledge was instrumental in understanding flows through the city and in shaping further steps in my research.

D.3 Provincial Government

Time: **43:18 h** | Contacts: **39** | Sources: **12** | Assists: **2 + 0** (contacts + sources)

Activity	Time	Quantity	Average time
E-mails	13:55 h	147	5 min
Meetings	9:58 h	11	54 min
Transportation	7:37 h	12	38 min
Reading	5:05 h	18	16 min
Background research	2:37 h	21	7 min
Calculating	3:45 h	5	45 min
Phone calls	21 min	8	2 min

Nature of work	Time
Acquiring data	5:30 h
Obtaining referrals	18:09 h
Cross-checking data	3 min
Understanding industry	10:34 h

Figure D.3: Sector activity breakdown: Provincial Government

The time distribution of the Western Cape Government is very different from the time distribution of the City of Cape Town. Personal contact in the form of e-mail correspondence (13:55 h) and meetings (9:58 h) are at the top of the list. Transportation outstrips the time spent on reading.

The organizational structure of the provincial government was less challenging than the City structure. I engaged with various departments and other units, detailed below.

GreenCape is a Sector Development Agency established 'to unlock the manufacturing and employment potential in the green economy in the Western Cape' (GreenCape 2015). This organization proved one of the most useful allies in my research. GreenCape is undertaking a multi-year 'Regional Resource Flow Modelling Project'. This project investigates the resource intensity of the Western Cape economy, which includes the mapping of flows in the region. Tools used include life cycle assessments and water footprints, among others. The project has developed a 'top down' Input/Output table for the Western Cape economy and a more detailed 'bottom up' flow study of the agricultural sector (GreenCape 2014). This project was one of the few currently ongoing research projects I encountered that was focused on regional material flows using industrial ecology tools.

Due to the similar research interests and supported by strong ties between my supervisor and GreenCape, I was able to closely interact with several people working at this organization. The researchers working on the Regional Resource Flow Model provided referrals to a variety of useful sources and contacts. They were able to indicate what strategies could be useful to cover data gaps, and they provided details on relevant industry associations and the data these organizations could provide. Furthermore, other industry experts at GreenCape provided valuable feedback

on the acquired data towards the end of the data collection process, and they also assisted in contacting specific people or organizations I had difficulties getting in touch with. The combination of operating in a similar field, of closely interacting with different levels of government and the private sector at the same time, and of having a great disposition to assist made this organization such a valuable asset in my research. The total time investment of 8:11 h is less than that of many other organizations, while the outcome was of much greater value.

Another organization that was of great value was the Western Cape Department of Agriculture (Elsenburg). Located in the municipality of Stellenbosch, this organization provides development, research and support services to the agricultural community in the Western Cape (Elsenburg 2015). Elsenburg provided the information on total hectares planted per crop in Cape Town, which was the principal input to getting agricultural production in the MFA.

Similar to GreenCape, people at Elsenburg were characterized by their great willingness to assist me in my quest for data. Nearly all people I contacted at the organization were very responsive and often willing to meet in person if this was requested. One person even offered to come to the office during his leave to accommodate my schedule. Furthermore, during one of my visits the people I had scheduled a meeting with made my visit even more productive by calling other colleagues and scheduling other meetings, after they learned of my specific data needs. I was even given a conference room to work in for a few hours as I waited for one colleague to become available.

The Western Cape Department of Economic Development & Tourism (DEDAT) was in terms of time the second most important organization (after Elsenburg and before GreenCape). This department had a variety of specialties ranging from waste management to metals, and from managing industry support groups to trade promotion.

Overall, people working for the Western Cape government were more responsive to e-mail than people working for the City. It was easier to set up meetings, and more related work was done at this level.

D.4 National Government

Between the three levels of government, national government received most of my attention. The total time investment was 60:42 h. The breakdown demonstrates a pattern that is very different from the other contact groups. The most time consuming activity was doing calculations (25:00 h in total), whereas there were only 3 meetings that took 2:06 h of my time.

Within national government there were many different departments and other organizations that I engaged with. The most important ones were:

Engagement was a mix between governmental departments, regulators, and public companies.

The Department of Agriculture, Forestry and Fisheries (DAFF) was a useful source of agricultural information. Average yields, production estimates, and other statistics provided by the Agricultural Abstracts were useful in scoping the agricultural activities in the area and complementing the data from Elsenburg. The Statistics and Economic Analysis Directorate at DAFF was furthermore a helpful source in locating potential data sources and in understanding what information they did and did not have available.

Time: **60:42 h** | Contacts: **49** | Sources: **24** | Assists: **1 + 0** (contacts + sources)

Activity	Time	Quantity	Average time
E-mails	9:59 h	127	4 min
Meetings	2:06 h	3	42 min
Transportation	3:31 h	6	35 min
Reading	10:02 h	26	23 min
Background research	8:25 h	35	14 min
Calculating	25:00 h	38	39 min
Phone calls	1:39 h	26	3 min

Nature of work	Time
Acquiring data	25:44 h
Cross-checking data	29:08 h

Figure D.4: Sector activity breakdown: National Government

Statistics South Africa (Stats SA), South Africa's official statistical service, produces in-depth demographical information on a local level, mostly through a periodic census. Information on agricultural production and activity is published as well through the Agricultural Census. The latest agricultural census information, however, is available from 2007, as the scheduled 2012 Agricultural Census did not take place. In terms of other environmental statistics, Stats SA published the first environmental economic account in 2002, focused on water. Several annual updates exist around minerals, energy, and fisheries data (Stats SA 2014b). In terms of material flows, mineral extraction is available on a national level, but no information is available on imports, exports, or output to nature (Parry 2014).

A problem observed many times with statistics from national government was that the scope of statistical publication did not match the scope of my area of study. Statistics were either published a level too high (on provincial level), or they were provided on the level of magisterial districts. There are several of these districts within the municipal boundaries of Cape Town, but the problem is that the borders do not fully match each other. Stats SA data (for instance, in the Agricultural Census) is often published on a magisterial district level. DAFF publishes data on a provincial level, and DMR publishes data on national and provincial scale, while internally listing mines per magisterial districts (Kohler 2014).

I attempted to obtain fossil fuel data from several governmental bodies, including the National Energy Regulator of South Africa (NERSA) and the Department of Energy (DoE). The most complete information was ultimately found on the website of the DoE, although its reliability was an issue that required a large time investment to investigate. Due to strict regulations around distribution of fuel sales information, no other organization that DoE was in the position to provide details on these volumes.

DMR collects data on mining production throughout the country but does not publish information on a municipal or magisterial district level. This is done to maintain the confidentiality of data on

individual mines.

Responsiveness varied hugely within national government. Stats SA and NERSA, both potential sources of valuable information, were both unresponsive. Stats SA indicated in an automatic reply that 'Turn around times vary from 24 hours to 5 working days', but in reality the first response took almost one month. NERSA did not respond at all to multiple e-mail messages and a phone conversation. On the other hand, DAFF responses often came back the same day, as did responses from SARS.

It is important to note that the impression of organizational responsiveness is often greatly influenced by one or a few people. At both SARS and DAFF there was one individual I principally communicated with via e-mail, and because these communications were promptly and professionally handled, I now tag this whole organization as being responsive.

D.5 Private Sector

Time: **75:14 h** | Contacts: **154** | Sources: **20** | Assists: **3 + 0** (contacts + sources)

Activity	Time	Quantity	Average time
E-mails	21:50 h	337	3 min
Meetings	14:38 h	14	1:02 h
Transportation	14:50 h	27	32 min
Reading	5:24 h	23	14 min
Background research	9:39 h	62	9 min
Calculating	7:29 h	15	29 min
Phone calls	1:24 h	27	3 min

Nature of work	Time
Acquiring data	28:56 h
Obtaining referrals	4:10 h
Cross-checking data	24:29 h
Understanding industry	14:31 h

Figure D.5: Sector activity breakdown: Private Sector

With a total time investment of 75:14 h, the private sector came in second after academia. The number of contacts (154) was highest of all groups. E-mailing stands out at the most important activity in terms in time, whereas reading received relatively little time compared to overall averages. Average meeting time was high at 1:02 h.

My interaction with the private sector took different shapes as time went by. At first, I mostly engaged with particular people working in the private sector but who were referred to me by people in academia, and who often had links to the academic sector through their work (their companies

were often involved in research, among other things). As I learned more about different companies and organizations and their potential role as data providers, I expanded the web of contacts. I had more e-mail communication and engaged in more meetings with people at different types of organizations. Most of these organizations I contacted in the first half of the data collection process were somehow related to knowledge and referrals: they either did some sort of research or they had a vast network of contacts in their field of expertise, which served me to better understand the main players involved in different industries. Towards the end of the period, I engaged in an e-mail campaign to try and obtain data from specific companies (focusing on the largest companies in each sector).

In terms of company types, there were several types of companies that I engaged with:

Consultancy firms included, among others, The Green House, WSP Africa Coastal Engineers, and Sustainable Energy Africa. These companies often had experience working on reports or other projects involving datasets that were of relevance. Some of the companies had worked on material flow projects, albeit of different types or on different scales than my project. People at these companies were highly useful in providing me contacts at government and private sector companies that were of great use in my future work. They were also useful to better understand how different industries operated, and who the major players were. In the case of Sustainable Energy Africa, this firm had worked on several emissions and energy reports for the City of Cape Town, and was the principal data provider for my emissions data.

NGOs were often useful because of their specific expertise. The Sustainable Livelihoods Foundation provided insight into informal harvesting in Cape Town and other flows and activities that take place in the informal sector. In a meeting with Ndifuna Ukwazi I learned more about the potential use of Public Access to Information Act (PAIA) requests.

Two private sector organizations stood out because they operate closely with government, while also servicing businesses and organizations in the region. The Western Cape Economic Development Partnership (WCEDP) is a non-profit independent company funded by national, provincial and local government. This company works closely together with several levels of government and links them often to the private sector. For instance, I attended a meeting from the Open Data Working Group, during which the challenges, implications, and opportunities of Open Data policies at City and Provincial level were discussed by experts from the City, the Province, NGOs, and private firms. Wesgro is a 'Destination Marketing, Investment and Trade Promotion Agency' for the Western Cape. This organization has a research division and publishes a variety of reports. Several people referred me to Westgro and their reports. Several of their reports include tables of regional imports and exports (total value rather than total mass, grouped by Harmonized System product classification). This data was of great interest to me when I first learned about this, as it was one of the first times I had seen regional data (rather than national figures) on imports and exports. However, the actual data was not generated by Westgro but was provided by Quantec.

Quantec is one of the companies I classified as a 'Data Repository'. These private companies gather statistical information - often from public sources or particular governmental institutions, and sell the data to interested parties. Their service is the aggregation and centralization of data, easy access and support, and at times these companies are also able to provide access to data that is not publicly available. One the one hand, these companies fill a gap that is created by governmental institutions that hold data but are not capable of disseminating this in a way the market demands. However, on the other hand these companies benefit from inefficient data distribution by the government,

and through private access to public data they maintain their value. The overall benefit of their existence is debatable and will likely depend on the user.

I contacted Quantec to find out more about their trade flow data. The relevant information was available as a report, as part of the 'RSA Provincial Trade Indicators (HS and SIC)'. These data are based on provincial trade statistics from SARS. SARS provides Quantec with import and export statistics based on the postal code of the involved company. Quantec aggregates the data by province and municipality (Quantec 2014). For my research this data was useful although there would be two important caveats. Firstly, postal codes of the importing or exporting company does not strictly correlate to the physical import or export (a company registered in Johannesburg could import products through Cape Town but this would not show up in the Cape Town trade statistics, for instance). Secondly, all data would be in total value (in Rand), rather than total mass. For the Western Cape, district level data would cost R2,332 + VAT per table, amounting to R4,664 + VAT for both the imports and the exports. I contacted the division of Trade Statistics at SARS and requested the same data, but interestingly this data was not available. The data extraction programs available to the Trade Statistics division did not allow for facilitating this kind of report (Van der Walt 2014).

Industry associations were among the most referenced organizations among my contacts and sources. In the database I catalogued over 60 potentially useful organizations. They were useful in different ways. They often either provided a centralized place to get industry statistics (or knowledge on where these statistics could be obtained), and the could provide useful insight into specific company activity in that industry within Cape Town. However, the sheer number of different industry associations made it clear that contacting them all one by one would be a very time consuming activity. I ultimately engaged with 26 of them, but mostly through e-mail communication and reading of industry documents. Total time spent on this sector was almost 10 hours.

Appendix E

Room for Improvement

Data on Cape Town material flows presented throughout this work are very useful to understand the metabolism of the city, but they have not yet been subjected to the required rigorous verification that is necessary so they can be used in a full Eurostat-based urban MFA study. This section provides initial tips on how to further verify and complement the data.

E.1 Domestic Extraction Used

E.1.1 Fishing

- By acquiring the 2014 Fishing Industry Handbook, data on 2013 can be used instead of the 2012 fish catch data currently used.
- Individual experts should be found for each species and for each type of fishing - or at least for the top 20. Another option is to consult different experts on the fish catch and take the average estimate instead of the estimate of a single expert.
- Fish catch volumes as reported by the Fishing Industry Handbook should be questioned. They should be contrasted with the Total Allowable Catch and if there is a large discrepancy, numbers should be verified with experts.

E.1.2 Biomass

- Yields for several crops are not from 2013 and attempts should be made to update those yields.
- All yields for fodder crops are rough approximates. Further discussions should take place with industry experts to establish better yields.
- Irrigation can strongly affect production of crops. Attempts should be made to estimate the land under irrigation for each crop, to further refine production estimates.

- Informal and illegal extraction of biomass should be further investigated. Work by Petersen *et al.* (2014) is a starting point for the harvest of wild-harvested medicine.

E.1.3 Mining

- Figures should be shown to industry experts to confirm reliability. Production figures are reported by the mines to DMR and verification with individual mines is therefore likely of limited benefit.
- Attempts can be made to quantify illegal mineral extraction, mostly focused on sand.

E.2 Imports and Exports

- Data provided by GAIN can be cross-checked, especially in areas where they indicate possible uncertainty. Industry associations could be used to verify the data, but it is important to review the sources used by GAIN, in order not to duplicate efforts.
- Information on coal seems to mismatch coal consumption as estimated by Sustainable Energy Africa, and should be verified.

E.3 Domestic Processed Output

- Emissions to water should be obtained - likely directly from the Waste Water Treatment Plants.
- Coal volume should be verified.
- An estimate should be made for the consumption of firewood.
- The City collects illegal dumping and moves this to landfill sites. This illegal dumping could be considered (temporary) output to nature, which is then taken back by the social-economic system when it is landfilled.
- Ankerlig emissions do not match expected emissions based on the emission factors provided by the City. This matter should be further investigated.
- Missing emission factors should be obtained.
- Methane emissions can be calculated from waste volumes and composition data. Small scale cattle farming should be estimated as well, and added to these numbers.

Appendix F

Activity Log

The full list of all activities undertaken during the data collection process is provided below. Contact names and document names have been redacted to protect privacy of the people involved and confidentiality of the sources used. Instead, the ID of the contact (denoted with a C) or document (denoted with a D) in the database is provided.

Admin was not related to a specific contact and therefore has no ID.

ID	Group	Activity	Date and time	Duration
		Admin	Aug 25, 2014 08:33:20 - 09:04:36	31 min
C 16	Academia	E-mails	Aug 26, 2014 10:04:36 - 10:07:06	3 min
C 2	Academia	E-mails	Aug 26, 2014 10:07:24 - 10:18:09	11 min
C 32	Academia	E-mails	Aug 26, 2014 10:18:45 - 10:21:11	2 min
		Admin	Aug 26, 2014 10:21:31 - 10:42:13	21 min
C 32	Academia	E-mails	Aug 26, 2014 10:42:25 - 10:43:21	1 min
		Admin	Aug 26, 2014 10:45:18 - 10:48:07	3 min
		Admin	Aug 26, 2014 15:42:38 - 16:13:04	30 min
		Admin	Aug 27, 2014 12:48:02 - 13:01:04	13 min
		Admin	Aug 27, 2014 13:02:10 - 13:09:25	7 min
D 2	Provincial Government	Reading	Aug 27, 2014 13:09:18 - 13:44:24	35 min
C 53	Provincial Government	Background research	Aug 27, 2014 13:44:43 - 14:03:20	19 min
C 50	Academia	Background research	Aug 27, 2014 14:03:54 - 14:50:02	46 min
C 50	Academia	Meetings	Aug 27, 2014 14:50:11 - 15:05:15	15 min
C 9	Academia	Meetings	Aug 27, 2014 15:29:41 - 15:46:14	17 min
C 9	Academia	Background research	Aug 27, 2014 15:54:43 - 15:56:40	2 min
C 51	Academia	Background research	Aug 27, 2014 15:57:16 - 16:09:07	12 min
D 7	Provincial Government	Reading	Aug 27, 2014 16:17:52 - 16:34:17	16 min

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ID	Group	Activity	Date and time	Duration
C 51	Academia	Meetings	Aug 27, 2014 16:35:32 - 17:05:51	30 min
C 51	Academia	Background research	Aug 27, 2014 17:06:01 - 17:15:58	10 min
D 7	Provincial Government	Reading	Aug 27, 2014 20:49:32 - 21:07:25	18 min
		Admin	Aug 28, 2014 08:37:42 - 09:01:56	24 min
C 39	Academia	Background research	Aug 28, 2014 09:02:51 - 09:20:49	18 min
C 39	Academia	E-mails	Aug 28, 2014 09:20:53 - 09:27:04	6 min
C 31	Academia	E-mails	Aug 28, 2014 09:28:47 - 09:49:29	21 min
C 41	Academia	Background research	Aug 28, 2014 15:47:03 - 15:55:30	8 min
C 41	Academia	E-mails	Aug 28, 2014 15:55:35 - 16:03:49	8 min
		Admin	Aug 28, 2014 16:05:06 - 16:07:01	2 min
D 2	Provincial Government	Reading	Aug 28, 2014 17:30:15 - 17:45:23	15 min
D 2	Provincial Government	Reading	Aug 29, 2014 06:06:49 - 06:29:23	23 min
D 17	Provincial Government	Reading	Aug 29, 2014 06:29:44 - 06:31:25	2 min
D 14	Provincial Government	Reading	Aug 29, 2014 06:31:52 - 07:12:02	40 min
C 32	Academia	E-mails	Aug 29, 2014 07:46:04 - 07:47:06	1 min
C 32	Academia	E-mails	Aug 29, 2014 07:49:50 - 07:50:14	0 min
D 14	Provincial Government	Reading	Aug 29, 2014 08:40:06 - 08:52:03	12 min
C 32	Academia	Meetings	Aug 29, 2014 10:36:04 - 11:03:08	27 min
C 32	Academia	E-mails	Aug 29, 2014 11:03:14 - 11:07:53	5 min
C 63	Academia	Background research	Aug 29, 2014 11:10:10 - 11:15:12	5 min
D 2	Provincial Government	Reading	Aug 29, 2014 14:17:36 - 14:20:42	3 min
D 14	Provincial Government	Reading	Aug 29, 2014 14:21:12 - 14:29:56	9 min
C 68	City of Cape Town	Background research	Aug 29, 2014 14:30:52 - 14:37:45	7 min
C 67	Government	Background research	Aug 29, 2014 14:37:57 - 14:41:41	4 min
C 68	City of Cape Town	E-mails	Aug 29, 2014 14:42:03 - 14:51:32	9 min
C 63	Academia	Meetings	Aug 29, 2014 15:04:06 - 16:01:58	58 min
C 63	Academia	E-mails	Aug 29, 2014 16:20:15 - 16:29:50	10 min
C 52	Private Sector	Background research	Aug 29, 2014 16:30:16 - 16:40:46	11 min
C 52	Private Sector	E-mails	Aug 29, 2014 16:40:46 - 16:47:46	7 min
D 12	Private Sector	Reading	Aug 29, 2014 16:48:40 - 16:51:23	3 min
D 16	Provincial Government	Reading	Aug 29, 2014 16:52:45 - 17:08:05	15 min
C 39	Academia	E-mails	Sep 01, 2014 06:31:02 - 06:35:55	5 min
D 16	Provincial Government	Reading	Sep 01, 2014 06:39:02 - 06:42:02	3 min
C 63	Academia	Background research	Sep 01, 2014 06:52:16 - 06:56:53	5 min
C 84	Academia	Background research	Sep 01, 2014 06:58:41 - 07:10:06	11 min
C 84	Academia	E-mails	Sep 01, 2014 07:10:15 - 07:14:34	4 min
D 31	Academia	Reading	Sep 01, 2014 12:29:59 - 12:57:57	28 min

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ID	Group	Activity	Date and time	Duration
C 8	Academia	Transportation	Sep 01, 2014 13:02:21 - 14:27:24	1:25 h
C 8	Academia	Meetings	Sep 01, 2014 14:27:32 - 15:28:17	1:01 h
C 8	Academia	Transportation	Sep 01, 2014 15:28:27 - 16:50:02	1:22 h
		Admin	Sep 02, 2014 10:12:13 - 10:12:47	1 min
C 90	Private Sector	E-mails	Sep 02, 2014 10:12:49 - 10:20:56	8 min
C 90	Private Sector	Background research	Sep 02, 2014 10:22:20 - 10:30:49	8 min
C 87	City of Cape Town	E-mails	Sep 02, 2014 10:43:01 - 10:54:43	12 min
C 86	Private Sector	E-mails	Sep 02, 2014 10:54:58 - 10:58:37	4 min
C 88	Provincial Government	E-mails	Sep 02, 2014 11:00:04 - 11:06:56	7 min
C 90	Private Sector	E-mails	Sep 02, 2014 15:53:22 - 15:54:45	1 min
C 90	Private Sector	Background research	Sep 02, 2014 15:54:49 - 15:55:51	1 min
C 51	Academia	E-mails	Sep 02, 2014 15:56:45 - 16:07:31	11 min
C 92	City of Cape Town	E-mails	Sep 02, 2014 17:11:35 - 17:16:15	5 min
C 68	City of Cape Town	Background research	Sep 02, 2014 17:16:30 - 17:23:55	7 min
C 8	Academia	Background research	Sep 02, 2014 17:28:15 - 17:32:45	5 min
		Admin	Sep 02, 2014 17:36:56 - 17:37:41	1 min
C 92	City of Cape Town	E-mails	Sep 03, 2014 09:51:32 - 09:57:29	6 min
		Admin	Sep 03, 2014 11:05:10 - 11:14:46	10 min
C 41	Academia	E-mails	Sep 03, 2014 11:15:39 - 11:19:13	4 min
C 41	Academia	Background research	Sep 03, 2014 11:19:17 - 11:21:32	2 min
C 92	City of Cape Town	E-mails	Sep 03, 2014 15:06:39 - 15:07:33	1 min
C 32	Academia	E-mails	Sep 03, 2014 16:02:34 - 16:03:31	1 min
		Admin	Sep 05, 2014 13:24:36 - 13:42:48	18 min
C 92	City of Cape Town	Transportation	Sep 05, 2014 14:17:06 - 14:56:09	39 min
C 92	City of Cape Town	Meetings	Sep 05, 2014 14:56:50 - 15:55:59	59 min
C 92	City of Cape Town	Transportation	Sep 05, 2014 15:56:41 - 16:44:44	48 min
		Admin	Sep 08, 2014 13:28:25 - 13:30:55	3 min
C 16	Academia	E-mails	Sep 08, 2014 13:31:05 - 13:32:38	2 min
C 31	Academia	E-mails	Sep 08, 2014 13:34:49 - 13:35:58	1 min
C 2	Academia	E-mails	Sep 08, 2014 13:36:12 - 13:38:11	2 min
C 86	Private Sector	E-mails	Sep 08, 2014 13:39:15 - 13:42:42	3 min
C 86	Private Sector	Background research	Sep 08, 2014 13:43:27 - 13:45:33	2 min
C 16	Academia	E-mails	Sep 08, 2014 13:45:46 - 13:49:30	4 min
C 92	City of Cape Town	Background research	Sep 08, 2014 13:56:00 - 14:03:43	8 min
C 92	City of Cape Town	Background research	Sep 08, 2014 14:08:09 - 14:11:01	3 min
C 110	Academia	Background research	Sep 08, 2014 14:13:19 - 14:54:44	41 min
C 110	Academia	Background research	Sep 08, 2014 14:55:32 - 15:02:44	7 min

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ID	Group	Activity	Date and time	Duration
D 33	Academia	Reading	Sep 08, 2014 16:44:03 - 17:03:40	20 min
C 113	Academia	E-mails	Sep 08, 2014 17:06:26 - 17:21:02	15 min
C 72	Private Sector	Background research	Sep 08, 2014 17:30:33 - 17:34:18	4 min
C 72	Private Sector	E-mails	Sep 08, 2014 19:58:25 - 20:06:01	8 min
C 71	Private Sector	Background research	Sep 08, 2014 20:08:05 - 20:17:49	10 min
C 71	Private Sector	E-mails	Sep 08, 2014 20:17:54 - 20:20:40	3 min
C 113	Academia	E-mails	Sep 08, 2014 20:59:25 - 21:04:06	5 min
		Admin	Sep 09, 2014 09:18:32 - 09:27:51	9 min
C 72	Private Sector	E-mails	Sep 09, 2014 13:49:14 - 13:53:04	4 min
C 105	City of Cape Town	E-mails	Sep 09, 2014 13:53:47 - 14:06:37	13 min
C 107	City of Cape Town	E-mails	Sep 09, 2014 14:11:37 - 14:12:58	1 min
C 104	Government	E-mails	Sep 09, 2014 14:13:07 - 14:17:27	4 min
C 106	City of Cape Town	E-mails	Sep 09, 2014 14:17:36 - 14:19:40	2 min
C 104	Government	Background research	Sep 09, 2014 14:19:58 - 14:24:45	5 min
C 108	Private Sector	Background research	Sep 09, 2014 14:25:54 - 14:29:35	4 min
C 108	Private Sector	E-mails	Sep 09, 2014 14:29:41 - 14:35:26	6 min
C 101	Private Sector	E-mails	Sep 09, 2014 14:36:14 - 14:42:58	7 min
C 41	Academia	E-mails	Sep 09, 2014 14:43:22 - 14:47:31	4 min
D 36	City of Cape Town	Reading	Sep 09, 2014 14:38:00 - 14:47:49	10 min
C 97	Provincial Government	E-mails	Sep 09, 2014 14:50:35 - 14:54:01	3 min
C 96	Provincial Government	E-mails	Sep 09, 2014 14:54:48 - 14:56:24	2 min
C 94	Provincial Government	Background research	Sep 09, 2014 14:56:57 - 15:05:12	8 min
C 95	Provincial Government	Background research	Sep 09, 2014 15:05:53 - 15:10:15	4 min
C 95	Provincial Government	E-mails	Sep 09, 2014 15:10:19 - 15:10:46	0 min
C 8	Academia	E-mails	Sep 09, 2014 15:11:26 - 15:13:27	2 min
C 41	Academia	E-mails	Sep 09, 2014 16:24:41 - 16:26:27	2 min
C 101	Private Sector	E-mails	Sep 09, 2014 16:26:47 - 16:32:28	6 min
C 101	Private Sector	Background research	Sep 09, 2014 16:32:34 - 16:35:26	3 min
C 118	Private Sector	E-mails	Sep 09, 2014 16:37:23 - 16:38:33	1 min
C 119	Government	E-mails	Sep 09, 2014 16:39:44 - 16:42:54	3 min
C 119	Government	E-mails	Sep 09, 2014 17:17:59 - 17:32:12	14 min
C 95	Provincial Government	E-mails	Sep 09, 2014 17:32:44 - 17:43:08	10 min
C 41	Academia	E-mails	Sep 09, 2014 17:43:37 - 17:44:20	1 min
C 101	Private Sector	E-mails	Sep 09, 2014 17:44:56 - 17:49:50	5 min
C 95	Provincial Government	E-mails	Sep 09, 2014 17:50:17 - 17:51:49	2 min
C 120	Provincial Government	E-mails	Sep 09, 2014 17:51:59 - 17:55:43	4 min
C 108	Private Sector	Background research	Sep 09, 2014 21:33:19 - 21:39:30	6 min

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ID	Group	Activity	Date and time	Duration
D 40	Private Sector	Reading	Sep 09, 2014 21:39:39 - 22:00:36	21 min
C 118	Private Sector	E-mails	Sep 09, 2014 22:00:46 - 22:04:56	4 min
C 120	Provincial Government	E-mails	Sep 10, 2014 08:32:42 - 08:38:33	6 min
C 121	Provincial Government	E-mails	Sep 10, 2014 08:40:01 - 08:41:50	2 min
C 113	Academia	Background research	Sep 10, 2014 09:10:19 - 09:13:01	3 min
C 118	Private Sector	E-mails	Sep 10, 2014 09:13:30 - 09:14:21	1 min
C 14	Provincial Government	E-mails	Sep 10, 2014 09:14:54 - 09:26:49	12 min
C 104	Government	E-mails	Sep 10, 2014 09:38:37 - 09:43:21	5 min
C 120	Provincial Government	E-mails	Sep 10, 2014 09:46:39 - 09:49:55	3 min
C 113	Academia	E-mails	Sep 10, 2014 10:45:53 - 10:47:16	1 min
C 95	Provincial Government	E-mails	Sep 10, 2014 10:47:45 - 10:50:39	3 min
C 103	Private Sector	Background research	Sep 10, 2014 13:42:16 - 14:15:50	34 min
C 102	Private Sector	Background research	Sep 10, 2014 14:18:56 - 14:21:38	3 min
D 35	Private Sector	Reading	Sep 10, 2014 14:21:46 - 14:31:31	10 min
C 86	Private Sector	Background research	Sep 10, 2014 14:31:46 - 14:36:26	5 min
C 86	Private Sector	E-mails	Sep 10, 2014 14:56:31 - 15:09:59	13 min
C 51	Academia	E-mails	Sep 10, 2014 15:11:11 - 15:15:50	5 min
C 123	Private Sector	Background research	Sep 10, 2014 15:16:44 - 15:22:29	6 min
C 123	Private Sector	E-mails	Sep 10, 2014 15:23:04 - 15:26:02	3 min
		Admin	Sep 11, 2014 10:17:42 - 10:19:26	2 min
C 97	Provincial Government	E-mails	Sep 11, 2014 11:54:55 - 11:59:23	4 min
C 120	Provincial Government	E-mails	Sep 11, 2014 11:59:41 - 12:02:46	3 min
C 97	Provincial Government	E-mails	Sep 11, 2014 14:03:03 - 14:04:45	2 min
C 104	Government	Phone calls	Sep 11, 2014 14:59:00 - 15:01:11	2 min
C 125	Private Sector	Background research	Sep 11, 2014 17:36:26 - 17:47:03	11 min
C 125	Private Sector	E-mails	Sep 11, 2014 17:47:09 - 17:53:59	7 min
C 76	Government	Background research	Sep 11, 2014 17:54:28 - 18:31:49	37 min
C 76	Government	Background research	Sep 11, 2014 20:38:59 - 21:00:33	22 min
D 42	Government	Reading	Sep 11, 2014 21:00:22 - 21:07:53	8 min
C 76	Government	Background research	Sep 11, 2014 21:08:32 - 21:50:22	42 min
D 22	Government	Reading	Sep 12, 2014 05:46:06 - 05:55:20	9 min
C 76	Government	Background research	Sep 12, 2014 05:55:43 - 06:15:41	20 min
		Admin	Sep 12, 2014 06:16:26 - 06:31:28	15 min
C 82	Academia	Background research	Sep 12, 2014 06:33:31 - 07:03:01	30 min
C 82	Academia	E-mails	Sep 12, 2014 07:03:06 - 07:10:23	7 min
C 97	Provincial Government	E-mails	Sep 12, 2014 07:10:38 - 07:12:50	2 min
D 22	Government	Reading	Sep 12, 2014 09:23:28 - 10:21:47	58 min

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ID	Group	Activity	Date and time	Duration
D 43	Government	Reading	Sep 12, 2014 10:22:48 - 10:50:27	28 min
D 36	City of Cape Town	Reading	Sep 12, 2014 12:16:46 - 12:49:51	33 min
C 71	Private Sector	E-mails	Sep 12, 2014 13:42:13 - 13:44:33	2 min
C 14	Provincial Government	E-mails	Sep 12, 2014 13:45:47 - 13:49:24	4 min
C 119	Government	E-mails	Sep 12, 2014 13:52:55 - 13:54:38	2 min
D 23	Academia	Reading	Sep 12, 2014 13:57:43 - 14:27:01	29 min
C 141	Academia	E-mails	Sep 12, 2014 14:33:26 - 14:39:06	6 min
D 26	Private Sector	Reading	Sep 12, 2014 14:39:52 - 14:43:59	4 min
D 28	Academia	Reading	Sep 12, 2014 14:44:07 - 14:47:34	3 min
C 78	Academia	Background research	Sep 12, 2014 14:48:44 - 14:49:53	1 min
D 54	Academia	Reading	Sep 12, 2014 14:51:16 - 14:53:41	2 min
D 25	Academia	Reading	Sep 12, 2014 14:53:54 - 14:56:35	3 min
C 14	Provincial Government	E-mails	Sep 12, 2014 14:57:39 - 14:58:08	0 min
C 119	Government	E-mails	Sep 12, 2014 14:58:46 - 15:01:41	3 min
D 56	Academia	Reading	Sep 12, 2014 15:02:57 - 15:16:35	14 min
C 104	Government	Phone calls	Sep 12, 2014 15:18:23 - 15:22:39	4 min
C 119	Government	E-mails	Sep 12, 2014 15:26:48 - 15:27:29	1 min
C 63	Academia	E-mails	Sep 12, 2014 15:29:23 - 15:36:05	7 min
C 119	Government	E-mails	Sep 12, 2014 15:38:40 - 15:43:20	5 min
D 56	Academia	Reading	Sep 12, 2014 15:44:22 - 16:04:32	20 min
C 17	Government	Background research	Sep 12, 2014 16:51:28 - 17:28:03	37 min
C 63	Academia	E-mails	Sep 15, 2014 07:03:19 - 07:10:12	7 min
C 141	Academia	E-mails	Sep 15, 2014 07:10:59 - 07:13:51	3 min
C 78	Academia	E-mails	Sep 15, 2014 07:14:08 - 07:16:44	3 min
C 104	Government	Phone calls	Sep 15, 2014 11:45:34 - 11:55:55	10 min
C 104	Government	E-mails	Sep 15, 2014 11:56:15 - 12:04:50	9 min
		Admin	Sep 15, 2014 12:56:09 - 12:56:09	0 min
C 119	Government	E-mails	Sep 15, 2014 12:56:44 - 12:57:26	1 min
C 16	Academia	Transportation	Sep 15, 2014 13:06:26 - 13:53:29	47 min
C 16	Academia	Meetings	Sep 15, 2014 13:55:14 - 15:26:52	1:32 h
C 16	Academia	Transportation	Sep 15, 2014 15:26:13 - 16:06:16	40 min
C 16	Academia	E-mails	Sep 15, 2014 16:26:42 - 16:35:56	9 min
C 107	City of Cape Town	E-mails	Sep 15, 2014 16:47:19 - 16:49:03	2 min
C 143	City of Cape Town	E-mails	Sep 15, 2014 16:49:15 - 16:53:24	4 min
C 144	City of Cape Town	E-mails	Sep 15, 2014 16:53:36 - 16:55:47	2 min
C 104	Government	E-mails	Sep 15, 2014 17:02:10 - 17:08:35	6 min
C 92	City of Cape Town	E-mails	Sep 15, 2014 17:08:45 - 17:19:11	10 min

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ID	Group	Activity	Date and time	Duration
C 143	City of Cape Town	E-mails	Sep 15, 2014 17:20:37 - 17:23:12	3 min
C 125	Private Sector	E-mails	Sep 16, 2014 06:49:58 - 06:52:00	2 min
C 86	Private Sector	E-mails	Sep 16, 2014 06:52:56 - 06:54:41	2 min
C 88	Provincial Government	E-mails	Sep 16, 2014 06:55:30 - 06:57:54	2 min
C 143	City of Cape Town	E-mails	Sep 16, 2014 12:01:22 - 12:02:35	1 min
C 92	City of Cape Town	E-mails	Sep 16, 2014 12:03:33 - 12:06:06	3 min
C 88	Provincial Government	E-mails	Sep 16, 2014 12:06:19 - 12:07:39	1 min
		Admin	Sep 16, 2014 12:17:24 - 12:26:27	9 min
D 11	Academia	Reading	Sep 16, 2014 12:30:29 - 14:57:10	2:27 h
C 41	Academia	Meetings	Sep 16, 2014 15:00:31 - 15:49:34	49 min
D 11	Academia	Reading	Sep 16, 2014 16:20:07 - 17:56:11	1:36 h
		Admin	Sep 16, 2014 19:26:27 - 19:39:04	13 min
C 41	Academia	Background research	Sep 16, 2014 19:39:20 - 20:00:07	21 min
C 41	Academia	E-mails	Sep 16, 2014 20:00:22 - 20:06:29	6 min
D 81	City of Cape Town	Reading	Sep 16, 2014 20:06:49 - 20:27:12	20 min
D 81	City of Cape Town	Reading	Sep 16, 2014 21:00:08 - 21:35:42	36 min
D 80	City of Cape Town	Reading	Sep 16, 2014 21:53:51 - 22:06:58	13 min
D 79	City of Cape Town	Reading	Sep 17, 2014 06:03:20 - 07:23:46	1:20 h
C 99	City of Cape Town	Background research	Sep 17, 2014 07:24:11 - 07:25:50	2 min
C 55	City of Cape Town	Background research	Sep 17, 2014 07:26:30 - 07:33:34	7 min
C 99	City of Cape Town	E-mails	Sep 17, 2014 07:33:41 - 07:38:52	5 min
C 169	Academia	E-mails	Sep 17, 2014 07:39:20 - 07:44:20	5 min
C 57	Academia	E-mails	Sep 17, 2014 07:44:59 - 07:53:23	8 min
D 81	City of Cape Town	Reading	Sep 17, 2014 07:53:56 - 08:02:25	8 min
C 172	City of Cape Town	E-mails	Sep 17, 2014 08:02:33 - 08:09:06	7 min
C 72	Private Sector	Background research	Sep 17, 2014 08:36:25 - 08:44:28	8 min
		Admin	Sep 17, 2014 08:44:36 - 08:56:50	12 min
C 174	City of Cape Town	E-mails	Sep 17, 2014 08:57:13 - 08:58:22	1 min
D 81	City of Cape Town	Reading	Sep 17, 2014 08:58:40 - 09:12:08	13 min
C 72	Private Sector	Transportation	Sep 17, 2014 09:44:16 - 09:57:19	13 min
C 72	Private Sector	Meetings	Sep 17, 2014 10:01:40 - 10:59:15	58 min
C 97	Provincial Government	Transportation	Sep 17, 2014 11:00:39 - 11:59:42	59 min
C 97	Provincial Government	Meetings	Sep 17, 2014 12:00:34 - 12:59:38	59 min
C 97	Provincial Government	Transportation	Sep 17, 2014 13:02:02 - 13:43:06	41 min
		Admin	Sep 17, 2014 14:08:18 - 14:16:29	8 min
C 96	Provincial Government	E-mails	Sep 17, 2014 14:16:44 - 14:26:39	10 min
C 72	Private Sector	Background research	Sep 17, 2014 14:29:43 - 14:34:13	5 min

Continued on next page

ID	Group	Activity	Date and time	Duration
D 98	Provincial Government	Reading	Sep 17, 2014 14:34:23 - 14:47:33	13 min
D 100	Provincial Government	Reading	Sep 17, 2014 14:48:26 - 14:56:53	8 min
C 53	Provincial Government	E-mails	Sep 17, 2014 14:58:13 - 15:02:52	5 min
C 72	Private Sector	Background research	Sep 18, 2014 07:41:30 - 07:52:26	11 min
C 72	Private Sector	E-mails	Sep 18, 2014 07:52:44 - 07:54:54	2 min
C 179	Government	E-mails	Sep 18, 2014 07:55:16 - 08:01:42	6 min
C 176	Private Sector	E-mails	Sep 18, 2014 08:01:49 - 08:04:58	3 min
		Admin	Sep 18, 2014 08:05:36 - 08:22:57	17 min
C 14	Provincial Government	Transportation	Sep 18, 2014 08:27:27 - 09:07:31	40 min
C 14	Provincial Government	Meetings	Sep 18, 2014 09:07:24 - 10:20:27	1:13 h
C 143	City of Cape Town	Transportation	Sep 18, 2014 10:20:51 - 10:30:53	10 min
C 14	Provincial Government	Background research	Sep 18, 2014 10:39:27 - 10:42:45	3 min
C 143	City of Cape Town	Meetings	Sep 18, 2014 11:12:55 - 11:45:13	32 min
C 143	City of Cape Town	Transportation	Sep 18, 2014 14:22:32 - 14:43:36	21 min
C 143	City of Cape Town	Background research	Sep 18, 2014 19:26:12 - 19:27:51	2 min
C 101	Private Sector	E-mails	Sep 18, 2014 19:28:59 - 19:30:23	1 min
C 176	Private Sector	E-mails	Sep 18, 2014 19:31:18 - 19:33:13	2 min
C 14	Provincial Government	Background research	Sep 18, 2014 19:34:47 - 19:55:36	21 min
C 97	Provincial Government	Background research	Sep 19, 2014 11:36:34 - 11:40:10	4 min
C 97	Provincial Government	E-mails	Sep 19, 2014 11:40:16 - 11:41:52	2 min
C 187	Private Sector	E-mails	Sep 19, 2014 11:42:00 - 11:46:54	5 min
C 121	Provincial Government	E-mails	Sep 19, 2014 11:47:50 - 11:55:31	8 min
C 55	City of Cape Town	Background research	Sep 19, 2014 11:55:58 - 12:00:41	5 min
C 99	City of Cape Town	E-mails	Sep 19, 2014 12:00:52 - 12:06:07	5 min
C 99	City of Cape Town	Background research	Sep 19, 2014 12:09:41 - 12:21:13	12 min
C 99	City of Cape Town	E-mails	Sep 19, 2014 12:21:17 - 12:27:01	6 min
		Admin	Sep 19, 2014 12:27:19 - 12:28:58	2 min
C 82	Academia	E-mails	Sep 19, 2014 12:29:08 - 12:31:02	2 min
C 106	City of Cape Town	E-mails	Sep 19, 2014 12:31:36 - 12:32:39	1 min
C 14	Provincial Government	E-mails	Sep 19, 2014 14:18:51 - 14:23:23	5 min
C 181	Provincial Government	Background research	Sep 19, 2014 14:23:32 - 14:28:32	5 min
C 86	Private Sector	E-mails	Sep 19, 2014 14:28:49 - 14:37:25	9 min
C 187	Private Sector	E-mails	Sep 19, 2014 14:37:31 - 14:40:20	3 min
C 57	Academia	E-mails	Sep 19, 2014 18:49:04 - 18:50:39	2 min
D 80	City of Cape Town	Reading	Sep 19, 2014 18:54:31 - 19:33:51	39 min
D 80	City of Cape Town	Reading	Sep 19, 2014 20:05:57 - 21:43:24	1:37 h
C 41	Academia	E-mails	Sep 19, 2014 21:43:31 - 21:46:44	3 min

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ID	Group	Activity	Date and time	Duration
C 188	Private Sector	E-mails	Sep 19, 2014 21:46:57 - 21:55:32	9 min
D 77	Academia	Reading	Sep 20, 2014 05:56:50 - 07:09:46	1:13 h
D 77	Academia	Reading	Sep 20, 2014 12:02:13 - 12:34:45	33 min
		Admin	Sep 20, 2014 12:37:11 - 12:39:29	2 min
		Admin	Sep 20, 2014 12:45:59 - 13:37:48	52 min
C 143	City of Cape Town	E-mails	Sep 22, 2014 13:36:25 - 13:39:22	3 min
		Admin	Sep 22, 2014 13:39:45 - 13:46:21	7 min
C 6	Academia	Meetings	Sep 22, 2014 13:46:31 - 14:20:13	34 min
C 193	City of Cape Town	E-mails	Sep 22, 2014 15:42:09 - 16:15:17	33 min
C 49	City of Cape Town	Background research	Sep 22, 2014 16:15:27 - 16:23:35	8 min
C 194	Provincial Government	E-mails	Sep 22, 2014 16:23:52 - 16:30:38	7 min
C 14	Provincial Government	Background research	Sep 22, 2014 16:33:52 - 16:44:53	11 min
C 14	Provincial Government	E-mails	Sep 22, 2014 16:45:21 - 16:54:28	9 min
C 101	Private Sector	Transportation	Sep 23, 2014 09:24:17 - 10:02:22	38 min
C 101	Private Sector	Meetings	Sep 23, 2014 10:19:26 - 11:24:03	1:05 h
C 101	Private Sector	Transportation	Sep 23, 2014 11:24:53 - 11:55:37	31 min
		Admin	Sep 23, 2014 12:11:37 - 12:17:36	6 min
C 141	Academia	E-mails	Sep 23, 2014 13:12:24 - 13:13:49	1 min
C 179	Government	E-mails	Sep 23, 2014 13:14:02 - 13:18:35	5 min
C 175	Academia	E-mails	Sep 23, 2014 13:18:56 - 13:29:24	10 min
C 169	Academia	E-mails	Sep 23, 2014 13:29:39 - 13:35:00	5 min
C 202	Private Sector	Background research	Sep 23, 2014 13:38:25 - 13:44:02	6 min
C 202	Private Sector	E-mails	Sep 23, 2014 13:44:08 - 13:49:45	6 min
C 41	Academia	E-mails	Sep 23, 2014 14:08:21 - 14:09:07	1 min
C 141	Academia	E-mails	Sep 23, 2014 14:09:36 - 14:10:21	1 min
C 203	City of Cape Town	E-mails	Sep 23, 2014 14:12:59 - 14:13:47	1 min
C 204	City of Cape Town	E-mails	Sep 23, 2014 14:13:59 - 14:27:44	14 min
C 202	Private Sector	E-mails	Sep 23, 2014 14:28:22 - 14:29:46	1 min
C 202	Private Sector	E-mails	Sep 23, 2014 14:41:14 - 14:42:26	1 min
		Admin	Sep 23, 2014 17:47:30 - 17:56:20	9 min
C 205	City of Cape Town	E-mails	Sep 23, 2014 18:00:50 - 18:05:22	5 min
C 116	Government	Background research	Sep 23, 2014 18:07:27 - 18:24:00	17 min
C 175	Academia	E-mails	Sep 24, 2014 05:14:28 - 05:15:34	1 min
		Admin	Sep 24, 2014 05:21:33 - 05:23:54	2 min
C 175	Academia	E-mails	Sep 24, 2014 07:04:15 - 07:05:41	1 min
D 125	Government	Reading	Sep 24, 2014 09:32:56 - 10:16:15	43 min
D 126	Government	Reading	Sep 24, 2014 10:16:50 - 10:49:38	33 min

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ID	Group	Activity	Date and time	Duration
C 116	Government	Background research	Sep 24, 2014 10:49:50 - 11:21:57	32 min
C 175	Academia	E-mails	Sep 24, 2014 21:34:48 - 21:39:43	5 min
		Admin	Sep 25, 2014 06:58:12 - 07:03:55	6 min
C 105	City of Cape Town	E-mails	Sep 25, 2014 07:05:54 - 07:19:14	13 min
C 78	Academia	E-mails	Sep 25, 2014 07:19:25 - 07:22:25	3 min
D 84	City of Cape Town	Reading	Sep 25, 2014 07:22:25 - 07:28:54	6 min
C 31	Academia	Background research	Sep 25, 2014 07:29:26 - 07:39:02	10 min
C 88	Provincial Government	Background research	Sep 25, 2014 07:39:18 - 07:44:00	5 min
C 88	Provincial Government	E-mails	Sep 25, 2014 07:44:04 - 07:48:17	4 min
C 188	Private Sector	E-mails	Sep 25, 2014 07:49:44 - 07:50:56	1 min
C 213	Private Sector	Background research	Sep 25, 2014 08:46:31 - 09:15:55	29 min
C 213	Private Sector	Transportation	Sep 25, 2014 09:19:33 - 09:59:36	40 min
C 213	Private Sector	Meetings	Sep 25, 2014 10:08:00 - 12:15:10	2:07 h
C 213	Private Sector	Transportation	Sep 25, 2014 12:15:31 - 12:47:34	32 min
C 220	Provincial Government	E-mails	Sep 25, 2014 13:45:04 - 13:50:26	5 min
C 187	Private Sector	Background research	Sep 25, 2014 13:52:04 - 13:58:47	7 min
C 78	Academia	E-mails	Sep 25, 2014 13:59:17 - 14:03:10	4 min
C 88	Provincial Government	E-mails	Sep 25, 2014 14:03:23 - 14:05:51	2 min
C 146	Academia	Background research	Sep 25, 2014 14:14:12 - 14:34:23	20 min
C 146	Academia	E-mails	Sep 25, 2014 14:34:28 - 14:39:51	5 min
C 224	Provincial Government	E-mails	Sep 25, 2014 14:44:35 - 14:52:40	8 min
C 222	Private Sector	E-mails	Sep 25, 2014 14:53:42 - 15:05:42	12 min
D 133	Government	Reading	Sep 25, 2014 16:33:46 - 17:09:48	36 min
C 225	Government	Background research	Sep 25, 2014 17:11:41 - 17:14:36	3 min
C 227	Government	Background research	Sep 25, 2014 17:14:43 - 17:18:39	4 min
C 225	Government	Background research	Sep 25, 2014 17:18:49 - 18:13:03	54 min
C 229	Government	E-mails	Sep 25, 2014 18:23:39 - 18:27:33	4 min
C 230	Government	E-mails	Sep 25, 2014 18:28:10 - 18:31:00	3 min
C 231	Private Sector	Background research	Sep 25, 2014 18:34:11 - 18:36:01	2 min
		Admin	Sep 26, 2014 06:15:02 - 06:19:42	5 min
C 176	Private Sector	E-mails	Sep 26, 2014 06:19:45 - 06:20:46	1 min
C 176	Private Sector	Phone calls	Sep 26, 2014 09:36:05 - 09:37:31	1 min
C 176	Private Sector	Phone calls	Sep 26, 2014 10:20:26 - 10:25:28	5 min
C 176	Private Sector	E-mails	Sep 26, 2014 10:27:51 - 10:28:56	1 min
C 202	Private Sector	Transportation	Sep 26, 2014 13:12:19 - 13:28:15	16 min
C 202	Private Sector	Meetings	Sep 26, 2014 13:28:33 - 14:44:19	1:16 h
C 202	Private Sector	Transportation	Sep 26, 2014 15:05:25 - 15:35:18	30 min

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ID	Group	Activity	Date and time	Duration
		Admin	Sep 26, 2014 16:27:59 - 16:33:46	6 min
D 134	City of Cape Town	Reading	Sep 26, 2014 16:40:08 - 16:58:17	18 min
D 146	City of Cape Town	Reading	Sep 26, 2014 16:58:40 - 17:06:53	8 min
D 88	Private Sector	Reading	Sep 26, 2014 17:07:51 - 17:29:04	21 min
C 222	Private Sector	E-mails	Sep 29, 2014 05:47:25 - 05:50:11	3 min
C 99	City of Cape Town	E-mails	Sep 29, 2014 05:50:29 - 05:53:12	3 min
C 78	Academia	E-mails	Sep 29, 2014 05:53:28 - 05:54:34	1 min
D 32	City of Cape Town	Reading	Sep 29, 2014 08:09:51 - 08:13:36	4 min
C 233	Private Sector	E-mails	Sep 29, 2014 15:39:31 - 15:44:58	5 min
C 141	Academia	E-mails	Sep 29, 2014 15:45:09 - 15:52:09	7 min
C 86	Private Sector	E-mails	Sep 29, 2014 16:52:16 - 16:57:35	5 min
C 12	Private Sector	Background research	Sep 29, 2014 16:57:48 - 17:05:07	7 min
		Admin	Sep 29, 2014 17:12:08 - 17:19:01	7 min
C 78	Academia	E-mails	Sep 30, 2014 06:33:17 - 06:34:30	1 min
		Admin	Sep 30, 2014 07:06:00 - 07:13:59	8 min
C 143	City of Cape Town	E-mails	Sep 30, 2014 08:27:20 - 08:35:03	8 min
C 237	City of Cape Town	E-mails	Sep 30, 2014 08:36:58 - 08:43:34	7 min
C 220	Provincial Government	Phone calls	Sep 30, 2014 09:07:14 - 09:11:07	4 min
C 179	Government	Phone calls	Sep 30, 2014 09:11:55 - 09:14:25	3 min
C 141	Academia	E-mails	Sep 30, 2014 09:17:43 - 09:18:03	0 min
C 175	Academia	E-mails	Sep 30, 2014 09:31:52 - 09:33:49	2 min
C 78	Academia	Background research	Sep 30, 2014 09:34:09 - 09:36:21	2 min
		Admin	Sep 30, 2014 09:52:16 - 10:19:06	27 min
C 78	Academia	Transportation	Sep 30, 2014 09:38:40 - 10:27:54	49 min
C 175	Academia	E-mails	Sep 30, 2014 10:37:12 - 10:38:27	1 min
C 141	Academia	E-mails	Sep 30, 2014 10:38:53 - 10:42:40	4 min
C 78	Academia	Meetings	Sep 30, 2014 10:44:39 - 11:40:36	56 min
C 8	Academia	E-mails	Sep 30, 2014 12:12:39 - 12:15:14	3 min
C 78	Academia	Transportation	Sep 30, 2014 11:40:53 - 12:42:37	1:02 h
C 78	Academia	Transportation	Sep 30, 2014 12:43:12 - 12:59:14	16 min
C 141	Academia	E-mails	Sep 30, 2014 14:02:31 - 14:19:23	17 min
C 238	City of Cape Town	E-mails	Sep 30, 2014 14:21:29 - 14:27:53	6 min
C 141	Academia	E-mails	Sep 30, 2014 14:28:00 - 14:28:36	1 min
C 237	City of Cape Town	E-mails	Sep 30, 2014 14:29:28 - 14:35:55	6 min
C 239	Provincial Government	E-mails	Sep 30, 2014 14:36:01 - 14:39:06	3 min
C 167	Academia	Background research	Sep 30, 2014 14:43:24 - 15:03:02	20 min
C 50	Academia	Meetings	Sep 30, 2014 15:03:21 - 15:35:23	32 min

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ID	Group	Activity	Date and time	Duration
C 240	Academia	Background research	Sep 30, 2014 15:42:32 - 15:56:20	14 min
		Admin	Sep 30, 2014 16:29:06 - 16:34:45	6 min
C 99	City of Cape Town	E-mails	Sep 30, 2014 17:32:58 - 17:34:01	1 min
		Admin	Sep 30, 2014 18:17:47 - 18:23:48	6 min
C 223	City of Cape Town	E-mails	Oct 01, 2014 05:56:33 - 05:59:56	3 min
C 223	City of Cape Town	E-mails	Oct 01, 2014 06:08:55 - 06:10:01	1 min
C 240	Academia	E-mails	Oct 01, 2014 06:14:31 - 06:22:14	8 min
		Admin	Oct 01, 2014 06:22:52 - 06:32:17	9 min
C 62	City of Cape Town	Background research	Oct 01, 2014 06:32:31 - 06:35:34	3 min
C 62	City of Cape Town	E-mails	Oct 01, 2014 06:35:39 - 06:46:01	10 min
C 220	Provincial Government	E-mails	Oct 01, 2014 06:46:10 - 06:47:31	1 min
C 95	Provincial Government	E-mails	Oct 01, 2014 06:47:39 - 06:53:13	6 min
C 14	Provincial Government	E-mails	Oct 01, 2014 06:53:23 - 06:54:22	1 min
C 96	Provincial Government	E-mails	Oct 01, 2014 06:54:37 - 06:56:38	2 min
C 169	Academia	Transportation	Oct 01, 2014 07:50:53 - 08:13:57	23 min
C 62	City of Cape Town	E-mails	Oct 01, 2014 08:18:49 - 08:23:36	5 min
C 244	City of Cape Town	E-mails	Oct 01, 2014 08:24:39 - 08:25:38	1 min
C 245	City of Cape Town	E-mails	Oct 01, 2014 08:26:06 - 08:27:30	1 min
C 169	Academia	Meetings	Oct 01, 2014 08:31:19 - 09:23:54	53 min
C 169	Academia	Background research	Oct 01, 2014 09:24:20 - 09:33:16	9 min
C 169	Academia	E-mails	Oct 01, 2014 09:33:39 - 09:35:04	1 min
C 141	Academia	Transportation	Oct 01, 2014 09:37:35 - 10:19:58	42 min
D 23	Academia	Reading	Oct 01, 2014 10:23:29 - 10:36:17	13 min
C 141	Academia	Meetings	Oct 01, 2014 10:38:06 - 11:22:44	45 min
C 141	Academia	Transportation	Oct 01, 2014 11:23:23 - 11:32:26	9 min
C 99	City of Cape Town	E-mails	Oct 01, 2014 11:48:30 - 11:53:01	5 min
C 169	Academia	E-mails	Oct 01, 2014 11:53:15 - 11:56:02	3 min
C 220	Provincial Government	E-mails	Oct 01, 2014 11:56:07 - 11:58:58	3 min
C 99	City of Cape Town	E-mails	Oct 01, 2014 11:59:28 - 11:59:38	0 min
C 234	Private Sector	E-mails	Oct 01, 2014 11:59:49 - 12:01:44	2 min
C 244	City of Cape Town	E-mails	Oct 01, 2014 12:02:07 - 12:04:33	2 min
C 245	City of Cape Town	E-mails	Oct 01, 2014 12:04:50 - 12:07:19	2 min
C 248	Government	E-mails	Oct 01, 2014 12:07:27 - 12:09:33	2 min
C 244	City of Cape Town	E-mails	Oct 01, 2014 12:13:48 - 12:14:19	1 min
C 243	Academia	E-mails	Oct 01, 2014 12:54:07 - 12:56:28	2 min
C 240	Academia	E-mails	Oct 01, 2014 12:56:34 - 12:57:49	1 min
C 99	City of Cape Town	Transportation	Oct 01, 2014 13:11:27 - 13:39:30	28 min

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ID	Group	Activity	Date and time	Duration
C 99	City of Cape Town	Meetings	Oct 01, 2014 13:55:37 - 15:13:02	1:17 h
C 233	Private Sector	Transportation	Oct 01, 2014 15:13:03 - 15:17:01	4 min
C 233	Private Sector	Meetings	Oct 01, 2014 15:17:02 - 15:34:11	17 min
C 99	City of Cape Town	E-mails	Oct 01, 2014 16:10:33 - 16:16:44	6 min
D 150	Provincial Government	Reading	Oct 01, 2014 16:24:08 - 16:48:19	24 min
C 233	Private Sector	Transportation	Oct 01, 2014 18:20:27 - 18:59:27	39 min
		Admin	Oct 02, 2014 06:38:12 - 06:57:25	19 min
C 176	Private Sector	Transportation	Oct 02, 2014 08:37:14 - 09:24:32	47 min
C 176	Private Sector	Meetings	Oct 02, 2014 09:21:23 - 10:21:55	1:01 h
C 176	Private Sector	Transportation	Oct 02, 2014 10:21:55 - 12:01:02	1:39 h
C 175	Academia	Phone calls	Oct 02, 2014 12:17:00 - 12:18:20	1 min
C 175	Academia	Transportation	Oct 02, 2014 12:07:03 - 13:18:06	1:11 h
C 175	Academia	Meetings	Oct 02, 2014 13:18:29 - 14:07:44	49 min
C 175	Academia	Transportation	Oct 02, 2014 14:30:02 - 15:37:11	1:07 h
C 224	Provincial Government	E-mails	Oct 02, 2014 16:20:18 - 16:23:38	3 min
		Admin	Oct 02, 2014 16:55:42 - 17:21:27	26 min
C 175	Academia	Background research	Oct 02, 2014 17:41:49 - 17:45:51	4 min
C 175	Academia	E-mails	Oct 02, 2014 17:46:01 - 18:17:59	32 min
C 7	Academia	E-mails	Oct 02, 2014 18:18:11 - 18:44:34	26 min
C 8	Academia	E-mails	Oct 02, 2014 18:44:41 - 18:48:27	4 min
C 41	Academia	E-mails	Oct 02, 2014 18:48:34 - 18:53:27	5 min
C 96	Provincial Government	E-mails	Oct 02, 2014 18:59:11 - 19:00:03	1 min
C 141	Academia	E-mails	Oct 02, 2014 19:00:29 - 19:06:59	7 min
C 248	Government	E-mails	Oct 02, 2014 19:08:59 - 19:10:58	2 min
C 267	Government	E-mails	Oct 02, 2014 19:11:09 - 19:13:06	2 min
C 176	Private Sector	Background research	Oct 03, 2014 06:10:14 - 06:13:50	4 min
C 92	City of Cape Town	E-mails	Oct 03, 2014 06:14:12 - 06:20:23	6 min
C 169	Academia	Background research	Oct 03, 2014 06:21:27 - 06:33:47	12 min
C 99	City of Cape Town	Background research	Oct 03, 2014 06:34:06 - 06:36:49	3 min
C 78	Academia	Background research	Oct 03, 2014 06:36:56 - 06:42:13	5 min
C 202	Private Sector	Background research	Oct 03, 2014 06:44:28 - 07:05:29	21 min
C 101	Private Sector	Background research	Oct 03, 2014 07:07:37 - 07:09:10	2 min
C 143	City of Cape Town	Background research	Oct 03, 2014 07:09:40 - 07:12:12	3 min
C 238	City of Cape Town	E-mails	Oct 03, 2014 07:14:53 - 07:16:26	2 min
C 14	Provincial Government	E-mails	Oct 03, 2014 07:16:46 - 07:20:23	4 min
D 122	Provincial Government	Reading	Oct 03, 2014 07:20:51 - 07:40:37	20 min
C 14	Provincial Government	E-mails	Oct 03, 2014 07:51:11 - 07:52:08	1 min

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ID	Group	Activity	Date and time	Duration
C 242	City of Cape Town	E-mails	Oct 03, 2014 08:43:30 - 08:51:17	8 min
C 240	Academia	E-mails	Oct 03, 2014 08:52:18 - 08:54:34	2 min
C 237	City of Cape Town	Background research	Oct 03, 2014 08:55:46 - 09:09:21	14 min
C 237	City of Cape Town	E-mails	Oct 03, 2014 09:09:36 - 09:13:53	4 min
C 240	Academia	E-mails	Oct 03, 2014 09:14:26 - 09:15:35	1 min
C 95	Provincial Government	E-mails	Oct 03, 2014 09:17:25 - 09:19:12	2 min
		Admin	Oct 03, 2014 09:22:09 - 09:54:28	32 min
C 63	Academia	Meetings	Oct 03, 2014 13:09:31 - 14:00:11	51 min
C 282	Academia	Meetings	Oct 03, 2014 14:02:13 - 14:04:55	3 min
C 282	Academia	E-mails	Oct 03, 2014 14:11:00 - 14:11:53	1 min
C 205	City of Cape Town	E-mails	Oct 03, 2014 14:41:44 - 14:42:46	1 min
C 187	Private Sector	E-mails	Oct 03, 2014 14:43:19 - 14:48:27	5 min
C 87	City of Cape Town	E-mails	Oct 03, 2014 14:51:31 - 14:57:46	6 min
C 116	Government	Background research	Oct 03, 2014 14:58:09 - 15:01:42	4 min
C 116	Government	E-mails	Oct 03, 2014 15:01:53 - 15:11:03	9 min
C 257	Private Sector	Background research	Oct 03, 2014 15:11:36 - 15:19:25	8 min
C 257	Private Sector	E-mails	Oct 03, 2014 15:19:30 - 15:22:47	3 min
C 284	Provincial Government	E-mails	Oct 03, 2014 15:24:00 - 15:30:05	6 min
C 224	Provincial Government	E-mails	Oct 03, 2014 15:30:41 - 15:32:38	2 min
C 285	Provincial Government	Background research	Oct 03, 2014 15:33:45 - 15:34:43	1 min
C 285	Provincial Government	E-mails	Oct 03, 2014 15:34:47 - 15:49:45	15 min
C 182	Provincial Government	E-mails	Oct 03, 2014 15:50 min - 15:54:01	4 min
C 96	Provincial Government	E-mails	Oct 03, 2014 15:54:33 - 15:55:06	1 min
C 237	City of Cape Town	E-mails	Oct 03, 2014 15:55:12 - 15:56:12	1 min
C 242	City of Cape Town	E-mails	Oct 03, 2014 15:56:43 - 15:57:22	1 min
C 29	Academia	E-mails	Oct 03, 2014 16:00:12 - 16:07:10	7 min
C 29	Academia	E-mails	Oct 03, 2014 17:11:22 - 17:20:12	9 min
C 71	Private Sector	E-mails	Oct 03, 2014 17:20:25 - 17:22:25	2 min
C 282	Academia	E-mails	Oct 03, 2014 17:22:46 - 17:23:38	1 min
C 182	Provincial Government	E-mails	Oct 03, 2014 17:27:44 - 17:33:13	5 min
C 71	Private Sector	E-mails	Oct 04, 2014 10:14:44 - 10:16:28	2 min
		Admin	Oct 04, 2014 10:20:29 - 10:24:53	4 min
D 158	Private Sector	Reading	Oct 04, 2014 10:25:04 - 10:40:44	16 min
D 158	Private Sector	Calculating	Oct 04, 2014 10:40:49 - 10:49:32	9 min
		Admin	Oct 04, 2014 10:49:55 - 10:56:12	6 min
D 159	Private Sector	Reading	Oct 04, 2014 10:56:46 - 10:59:22	3 min
D 156	Private Sector	Reading	Oct 04, 2014 10:59:46 - 11:02:06	2 min

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ID	Group	Activity	Date and time	Duration
D 160	Academia	Reading	Oct 04, 2014 11:02:26 - 11:26:46	24 min
C 275	Academia	Background research	Oct 04, 2014 11:26:59 - 11:32:09	5 min
C 275	Academia	E-mails	Oct 04, 2014 11:32:14 - 11:38:23	6 min
C 23	Private Sector	Background research	Oct 04, 2014 11:51:13 - 12:10:14	19 min
C 23	Private Sector	E-mails	Oct 04, 2014 12:10:20 - 12:12:51	3 min
C 19	Private Sector	Background research	Oct 04, 2014 12:13:14 - 12:27:08	14 min
D 168	Private Sector	Reading	Oct 04, 2014 13:15:08 - 13:38:42	24 min
C 19	Private Sector	E-mails	Oct 04, 2014 13:38:49 - 13:49:32	11 min
C 115	Private Sector	Background research	Oct 04, 2014 13:50:33 - 13:58:07	8 min
C 115	Private Sector	E-mails	Oct 04, 2014 13:58:12 - 14:03:06	5 min
C 287	Private Sector	Background research	Oct 04, 2014 14:03:53 - 14:04:44	1 min
C 287	Private Sector	E-mails	Oct 04, 2014 14:04:48 - 14:06:11	1 min
C 288	Private Sector	Background research	Oct 04, 2014 14:06:43 - 14:08:45	2 min
C 81	Academia	Background research	Oct 04, 2014 14:10:27 - 14:26:35	16 min
D 170	Academia	Reading	Oct 04, 2014 14:26:42 - 14:33:26	7 min
		Admin	Oct 04, 2014 16:50:16 - 17:27:33	37 min
		Admin	Oct 04, 2014 17:27:36 - 17:27:36	0 min
		Admin	Oct 06, 2014 05:49:37 - 05:53:42	4 min
C 86	Private Sector	E-mails	Oct 06, 2014 05:53:49 - 05:55:05	1 min
C 185	Provincial Government	E-mails	Oct 06, 2014 05:55:12 - 05:59:32	4 min
C 176	Private Sector	E-mails	Oct 06, 2014 05:59:39 - 06:02:42	3 min
		Admin	Oct 06, 2014 06:05:04 - 06:15:53	11 min
		Admin	Oct 06, 2014 07:24:32 - 07:36:53	12 min
C 141	Academia	E-mails	Oct 06, 2014 07:37:08 - 07:42:58	6 min
C 267	Government	E-mails	Oct 06, 2014 07:44:47 - 07:51:32	7 min
C 176	Private Sector	E-mails	Oct 06, 2014 08:15:14 - 08:15:51	1 min
C 109	City of Cape Town	E-mails	Oct 06, 2014 09:05:14 - 09:07:32	2 min
C 284	Provincial Government	E-mails	Oct 06, 2014 09:18:52 - 09:21:42	3 min
C 267	Government	E-mails	Oct 06, 2014 09:21:57 - 09:23:46	2 min
C 92	City of Cape Town	E-mails	Oct 06, 2014 09:51:02 - 09:51:39	1 min
C 275	Academia	E-mails	Oct 06, 2014 09:51:51 - 09:54:01	2 min
C 284	Provincial Government	E-mails	Oct 06, 2014 09:54:07 - 09:57:10	3 min
C 267	Government	E-mails	Oct 06, 2014 09:57:20 - 10:02:21	5 min
D 142	Government	Reading	Oct 06, 2014 10:02:30 - 10:11:29	9 min
C 244	City of Cape Town	Transportation	Oct 06, 2014 11:06:34 - 11:58:17	52 min
C 244	City of Cape Town	Meetings	Oct 06, 2014 11:58:41 - 12:50:56	52 min
C 244	City of Cape Town	Transportation	Oct 06, 2014 12:50:56 - 13:32:50	42 min

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ID	Group	Activity	Date and time	Duration
		Admin	Oct 06, 2014 15:11:26 - 15:15:22	4 min
C 244	City of Cape Town	E-mails	Oct 06, 2014 15:15:47 - 15:18:30	3 min
C 176	Private Sector	E-mails	Oct 06, 2014 15:18:46 - 15:24:34	6 min
C 176	Private Sector	Background research	Oct 06, 2014 15:24:41 - 15:28:56	4 min
C 267	Government	E-mails	Oct 06, 2014 15:29:28 - 15:30:43	1 min
C 275	Academia	E-mails	Oct 06, 2014 15:30:49 - 15:32:18	1 min
C 176	Private Sector	E-mails	Oct 06, 2014 15:36:23 - 15:37:06	1 min
C 176	Private Sector	E-mails	Oct 06, 2014 16:01:43 - 16:15:36	14 min
		Admin	Oct 07, 2014 08:30:55 - 08:36:03	5 min
C 248	Government	E-mails	Oct 07, 2014 08:36:30 - 08:41:44	5 min
C 6	Academia	E-mails	Oct 07, 2014 08:41:52 - 09:13:11	31 min
		Admin	Oct 07, 2014 09:13:49 - 09:30:07	16 min
C 71	Private Sector	Transportation	Oct 07, 2014 09:35:10 - 10:20:26	45 min
D 185	Academia	Reading	Oct 07, 2014 10:21:26 - 10:30:16	9 min
C 71	Private Sector	Meetings	Oct 07, 2014 10:31:29 - 11:48:19	1:17 h
C 71	Private Sector	Transportation	Oct 07, 2014 11:48:26 - 12:29:01	41 min
		Admin	Oct 07, 2014 13:55:23 - 13:59:48	4 min
C 275	Academia	Meetings	Oct 07, 2014 14:00:29 - 14:42:43	42 min
C 243	Academia	Background research	Oct 07, 2014 14:55:16 - 15:15:23	20 min
C 121	Provincial Government	E-mails	Oct 07, 2014 15:55:11 - 15:57:49	3 min
C 82	Academia	Background research	Oct 07, 2014 15:58:05 - 16:02:38	5 min
C 63	Academia	E-mails	Oct 07, 2014 16:03:24 - 16:03:52	0 min
C 29	Academia	E-mails	Oct 07, 2014 16:04:12 - 16:06:55	3 min
C 8	Academia	E-mails	Oct 07, 2014 16:09:00 - 16:10:02	1 min
C 99	City of Cape Town	Background research	Oct 07, 2014 16:10:25 - 16:29:40	19 min
D 178	Government	Reading	Oct 07, 2014 16:29:48 - 16:31:58	2 min
C 291	Private Sector	Background research	Oct 07, 2014 16:32:11 - 16:39:29	7 min
C 291	Private Sector	E-mails	Oct 07, 2014 16:39:34 - 16:41:49	2 min
C 63	Academia	E-mails	Oct 07, 2014 16:42:38 - 16:42:48	0 min
C 82	Academia	E-mails	Oct 07, 2014 16:42:55 - 16:45:40	3 min
C 99	City of Cape Town	E-mails	Oct 07, 2014 16:45:56 - 16:48:17	2 min
C 275	Academia	Background research	Oct 07, 2014 16:53:50 - 17:08:42	15 min
C 23	Private Sector	E-mails	Oct 08, 2014 05:24:43 - 05:25:39	1 min
		Admin	Oct 08, 2014 09:09:39 - 09:20:55	11 min
C 14	Provincial Government	E-mails	Oct 08, 2014 09:52:43 - 09:56:29	4 min
C 224	Provincial Government	Transportation	Oct 08, 2014 10:13:45 - 10:47:11	33 min
C 281	Provincial Government	Meetings	Oct 08, 2014 10:47:51 - 11:17:51	30 min

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ID	Group	Activity	Date and time	Duration
C 224	Provincial Government	Meetings	Oct 08, 2014 11:17:51 - 11:56:12	38 min
C 224	Provincial Government	Background research	Oct 08, 2014 12:00:48 - 12:08:46	8 min
D 185	Academia	Reading	Oct 08, 2014 12:11:46 - 12:25:10	13 min
C 315	Private Sector	E-mails	Oct 08, 2014 13:14:58 - 13:16:55	2 min
C 182	Provincial Government	E-mails	Oct 08, 2014 14:05:14 - 14:05:54	1 min
C 182	Provincial Government	E-mails	Oct 08, 2014 15:04:40 - 15:12:50	8 min
C 182	Provincial Government	E-mails	Oct 08, 2014 16:29:03 - 16:32:42	4 min
C 224	Provincial Government	Transportation	Oct 08, 2014 18:17:01 - 18:34:06	17 min
		Admin	Oct 09, 2014 09:02:05 - 09:08:16	6 min
C 224	Provincial Government	E-mails	Oct 09, 2014 09:13:12 - 09:16:23	3 min
C 175	Academia	E-mails	Oct 09, 2014 10:01:38 - 10:02:21	1 min
C 224	Provincial Government	Background research	Oct 09, 2014 10:37:19 - 10:49:18	12 min
		Admin	Oct 09, 2014 10:54:49 - 11:07:21	13 min
D 185	Academia	Background research	Oct 09, 2014 11:07:33 - 11:23:01	15 min
C 328	Academia	Meetings	Oct 09, 2014 12:19:41 - 12:23:05	3 min
C 284	Provincial Government	Transportation	Oct 09, 2014 13:55:25 - 14:20:22	25 min
C 284	Provincial Government	Meetings	Oct 09, 2014 14:20:23 - 15:02:58	43 min
C 284	Provincial Government	Transportation	Oct 09, 2014 15:02:58 - 15:39:06	36 min
		Admin	Oct 09, 2014 16:37:47 - 17:12:26	35 min
		Admin	Oct 10, 2014 06:33:15 - 07:08:10	35 min
C 292	Academia	Meetings	Oct 10, 2014 11:24:00 - 11:38:00	14 min
C 82	Academia	Meetings	Oct 10, 2014 12:49:00 - 13:12:00	23 min
		Admin	Oct 10, 2014 13:25:29 - 13:30:18	5 min
C 141	Academia	E-mails	Oct 10, 2014 13:30:28 - 13:31:39	1 min
C 175	Academia	E-mails	Oct 10, 2014 13:31:47 - 13:37:23	6 min
C 86	Private Sector	E-mails	Oct 10, 2014 13:39:27 - 13:41:10	2 min
C 263	Academia	E-mails	Oct 10, 2014 13:54:05 - 14:21:47	28 min
		Admin	Oct 10, 2014 14:23:21 - 16:14:29	1:51 h
		Admin	Oct 10, 2014 20:48:48 - 21:37:24	49 min
D 189	City of Cape Town	Reading	Oct 10, 2014 21:37:35 - 21:43:28	6 min
		Admin	Oct 11, 2014 09:41:56 - 10:58:46	1:17 h
		Admin	Oct 11, 2014 18:08:30 - 18:33:22	25 min
		Admin	Oct 11, 2014 21:00:28 - 21:42:12	42 min
C 141	Academia	E-mails	Oct 11, 2014 21:42:32 - 21:44:16	2 min
C 141	Academia	E-mails	Oct 13, 2014 06:22:19 - 06:23:43	1 min
		Admin	Oct 13, 2014 07:34:34 - 07:47:22	13 min
C 303	Academia	Background research	Oct 13, 2014 09:18:04 - 09:20:10	2 min

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ID	Group	Activity	Date and time	Duration
C 303	Academia	E-mails	Oct 13, 2014 09:20:14 - 09:21:50	2 min
C 307	Private Sector	Background research	Oct 13, 2014 09:22:33 - 09:28:48	6 min
C 307	Private Sector	E-mails	Oct 13, 2014 09:28:53 - 09:34:17	5 min
C 308	Private Sector	Background research	Oct 13, 2014 09:34:53 - 09:36:29	2 min
C 308	Private Sector	E-mails	Oct 13, 2014 09:36:32 - 09:43:24	7 min
C 248	Government	E-mails	Oct 13, 2014 09:43:33 - 09:44:52	1 min
C 125	Private Sector	E-mails	Oct 13, 2014 09:48:04 - 10:03:53	16 min
C 303	Academia	E-mails	Oct 13, 2014 10:06:38 - 10:07:08	1 min
C 257	Private Sector	Background research	Oct 13, 2014 10:07:22 - 10:23:05	16 min
C 422	Private Sector	E-mails	Oct 13, 2014 10:23:36 - 10:31:48	8 min
C 307	Private Sector	E-mails	Oct 13, 2014 10:31:55 - 10:36:57	5 min
C 281	Provincial Government	E-mails	Oct 13, 2014 11:09:12 - 11:13:16	4 min
C 308	Private Sector	E-mails	Oct 13, 2014 12:54:07 - 12:58:46	5 min
		Admin	Oct 13, 2014 12:59:37 - 13:38:10	39 min
D 176	Private Sector	Calculating	Oct 13, 2014 14:11:35 - 14:21:13	10 min
C 243	Academia	Meetings	Oct 13, 2014 14:59:28 - 15:32:45	33 min
C 243	Academia	Background research	Oct 13, 2014 15:48:39 - 16:03:18	15 min
C 303	Academia	E-mails	Oct 13, 2014 16:03:55 - 16:06:30	3 min
C 113	Academia	E-mails	Oct 13, 2014 16:58:12 - 17:01:23	3 min
C 113	Academia	E-mails	Oct 13, 2014 17:15:16 - 17:15:50	1 min
		Admin	Oct 14, 2014 05:36:03 - 05:38:56	3 min
C 291	Private Sector	E-mails	Oct 14, 2014 05:39:03 - 05:45:42	7 min
C 78	Academia	E-mails	Oct 14, 2014 05:45:48 - 05:47:05	1 min
C 305	Private Sector	E-mails	Oct 14, 2014 05:47:13 - 05:51:45	5 min
C 19	Private Sector	E-mails	Oct 14, 2014 05:52:42 - 05:59:33	7 min
C 29	Academia	E-mails	Oct 14, 2014 05:59:47 - 06:00:58	1 min
C 429	Government	E-mails	Oct 14, 2014 06:01:04 - 06:07:07	6 min
C 246	City of Cape Town	E-mails	Oct 14, 2014 06:07:45 - 06:13:22	6 min
C 6	Academia	E-mails	Oct 14, 2014 06:13:47 - 06:17:18	4 min
D 27	Academia	Reading	Oct 14, 2014 06:17:30 - 06:32:38	15 min
C 29	Academia	E-mails	Oct 14, 2014 06:33:32 - 06:35:15	2 min
C 6	Academia	E-mails	Oct 14, 2014 06:35:20 - 06:37:20	2 min
C 308	Private Sector	E-mails	Oct 14, 2014 06:39:29 - 06:42:43	3 min
D 176	Private Sector	Calculating	Oct 14, 2014 06:50:50 - 07:51:26	1:01 h
C 176	Private Sector	E-mails	Oct 14, 2014 07:51:31 - 08:32:27	41 min
D 176	Private Sector	Calculating	Oct 14, 2014 12:09:35 - 12:46:48	37 min
C 92	City of Cape Town	E-mails	Oct 14, 2014 12:48:19 - 13:02:12	14 min

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ID	Group	Activity	Date and time	Duration
C 315	Private Sector	Background research	Oct 14, 2014 13:10:42 - 13:14:02	3 min
C 92	City of Cape Town	E-mails	Oct 14, 2014 13:14:57 - 13:16:26	1 min
D 60	Government	Calculating	Oct 14, 2014 13:20:26 - 13:28:46	8 min
C 119	Government	E-mails	Oct 14, 2014 13:28:58 - 13:34:51	6 min
C 125	Private Sector	E-mails	Oct 14, 2014 14:52:35 - 14:56:32	4 min
C 423	Academia	E-mails	Oct 14, 2014 14:57:41 - 15:04:24	7 min
D 64	Government	Reading	Oct 14, 2014 15:04:48 - 15:16:21	12 min
C 371	Government	Background research	Oct 14, 2014 15:18:06 - 15:22:36	5 min
		Admin	Oct 15, 2014 06:52:49 - 06:54:54	2 min
C 78	Academia	E-mails	Oct 15, 2014 06:55:09 - 06:55:29	0 min
C 146	Academia	E-mails	Oct 15, 2014 06:55:35 - 06:57:36	2 min
C 305	Private Sector	E-mails	Oct 15, 2014 06:57:46 - 07:05:28	8 min
C 432	Government	Background research	Oct 15, 2014 07:06:04 - 07:08:13	2 min
C 432	Government	E-mails	Oct 15, 2014 07:08:18 - 07:25:04	17 min
C 424	Academia	E-mails	Oct 15, 2014 07:25:24 - 07:37:41	12 min
C 432	Government	E-mails	Oct 15, 2014 07:44:59 - 07:45:41	1 min
C 41	Academia	E-mails	Oct 15, 2014 07:48:15 - 07:50:52	3 min
C 99	City of Cape Town	E-mails	Oct 15, 2014 07:51:06 - 07:53:41	3 min
C 99	City of Cape Town	E-mails	Oct 15, 2014 08:35:17 - 08:36:08	1 min
C 308	Private Sector	E-mails	Oct 15, 2014 10:52:47 - 10:54:34	2 min
C 263	Academia	E-mails	Oct 15, 2014 10:57:12 - 11:15:57	19 min
C 305	Private Sector	E-mails	Oct 15, 2014 11:29:52 - 11:35:58	6 min
C 434	Private Sector	E-mails	Oct 15, 2014 11:44:26 - 11:47:22	3 min
C 248	Government	E-mails	Oct 16, 2014 09:27:00 - 09:29:26	2 min
C 435	Private Sector	E-mails	Oct 16, 2014 09:30 min - 09:35:40	6 min
C 436	Government	E-mails	Oct 16, 2014 09:39:30 - 09:43:11	4 min
C 305	Private Sector	E-mails	Oct 16, 2014 09:43:32 - 09:45:38	2 min
C 437	Government	E-mails	Oct 16, 2014 09:47:58 - 09:57:27	9 min
C 438	Private Sector	E-mails	Oct 16, 2014 09:58:16 - 10:06:50	9 min
D 201	Government	Reading	Oct 16, 2014 10:07:07 - 10:09:45	3 min
C 424	Academia	E-mails	Oct 16, 2014 10:10:44 - 10:13:12	2 min
C 263	Academia	E-mails	Oct 16, 2014 10:14:22 - 10:23:35	9 min
C 248	Government	E-mails	Oct 16, 2014 10:24:01 - 10:28:23	4 min
C 6	Academia	Meetings	Oct 16, 2014 12:02:52 - 13:31:21	1:28 h
C 181	Provincial Government	Meetings	Oct 16, 2014 18:53:00 - 18:55:00	2 min
C 292	Academia	E-mails	Oct 17, 2014 05:20:20 - 05:22:12	2 min
		Admin	Oct 17, 2014 08:24:50 - 08:31:22	7 min

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ID	Group	Activity	Date and time	Duration
C 181	Provincial Government	E-mails	Oct 17, 2014 08:31:58 - 08:36:16	4 min
C 175	Academia	E-mails	Oct 17, 2014 08:36:28 - 08:43:07	7 min
C 14	Provincial Government	E-mails	Oct 17, 2014 08:43:15 - 08:50:56	8 min
C 6	Academia	Background research	Oct 17, 2014 08:59:07 - 09:22:41	24 min
C 308	Private Sector	Transportation	Oct 17, 2014 11:45:17 - 11:56:20	11 min
C 308	Private Sector	Meetings	Oct 17, 2014 11:56:50 - 12:54:10	57 min
C 308	Private Sector	Transportation	Oct 17, 2014 12:54:10 - 13:03:19	9 min
C 442	Academia	E-mails	Oct 17, 2014 14:36:51 - 14:38:08	1 min
C 448	Private Sector	E-mails	Oct 17, 2014 14:38:17 - 14:44:31	6 min
C 146	Academia	E-mails	Oct 17, 2014 14:45:35 - 14:46:56	1 min
C 455	Academia	E-mails	Oct 17, 2014 14:47:11 - 14:48:45	2 min
C 437	Government	E-mails	Oct 17, 2014 14:49:41 - 14:51:57	2 min
C 249	Academia	E-mails	Oct 17, 2014 14:52:10 - 14:56:57	5 min
C 432	Government	E-mails	Oct 17, 2014 15:03:37 - 15:10:15	7 min
C 237	City of Cape Town	E-mails	Oct 17, 2014 15:14:08 - 15:23:28	9 min
		Admin	Oct 20, 2014 08:25:25 - 08:47:23	22 min
C 149	Government	Background research	Oct 20, 2014 08:47:42 - 09:15:14	28 min
C 248	Government	Transportation	Oct 20, 2014 09:20 min - 10:10 min	50 min
C 248	Government	Meetings	Oct 20, 2014 10:10 min - 11:17:00	1:07 h
C 420	Government	Transportation	Oct 20, 2014 11:17:00 - 11:36:00	19 min
C 420	Government	Background research	Oct 20, 2014 11:36:00 - 12:21:00	45 min
C 420	Government	Transportation	Oct 20, 2014 12:21:00 - 12:47:00	26 min
C 248	Government	Background research	Oct 20, 2014 14:39:52 - 14:50:07	10 min
D 204	Private Sector	Reading	Oct 22, 2014 08:45:25 - 09:27:04	42 min
D 33	Academia	Reading	Oct 22, 2014 09:27:57 - 09:50:07	22 min
C 113	Academia	E-mails	Oct 22, 2014 09:54:23 - 09:59:54	6 min
C 448	Private Sector	E-mails	Oct 22, 2014 10:00:25 - 10:04:54	4 min
C 464	Private Sector	E-mails	Oct 22, 2014 10:59:14 - 11:13:29	14 min
C 432	Government	E-mails	Oct 22, 2014 11:13:40 - 11:15:40	2 min
C 465	City of Cape Town	E-mails	Oct 22, 2014 11:16:33 - 11:25:33	9 min
C 249	Academia	E-mails	Oct 22, 2014 11:25:52 - 11:29:30	4 min
C 466	Government	E-mails	Oct 22, 2014 11:30:42 - 11:36:37	6 min
C 466	Government	Background research	Oct 22, 2014 11:36:41 - 11:42:37	6 min
C 423	Academia	E-mails	Oct 22, 2014 11:42:52 - 11:47:04	4 min
C 466	Government	E-mails	Oct 22, 2014 11:47:14 - 11:47:35	0 min
C 263	Academia	E-mails	Oct 22, 2014 11:47:44 - 11:54:39	7 min
C 176	Private Sector	E-mails	Oct 22, 2014 11:55:14 - 12:09:00	14 min

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ID	Group	Activity	Date and time	Duration
C 467	Private Sector	E-mails	Oct 22, 2014 12:09:12 - 12:15:56	7 min
C 63	Academia	E-mails	Oct 22, 2014 14:06:55 - 14:09:16	2 min
C 458	Government	E-mails	Oct 22, 2014 14:09:44 - 14:18:25	9 min
C 460	Government	E-mails	Oct 22, 2014 14:20 min - 14:25:22	5 min
C 458	Government	Background research	Oct 22, 2014 14:25:33 - 14:29:08	4 min
C 460	Government	Background research	Oct 22, 2014 14:29:26 - 14:31:32	2 min
D 196	Government	Reading	Oct 22, 2014 14:31:41 - 14:41:39	10 min
D 196	Government	E-mails	Oct 22, 2014 14:41:47 - 14:42:43	1 min
C 63	Academia	E-mails	Oct 22, 2014 14:43:51 - 14:44:30	1 min
C 464	Private Sector	E-mails	Oct 22, 2014 14:45:08 - 14:46:33	1 min
C 465	City of Cape Town	E-mails	Oct 22, 2014 14:46:45 - 14:47:36	1 min
C 249	Academia	E-mails	Oct 22, 2014 14:47:46 - 14:49:47	2 min
C 448	Private Sector	E-mails	Oct 22, 2014 14:50:18 - 14:52:51	3 min
		Admin	Oct 22, 2014 14:59:04 - 15:00:05	1 min
C 424	Academia	Phone calls	Oct 22, 2014 15:00:47 - 15:05:29	5 min
C 465	City of Cape Town	E-mails	Oct 22, 2014 15:07:02 - 15:07:14	0 min
C 469	Government	E-mails	Oct 22, 2014 15:35:01 - 15:40:27	5 min
C 469	Government	E-mails	Oct 22, 2014 15:50:34 - 15:52:24	2 min
C 458	Government	E-mails	Oct 22, 2014 15:53:01 - 16:05:20	12 min
C 469	Government	E-mails	Oct 22, 2014 16:05:33 - 16:13:41	8 min
C 424	Academia	Transportation	Oct 23, 2014 09:42:00 - 09:59:00	17 min
C 424	Academia	Meetings	Oct 23, 2014 09:59:00 - 10:36:00	37 min
C 424	Academia	Transportation	Oct 23, 2014 10:36:00 - 10:49:00	13 min
C 424	Academia	Background research	Oct 23, 2014 10:59:46 - 11:10:45	11 min
D 210	Academia	Reading	Oct 23, 2014 11:11:12 - 11:25:56	15 min
C 248	Government	Background research	Oct 23, 2014 11:27:13 - 11:33:47	7 min
C 469	Government	E-mails	Oct 23, 2014 11:46:55 - 11:49:51	3 min
C 179	Government	E-mails	Oct 23, 2014 16:42:38 - 16:43:04	0 min
C 455	Academia	Transportation	Oct 24, 2014 13:42:00 - 14:00 min	18 min
C 455	Academia	Meetings	Oct 24, 2014 14:00 min - 15:29:00	1:29 h
C 455	Academia	Transportation	Oct 24, 2014 15:29:00 - 15:40 min	11 min
C 455	Academia	Background research	Oct 24, 2014 16:20:20 - 16:28:55	9 min
C 455	Academia	E-mails	Oct 24, 2014 16:55:24 - 16:59:33	4 min
C 482	Academia	E-mails	Oct 24, 2014 16:59:45 - 17:01:06	1 min
D 215	Government	Reading	Oct 25, 2014 16:46:56 - 16:49:52	3 min
D 216	Government	Reading	Oct 25, 2014 16:50:07 - 16:52:25	2 min
		Admin	Oct 25, 2014 16:52:54 - 16:58:54	6 min

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ID	Group	Activity	Date and time	Duration
C 113	Academia	E-mails	Oct 27, 2014 11:12:59 - 11:13:32	1 min
D 33	Academia	Reading	Oct 27, 2014 11:14:07 - 11:48:41	35 min
C 113	Academia	Phone calls	Oct 27, 2014 12:02:57 - 12:29:36	27 min
C 113	Academia	Background research	Oct 27, 2014 12:29:43 - 12:31:30	2 min
D 208	Academia	Reading	Oct 27, 2014 13:24:18 - 13:40 min	16 min
D 210	Academia	Reading	Oct 27, 2014 13:40:49 - 14:32:14	51 min
C 193	City of Cape Town	E-mails	Oct 28, 2014 09:08:35 - 09:12:51	4 min
C 176	Private Sector	E-mails	Oct 28, 2014 09:13:41 - 09:28:52	15 min
C 194	Provincial Government	E-mails	Oct 28, 2014 09:29:32 - 09:30:40	1 min
C 6	Academia	E-mails	Oct 28, 2014 09:43:05 - 09:55:02	12 min
C 263	Academia	E-mails	Oct 28, 2014 10:04:55 - 10:10:09	5 min
C 482	Academia	E-mails	Oct 28, 2014 10:27:40 - 10:29:08	1 min
C 482	Academia	E-mails	Oct 28, 2014 11:16:19 - 11:16:48	0 min
C 482	Academia	Transportation	Oct 30, 2014 09:51:00 - 10:00:00	9 min
C 482	Academia	Meetings	Oct 30, 2014 10:00:00 - 11:49:00	1:49 h
C 482	Academia	Transportation	Oct 30, 2014 11:49:00 - 12:00 min	11 min
		Admin	Oct 31, 2014 11:17:24 - 11:30:44	13 min
		Admin	Oct 31, 2014 11:30:47 - 11:30:47	0 min
C 482	Academia	Background research	Oct 31, 2014 11:25:11 - 11:43:24	18 min
C 482	Academia	E-mails	Oct 31, 2014 11:43:28 - 11:46:59	4 min
C 284	Provincial Government	E-mails	Oct 31, 2014 11:47:43 - 11:49:57	2 min
C 71	Private Sector	E-mails	Oct 31, 2014 11:50:19 - 11:53:22	3 min
C 179	Government	E-mails	Oct 31, 2014 11:56:23 - 11:57:07	1 min
C 6	Academia	E-mails	Oct 31, 2014 11:57:21 - 11:58:41	1 min
C 29	Academia	E-mails	Oct 31, 2014 11:58:46 - 11:59:22	1 min
C 63	Academia	E-mails	Oct 31, 2014 11:59:42 - 12:00:48	1 min
C 41	Academia	E-mails	Oct 31, 2014 12:01:30 - 12:03:02	2 min
C 29	Academia	E-mails	Oct 31, 2014 12:03:16 - 12:04:27	1 min
C 465	City of Cape Town	E-mails	Oct 31, 2014 12:04:36 - 12:06:14	2 min
D 33	Academia	Reading	Oct 31, 2014 12:07:16 - 12:13:18	6 min
C 458	Government	E-mails	Oct 31, 2014 12:13:24 - 12:15:05	2 min
C 41	Academia	E-mails	Oct 31, 2014 12:15:14 - 12:15:51	1 min
C 308	Private Sector	E-mails	Oct 31, 2014 15:21:47 - 15:24:07	2 min
C 467	Private Sector	E-mails	Oct 31, 2014 15:24:32 - 15:26:08	2 min
C 424	Academia	E-mails	Oct 31, 2014 15:26:16 - 15:34:11	8 min
C 63	Academia	E-mails	Oct 31, 2014 15:48:21 - 15:49:01	1 min
C 29	Academia	E-mails	Oct 31, 2014 15:49:13 - 15:50:23	1 min

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ID	Group	Activity	Date and time	Duration
C 284	Provincial Government	E-mails	Oct 31, 2014 15:50:33 - 15:50:52	0 min
C 424	Academia	E-mails	Oct 31, 2014 21:10:24 - 21:11:28	1 min
C 29	Academia	E-mails	Nov 04, 2014 06:52:23 - 06:53:53	2 min
C 29	Academia	E-mails	Nov 04, 2014 12:56:23 - 12:57:37	1 min
C 465	City of Cape Town	E-mails	Nov 04, 2014 12:57:45 - 12:58:44	1 min
C 455	Academia	E-mails	Nov 04, 2014 12:59:03 - 12:59:43	1 min
C 465	City of Cape Town	E-mails	Nov 04, 2014 13:11:01 - 13:11:25	0 min
D 33	Academia	E-mails	Nov 05, 2014 08:11:58 - 08:14:20	2 min
C 113	Academia	E-mails	Nov 05, 2014 08:14:27 - 08:16:43	2 min
C 29	Academia	E-mails	Nov 05, 2014 08:21:45 - 08:22:00	0 min
C 470	Government	E-mails	Nov 05, 2014 08:27:38 - 08:30:25	3 min
C 482	Academia	E-mails	Nov 05, 2014 08:30:40 - 08:32:05	1 min
C 482	Academia	Background research	Nov 05, 2014 08:32:10 - 08:41:10	9 min
		Admin	Nov 05, 2014 08:41:31 - 09:03:01	22 min
C 116	Government	E-mails	Nov 05, 2014 09:03:27 - 09:04:38	1 min
C 257	Private Sector	E-mails	Nov 05, 2014 09:04:45 - 09:15:42	11 min
C 432	Government	E-mails	Nov 05, 2014 09:15:59 - 09:18:59	3 min
C 82	Academia	E-mails	Nov 05, 2014 09:19:34 - 09:21:09	2 min
		Background research	Nov 05, 2014 09:21:26 - 09:37:18	16 min
D 167	Provincial Government	Calculating	Nov 05, 2014 09:38:19 - 10:08:14	30 min
D 52	Government	Reading	Nov 05, 2014 10:08:21 - 10:27:15	19 min
C 531	Private Sector	Background research	Nov 05, 2014 10:27:46 - 10:30:58	3 min
D 167	Provincial Government	Calculating	Nov 05, 2014 10:31:35 - 11:12:38	41 min
C 305	Private Sector	E-mails	Nov 05, 2014 11:12:47 - 11:29:02	16 min
C 432	Government	E-mails	Nov 05, 2014 11:30:23 - 11:33:23	3 min
C 257	Private Sector	E-mails	Nov 05, 2014 11:33:44 - 11:34:40	1 min
C 534	Private Sector	E-mails	Nov 05, 2014 11:34:58 - 11:35:57	1 min
C 182	Provincial Government	E-mails	Nov 05, 2014 11:41:42 - 11:49:38	8 min
C 432	Government	E-mails	Nov 05, 2014 14:33:04 - 14:35:02	2 min
D 33	Academia	E-mails	Nov 05, 2014 14:35:12 - 14:40:22	5 min
C 182	Provincial Government	E-mails	Nov 05, 2014 15:23:16 - 15:24:56	2 min
D 167	Provincial Government	Calculating	Nov 05, 2014 15:25:05 - 16:21:35	57 min
C 257	Private Sector	Background research	Nov 06, 2014 08:23:32 - 08:42:12	19 min
C 6	Academia	E-mails	Nov 06, 2014 08:42:21 - 08:48:42	6 min
C 6	Academia	E-mails	Nov 06, 2014 09:20:36 - 09:24:37	4 min
C 534	Private Sector	E-mails	Nov 06, 2014 09:25:57 - 09:31:54	6 min
C 470	Government	E-mails	Nov 06, 2014 09:39:48 - 09:41:13	1 min

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ID	Group	Activity	Date and time	Duration
C 229	Government	E-mails	Nov 06, 2014 09:41:25 - 09:49:52	8 min
		Admin	Nov 06, 2014 09:51:55 - 09:57:22	5 min
C 19	Private Sector	E-mails	Nov 06, 2014 09:57:31 - 10:03:58	6 min
		Background research	Nov 06, 2014 10:04:24 - 10:31:52	27 min
C 29	Academia	Meetings	Nov 06, 2014 11:01:12 - 11:45:51	45 min
C 29	Academia	E-mails	Nov 06, 2014 11:55:52 - 11:59:59	4 min
C 229	Government	Background research	Nov 06, 2014 13:00:30 - 13:32:58	32 min
C 432	Government	E-mails	Nov 06, 2014 13:34:29 - 13:38:20	4 min
C 535	Private Sector	Background research	Nov 06, 2014 13:39:55 - 13:44:40	5 min
C 535	Private Sector	E-mails	Nov 06, 2014 13:44:44 - 13:49:47	5 min
C 20	Private Sector	E-mails	Nov 06, 2014 13:50:55 - 13:56:45	6 min
		Background research	Nov 06, 2014 13:58:37 - 14:10:50	12 min
C 50	Academia	Meetings	Nov 06, 2014 14:18:08 - 14:40:38	23 min
C 229	Government	E-mails	Nov 06, 2014 14:41:00 - 14:50:27	9 min
C 6	Academia	E-mails	Nov 06, 2014 16:27:17 - 16:30:27	3 min
		Background research	Nov 06, 2014 19:13:12 - 19:22:23	9 min
		Background research	Nov 06, 2014 20:05:08 - 20:16:02	11 min
D 166	Academia	Reading	Nov 06, 2014 20:16:07 - 20:48:43	33 min
D 166	Academia	Reading	Nov 06, 2014 21:14:32 - 23:09:31	1:55 h
		Background research	Nov 06, 2014 23:09:44 - 23:34:35	25 min
C 6	Academia	E-mails	Nov 07, 2014 08:17:31 - 08:18:19	1 min
C 465	City of Cape Town	E-mails	Nov 07, 2014 09:50:05 - 09:50:37	1 min
C 537	Private Sector	Background research	Nov 07, 2014 09:58:46 - 10:03:17	5 min
C 538	Private Sector	E-mails	Nov 07, 2014 10:03:29 - 10:06:08	3 min
D 61	Government	Reading	Nov 07, 2014 10:06:53 - 10:08:26	2 min
C 17	Government	E-mails	Nov 07, 2014 10:08:31 - 10:11:55	3 min
D 62	Government	Reading	Nov 07, 2014 10:13:00 - 10:40:56	28 min
C 17	Government	Background research	Nov 07, 2014 10:41:04 - 10:41:52	1 min
D 22	Government	Reading	Nov 07, 2014 10:42:30 - 10:45:12	3 min
C 76	Government	Background research	Nov 07, 2014 10:45:43 - 10:48:34	3 min
		Background research	Nov 07, 2014 11:00:42 - 11:10:10	9 min
D 167	Provincial Government	Calculating	Nov 07, 2014 11:10:27 - 12:01:11	51 min
C 182	Provincial Government	E-mails	Nov 07, 2014 12:01:19 - 12:18:18	17 min
D 97	Academia	Reading	Nov 07, 2014 13:19:01 - 13:39:48	21 min
C 237	City of Cape Town	Transportation	Nov 07, 2014 13:47:00 - 14:23:17	36 min
C 237	City of Cape Town	Meetings	Nov 07, 2014 14:23:20 - 15:20 min	57 min
C 237	City of Cape Town	Transportation	Nov 07, 2014 15:20 min - 15:52:00	32 min

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ID	Group	Activity	Date and time	Duration
C 237	City of Cape Town	Background research	Nov 07, 2014 16:18:48 - 16:24:58	6 min
C 237	City of Cape Town	E-mails	Nov 07, 2014 16:25:04 - 16:33:36	9 min
C 308	Private Sector	E-mails	Nov 07, 2014 16:34:35 - 16:35:15	1 min
C 182	Provincial Government	E-mails	Nov 07, 2014 16:35:44 - 16:39:56	4 min
		Admin	Nov 07, 2014 16:40:08 - 16:46:53	7 min
D 215	Government	Calculating	Nov 07, 2014 16:48:15 - 17:07:57	20 min
C 469	Government	E-mails	Nov 07, 2014 17:08:03 - 17:22:04	14 min
C 263	Academia	E-mails	Nov 07, 2014 17:22:59 - 17:29:52	7 min
D 216	Government	Calculating	Nov 07, 2014 21:01:27 - 22:11:49	1:10 h
D 216	Government	Calculating	Nov 08, 2014 09:19:59 - 10:34:41	1:15 h
D 216	Government	Calculating	Nov 08, 2014 12:54:51 - 14:02:41	1:08 h
D 216	Government	Calculating	Nov 08, 2014 21:58:52 - 22:37:12	38 min
C 82	Academia	E-mails	Nov 09, 2014 20:28:34 - 20:29:33	1 min
C 469	Government	E-mails	Nov 10, 2014 17:16:22 - 17:27:13	11 min
C 194	Provincial Government	E-mails	Nov 12, 2014 15:47:51 - 15:48:21	1 min
C 534	Private Sector	E-mails	Nov 12, 2014 15:49:47 - 15:58:11	8 min
C 469	Government	E-mails	Nov 12, 2014 15:58:19 - 16:05:57	8 min
C 263	Academia	E-mails	Nov 12, 2014 19:25:49 - 19:27:07	1 min
C 469	Government	E-mails	Nov 13, 2014 08:35:25 - 08:37:56	3 min
C 469	Government	Background research	Nov 13, 2014 08:38:07 - 08:39:07	1 min
C 237	City of Cape Town	E-mails	Nov 13, 2014 08:39:28 - 08:43:14	4 min
C 465	City of Cape Town	E-mails	Nov 13, 2014 08:43:23 - 08:44:17	1 min
C 176	Private Sector	E-mails	Nov 13, 2014 08:45:11 - 08:46:22	1 min
		Admin	Nov 13, 2014 08:46:54 - 08:57:16	10 min
C 225	Government	Background research	Nov 13, 2014 08:57:38 - 09:09:15	12 min
D 213	Government	Reading	Nov 13, 2014 09:09:23 - 09:57:47	48 min
D 140	Government	Reading	Nov 13, 2014 09:58:01 - 10:21:20	23 min
C 244	City of Cape Town	Phone calls	Nov 13, 2014 10:21:46 - 10:25:23	4 min
C 244	City of Cape Town	E-mails	Nov 13, 2014 10:27:00 - 10:34:32	8 min
		Admin	Nov 13, 2014 10:54:58 - 11:15:46	21 min
		Background research	Nov 13, 2014 11:16:42 - 11:23:38	7 min
		Background research	Nov 13, 2014 11:37:30 - 11:45:45	8 min
C 244	City of Cape Town	E-mails	Nov 13, 2014 11:45:59 - 11:48:30	3 min
C 489	Private Sector	E-mails	Nov 13, 2014 13:37:28 - 13:46:52	9 min
C 512	Private Sector	E-mails	Nov 13, 2014 13:47:23 - 13:49:50	2 min
C 505	Private Sector	E-mails	Nov 13, 2014 13:50:34 - 13:52:24	2 min
C 320	Private Sector	E-mails	Nov 13, 2014 13:53:15 - 13:54:24	1 min

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ID	Group	Activity	Date and time	Duration
C 494	Private Sector	E-mails	Nov 13, 2014 13:55:15 - 13:58:23	3 min
C 493	Private Sector	E-mails	Nov 13, 2014 13:59:03 - 14:02:48	4 min
C 495	Private Sector	Background research	Nov 13, 2014 14:03:03 - 14:09:59	7 min
C 495	Private Sector	Phone calls	Nov 13, 2014 14:10:21 - 14:11:17	1 min
C 426	Private Sector	Phone calls	Nov 13, 2014 14:12:02 - 14:13:36	2 min
C 426	Private Sector	Phone calls	Nov 13, 2014 14:13:42 - 14:18:31	5 min
C 426	Private Sector	Phone calls	Nov 13, 2014 14:18:37 - 14:24:03	5 min
C 426	Private Sector	Phone calls	Nov 13, 2014 14:24:10 - 14:24:58	1 min
C 528	Private Sector	E-mails	Nov 13, 2014 14:25:26 - 14:27:15	2 min
C 426	Private Sector	Phone calls	Nov 13, 2014 14:27:39 - 14:29:11	2 min
C 489	Private Sector	E-mails	Nov 13, 2014 14:29:30 - 14:30:25	1 min
C 320	Private Sector	E-mails	Nov 13, 2014 15:06:58 - 15:07:50	1 min
C 237	City of Cape Town	E-mails	Nov 13, 2014 15:08:47 - 15:09:09	0 min
D 140	Government	Reading	Nov 13, 2014 17:24:02 - 19:16:54	1:53 h
C 244	City of Cape Town	E-mails	Nov 13, 2014 19:30:13 - 19:36:47	7 min
D 140	Government	Reading	Nov 13, 2014 19:36:59 - 19:58:16	21 min
C 244	City of Cape Town	E-mails	Nov 13, 2014 21:25:15 - 21:27:07	2 min
C 229	Government	E-mails	Nov 13, 2014 21:27:16 - 21:34:34	7 min
		Background research	Nov 14, 2014 07:59:56 - 08:18:12	18 min
		Admin	Nov 14, 2014 09:21:36 - 09:23:57	2 min
C 543	Academia	E-mails	Nov 14, 2014 09:24:01 - 09:26:15	2 min
C 512	Private Sector	E-mails	Nov 14, 2014 09:30:55 - 09:32:30	2 min
C 176	Private Sector	E-mails	Nov 14, 2014 09:32:38 - 09:34:12	2 min
		Background research	Nov 14, 2014 09:39:53 - 09:46:55	7 min
C 14	Provincial Government	E-mails	Nov 14, 2014 09:47:05 - 09:48:18	1 min
		Background research	Nov 14, 2014 09:48:24 - 09:58:04	10 min
C 455	Academia	E-mails	Nov 14, 2014 09:58:09 - 10:03:21	5 min
C 181	Provincial Government	E-mails	Nov 14, 2014 10:03:27 - 10:11:56	8 min
C 544	Private Sector	E-mails	Nov 14, 2014 10:12:18 - 10:15:17	3 min
C 495	Private Sector	Phone calls	Nov 14, 2014 10:15:57 - 10:19:33	4 min
C 535	Private Sector	Phone calls	Nov 14, 2014 10:19:47 - 10:23:02	3 min
C 545	Private Sector	E-mails	Nov 14, 2014 10:23:13 - 10:26:49	4 min
C 512	Private Sector	E-mails	Nov 14, 2014 10:28:16 - 10:34:22	6 min
C 16	Academia	E-mails	Nov 14, 2014 11:17:03 - 11:34:28	17 min
C 465	City of Cape Town	E-mails	Nov 14, 2014 14:01:37 - 14:02:27	1 min
		Background research	Nov 14, 2014 14:05:19 - 14:50:15	45 min
C 63	Academia	E-mails	Nov 14, 2014 14:50:27 - 14:53:53	3 min

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ID	Group	Activity	Date and time	Duration
		Background research	Nov 14, 2014 14:54:03 - 15:40:42	47 min
C 63	Academia	E-mails	Nov 14, 2014 15:45:59 - 15:48:03	2 min
C 181	Provincial Government	E-mails	Nov 14, 2014 19:01:57 - 19:02:34	1 min
		Background research	Nov 15, 2014 17:46:49 - 17:57:39	11 min
D 216	Government	Calculating	Nov 15, 2014 17:58:03 - 18:57:26	59 min
D 216	Government	Calculating	Nov 15, 2014 19:42:20 - 20:16:58	35 min
D 216	Government	Calculating	Nov 15, 2014 20:56:16 - 22:34:47	1:39 h
D 216	Government	Calculating	Nov 16, 2014 05:46:59 - 07:37:36	1:51 h
D 216	Government	Calculating	Nov 16, 2014 08:55:18 - 10:03:52	1:09 h
D 216	Government	Calculating	Nov 16, 2014 10:45:50 - 11:00:18	14 min
D 216	Government	Calculating	Nov 17, 2014 14:37:48 - 16:42:21	2:05 h
C 469	Government	E-mails	Nov 17, 2014 16:42:31 - 16:44:45	2 min
D 216	Government	Calculating	Nov 17, 2014 16:50:47 - 17:29:54	39 min
D 216	Government	Calculating	Nov 17, 2014 18:48:26 - 19:40:31	52 min
D 216	Government	Calculating	Nov 17, 2014 20:06:27 - 20:14:37	8 min
D 97	Academia	Calculating	Nov 17, 2014 20:14:49 - 20:31:18	16 min
		Background research	Nov 18, 2014 05:19:56 - 05:38:16	18 min
D 190	Academia	Reading	Nov 18, 2014 05:38:35 - 07:04:39	1:26 h
C 469	Government	E-mails	Nov 18, 2014 07:42:30 - 07:50 min	8 min
C 469	Government	E-mails	Nov 18, 2014 08:09:27 - 08:13:07	4 min
D 229	Private Sector	Reading	Nov 18, 2014 08:47:24 - 09:14:56	28 min
D 190	Academia	Calculating	Nov 18, 2014 09:15:09 - 09:33:37	18 min
		Background research	Nov 18, 2014 09:33:52 - 09:45:05	11 min
C 469	Government	Background research	Nov 18, 2014 09:51:14 - 10:03:13	12 min
C 469	Government	E-mails	Nov 18, 2014 10:03:17 - 10:10:45	7 min
D 215	Government	Calculating	Nov 18, 2014 10:11:12 - 10:37:32	26 min
C 179	Government	E-mails	Nov 18, 2014 11:02:53 - 11:04:34	2 min
C 6	Academia	Meetings	Nov 18, 2014 11:02:13 - 12:02:00	1:00 h
C 489	Private Sector	E-mails	Nov 18, 2014 19:01:34 - 19:03:37	2 min
C 469	Government	E-mails	Nov 18, 2014 19:10 min - 19:10:33	1 min
C 543	Academia	E-mails	Nov 18, 2014 19:10:55 - 19:13:45	3 min
C 489	Private Sector	E-mails	Nov 19, 2014 06:42:58 - 06:45:52	3 min
C 489	Private Sector	E-mails	Nov 19, 2014 06:53:25 - 06:56:46	3 min
C 181	Provincial Government	E-mails	Nov 19, 2014 09:24:48 - 09:32:38	8 min
C 534	Private Sector	Background research	Nov 19, 2014 09:35:37 - 09:43:40	8 min
C 534	Private Sector	E-mails	Nov 19, 2014 09:50:37 - 10:03:59	13 min
D 215	Government	Calculating	Nov 19, 2014 10:13:20 - 11:26:43	1:13 h

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ID	Group	Activity	Date and time	Duration
C 263	Academia	E-mails	Nov 19, 2014 11:29:53 - 11:35:20	5 min
D 234	Private Sector	Reading	Nov 19, 2014 11:36:25 - 11:45:56	10 min
		Background research	Nov 19, 2014 11:46:08 - 12:05:15	19 min
C 489	Private Sector	E-mails	Nov 19, 2014 12:56:17 - 12:57:05	1 min
C 181	Provincial Government	E-mails	Nov 19, 2014 13:56:52 - 14:00:06	3 min
D 234	Private Sector	Reading	Nov 19, 2014 14:01:55 - 14:10:19	8 min
C 181	Provincial Government	E-mails	Nov 20, 2014 05:16:38 - 05:17:22	1 min
C 543	Academia	E-mails	Nov 20, 2014 05:17:34 - 05:18:05	1 min
C 75	Private Sector	Transportation	Nov 20, 2014 12:06:00 - 12:40 min	34 min
C 75	Private Sector	Background research	Nov 20, 2014 12:40 min - 14:18:00	1:38 h
C 75	Private Sector	Transportation	Nov 20, 2014 14:18:00 - 14:47:00	29 min
C 534	Private Sector	E-mails	Nov 20, 2014 15:52:02 - 16:09:36	18 min
		Admin	Nov 20, 2014 16:19:04 - 16:28:52	10 min
C 469	Government	E-mails	Nov 20, 2014 16:29:25 - 16:33:15	4 min
		Background research	Nov 20, 2014 21:10:33 - 21:48:23	38 min
C 564	Academia	E-mails	Nov 20, 2014 21:48:28 - 21:50:07	2 min
		Admin	Nov 21, 2014 09:00:49 - 09:05:59	5 min
C 489	Private Sector	Transportation	Nov 21, 2014 09:09:00 - 10:21:00	1:12 h
C 489	Private Sector	Meetings	Nov 21, 2014 10:21:00 - 11:27:40	1:07 h
C 547	Private Sector	Background research	Nov 21, 2014 11:28:00 - 11:52:00	24 min
C 565	Private Sector	Meetings	Nov 21, 2014 11:52:00 - 11:58:00	6 min
C 489	Private Sector	Transportation	Nov 21, 2014 11:58:00 - 12:27:00	29 min
		Admin	Nov 21, 2014 14:51:17 - 14:59:00	8 min
		Admin	Nov 21, 2014 14:59:47 - 15:03:25	4 min
		Background research	Nov 21, 2014 15:03:28 - 15:13:44	10 min
C 489	Private Sector	Background research	Nov 21, 2014 15:13:52 - 15:17:18	3 min
C 489	Private Sector	E-mails	Nov 21, 2014 15:17:25 - 15:22:46	5 min
C 574	Private Sector	E-mails	Nov 21, 2014 15:23:29 - 15:27:48	4 min
C 63	Academia	E-mails	Nov 21, 2014 15:28:13 - 15:30:41	2 min
C 565	Private Sector	E-mails	Nov 21, 2014 15:32:45 - 15:43:51	11 min
C 564	Academia	E-mails	Nov 21, 2014 15:44:35 - 15:46:44	2 min
C 575	Private Sector	E-mails	Nov 21, 2014 15:46:45 - 15:51:47	5 min
C 576	Private Sector	E-mails	Nov 21, 2014 15:51:47 - 15:54:31	3 min
C 469	Government	E-mails	Nov 21, 2014 15:58:32 - 16:05:27	7 min
C 292	Academia	Meetings	Nov 24, 2014 10:30:34 - 11:05:16	35 min
C 181	Provincial Government	E-mails	Nov 24, 2014 11:12:18 - 11:19:03	7 min
C 578	Private Sector	E-mails	Nov 24, 2014 11:20:55 - 11:23:07	2 min

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ID	Group	Activity	Date and time	Duration
C 469	Government	E-mails	Nov 24, 2014 11:23:19 - 11:24:26	1 min
		Admin	Nov 24, 2014 11:24:45 - 11:38:20	14 min
C 176	Private Sector	E-mails	Nov 24, 2014 11:38:28 - 11:39:48	1 min
C 545	Private Sector	Background research	Nov 24, 2014 11:40:11 - 11:47:15	7 min
C 545	Private Sector	E-mails	Nov 24, 2014 11:47:19 - 11:50:21	3 min
D 167	Provincial Government	Calculating	Nov 24, 2014 11:50:35 - 12:36:21	46 min
C 182	Provincial Government	E-mails	Nov 24, 2014 12:36:33 - 12:46:58	10 min
C 176	Private Sector	E-mails	Nov 24, 2014 14:08:24 - 14:09:14	1 min
C 574	Private Sector	E-mails	Nov 24, 2014 14:09:34 - 14:13:03	3 min
D 33	Academia	E-mails	Nov 24, 2014 15:49:48 - 15:51:38	2 min
D 234	Private Sector	Reading	Nov 24, 2014 15:52:04 - 16:13:02	21 min
C 320	Private Sector	E-mails	Nov 24, 2014 16:13:15 - 16:26:11	13 min
C 176	Private Sector	E-mails	Nov 25, 2014 08:57:27 - 08:58:00	1 min
		Background research	Nov 25, 2014 09:36:23 - 09:38:03	2 min
C 229	Government	E-mails	Nov 25, 2014 09:38:09 - 09:39:55	2 min
C 113	Academia	E-mails	Nov 25, 2014 09:40:24 - 09:41:34	1 min
		Background research	Nov 25, 2014 09:41:46 - 09:55:02	13 min
C 229	Government	E-mails	Nov 25, 2014 10:50:26 - 10:55:02	5 min
C 574	Private Sector	E-mails	Nov 25, 2014 10:55:44 - 10:57:04	1 min
C 182	Provincial Government	E-mails	Nov 25, 2014 16:34:33 - 16:37:44	3 min
C 579	Provincial Government	E-mails	Nov 25, 2014 16:37:48 - 16:49:38	12 min
C 534	Private Sector	E-mails	Nov 25, 2014 16:55:49 - 17:05:46	10 min
D 216	Government	Calculating	Nov 25, 2014 17:17:29 - 18:02:02	45 min
D 216	Government	Calculating	Nov 26, 2014 06:35:08 - 06:54:56	20 min
D 43	Government	Reading	Nov 26, 2014 06:55:33 - 07:15:01	19 min
		Admin	Nov 26, 2014 09:33:14 - 09:38:48	6 min
		Background research	Nov 26, 2014 10:30:47 - 10:40:59	10 min
		Background research	Nov 26, 2014 10:41:04 - 10:42:47	2 min
		Background research	Nov 26, 2014 10:42:53 - 12:02:08	1:19 h
		Background research	Nov 26, 2014 15:53:01 - 16:08:30	15 min
C 579	Provincial Government	E-mails	Nov 26, 2014 16:08:50 - 16:23:56	15 min
C 544	Private Sector	E-mails	Nov 26, 2014 16:24:04 - 16:25:26	1 min
C 181	Provincial Government	Background research	Nov 27, 2014 05:46:44 - 05:48:39	2 min
C 580	Provincial Government	E-mails	Nov 27, 2014 05:48:50 - 07:21:53	1:33 h
		Background research	Nov 27, 2014 07:22:57 - 07:27:17	4 min
		Background research	Nov 27, 2014 08:10 min - 09:22:18	1:12 h
D 96	Provincial Government	Reading	Nov 27, 2014 09:22:26 - 09:46:58	25 min

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ID	Group	Activity	Date and time	Duration
D 210	Academia	Reading	Nov 27, 2014 09:49:57 - 10:01:27	12 min
D 176	Private Sector	Calculating	Nov 27, 2014 10:01:49 - 10:40:48	39 min
		Background research	Nov 27, 2014 10:41:00 - 11:58:37	1:18 h
C 176	Private Sector	E-mails	Nov 27, 2014 12:37:04 - 12:38:12	1 min
C 580	Provincial Government	E-mails	Nov 27, 2014 13:14:26 - 13:15:45	1 min
C 583	Provincial Government	E-mails	Nov 27, 2014 13:16:07 - 13:58:09	42 min
C 92	City of Cape Town	E-mails	Nov 27, 2014 14:01:20 - 14:08:23	7 min
D 130	Private Sector	Reading	Nov 27, 2014 14:10:46 - 14:16:41	6 min
C 289	Private Sector	E-mails	Nov 27, 2014 14:17:18 - 14:37:56	21 min
		Admin	Nov 27, 2014 14:43:54 - 15:00:47	17 min
C 75	Private Sector	Background research	Nov 27, 2014 15:04:59 - 15:19:10	14 min
C 75	Private Sector	E-mails	Nov 27, 2014 15:19:17 - 15:25:08	6 min
C 576	Private Sector	E-mails	Nov 27, 2014 15:28:39 - 15:30:34	2 min
C 293	Government	Transportation	Nov 28, 2014 09:47:56 - 10:28:00	40 min
C 293	Government	Background research	Nov 28, 2014 10:28:00 - 10:53:00	25 min
		Admin	Nov 28, 2014 12:28:50 - 12:31:12	2 min
C 583	Provincial Government	E-mails	Nov 29, 2014 14:01:21 - 14:05:04	4 min
		Admin	Dec 01, 2014 09:39:48 - 09:45:03	5 min
C 400	Academia	E-mails	Dec 01, 2014 09:50:02 - 09:50:55	1 min
C 185	Provincial Government	E-mails	Dec 01, 2014 09:51:55 - 10:13:50	22 min
C 443	Provincial Government	E-mails	Dec 01, 2014 10:13:57 - 10:17:17	3 min
C 588	Provincial Government	E-mails	Dec 01, 2014 10:18:01 - 10:30:16	12 min
C 587	Academia	E-mails	Dec 01, 2014 10:31:07 - 10:31:39	1 min
C 589	Government	E-mails	Dec 01, 2014 10:44:22 - 10:52:04	8 min
D 216	Government	Calculating	Dec 01, 2014 10:52:23 - 10:58:58	7 min
C 589	Government	E-mails	Dec 01, 2014 10:59:12 - 11:00:06	1 min
C 588	Provincial Government	E-mails	Dec 01, 2014 11:09:42 - 11:15:33	6 min
C 579	Provincial Government	E-mails	Dec 01, 2014 11:17:12 - 11:37:26	20 min
C 583	Provincial Government	E-mails	Dec 01, 2014 11:39:05 - 11:42:40	4 min
C 565	Private Sector	Phone calls	Dec 01, 2014 11:44:24 - 11:47:09	3 min
C 565	Private Sector	E-mails	Dec 01, 2014 11:47:13 - 11:49:11	2 min
		Admin	Dec 01, 2014 11:54:14 - 11:56:12	2 min
C 587	Academia	Meetings	Dec 01, 2014 12:24:00 - 12:47:00	23 min
C 182	Provincial Government	E-mails	Dec 01, 2014 13:01:37 - 13:03:41	2 min
C 574	Private Sector	Transportation	Dec 01, 2014 13:14:22 - 13:50:52	37 min
C 574	Private Sector	Meetings	Dec 01, 2014 13:50:58 - 15:15:00	1:24 h
C 574	Private Sector	Transportation	Dec 01, 2014 15:15:00 - 15:50 min	35 min

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ID	Group	Activity	Date and time	Duration
C 595	Provincial Government	E-mails	Dec 01, 2014 16:57:04 - 17:03:45	7 min
		Admin	Dec 01, 2014 17:03:55 - 17:09:29	6 min
C 289	Private Sector	E-mails	Dec 01, 2014 17:09:41 - 17:10:59	1 min
C 579	Provincial Government	E-mails	Dec 01, 2014 17:11:31 - 17:15:00	3 min
C 584	Provincial Government	E-mails	Dec 01, 2014 17:15:14 - 17:19:11	4 min
C 601	Private Sector	E-mails	Dec 01, 2014 17:20:07 - 17:21:04	1 min
C 600	Academia	E-mails	Dec 01, 2014 17:21:28 - 17:29:56	8 min
C 600	Academia	E-mails	Dec 01, 2014 20:49:59 - 20:58:42	9 min
C 600	Academia	E-mails	Dec 02, 2014 13:35:07 - 13:39:27	4 min
C 565	Private Sector	E-mails	Dec 02, 2014 13:39:35 - 13:40:39	1 min
		Admin	Dec 02, 2014 13:56:24 - 14:01:42	5 min
C 579	Provincial Government	E-mails	Dec 02, 2014 14:01:49 - 14:05:14	3 min
C 603	Provincial Government	E-mails	Dec 02, 2014 14:05:17 - 14:13:24	8 min
C 443	Provincial Government	E-mails	Dec 02, 2014 14:15:23 - 14:18:17	3 min
C 284	Provincial Government	E-mails	Dec 02, 2014 14:18:55 - 14:25:13	6 min
C 579	Provincial Government	E-mails	Dec 02, 2014 14:25:22 - 14:31:17	6 min
C 176	Private Sector	E-mails	Dec 02, 2014 14:31:34 - 14:34:18	3 min
C 534	Private Sector	Background research	Dec 02, 2014 14:34:54 - 14:43:59	9 min
C 534	Private Sector	E-mails	Dec 02, 2014 14:44:02 - 14:48:13	4 min
C 489	Private Sector	Background research	Dec 02, 2014 14:48:24 - 14:59:02	11 min
C 579	Provincial Government	E-mails	Dec 02, 2014 14:59:20 - 15:02:33	3 min
C 237	City of Cape Town	Background research	Dec 02, 2014 15:02:58 - 15:04:02	1 min
C 75	Private Sector	Background research	Dec 02, 2014 15:04:55 - 15:10:45	6 min
C 194	Provincial Government	Background research	Dec 02, 2014 15:11:07 - 15:31:34	20 min
D 240	Government	Calculating	Dec 02, 2014 15:31:42 - 16:02:24	31 min
D 155	Government	Reading	Dec 02, 2014 16:10:02 - 16:17:55	8 min
C 589	Government	E-mails	Dec 02, 2014 16:20:56 - 16:21:56	1 min
C 606	Academia	E-mails	Dec 02, 2014 16:55:51 - 16:56:50	1 min
C 589	Government	E-mails	Dec 02, 2014 16:56:59 - 16:58:06	1 min
C 600	Academia	E-mails	Dec 02, 2014 22:21:32 - 22:35:05	14 min
C 229	Government	E-mails	Dec 03, 2014 11:13:54 - 11:16:38	3 min
C 6	Academia	Meetings	Dec 04, 2014 11:04:00 - 12:01:00	57 min
C 589	Government	Transportation	Dec 04, 2014 12:33:00 - 13:06:00	33 min
C 589	Government	Meetings	Dec 04, 2014 13:06:00 - 13:56:00	50 min
C 589	Government	Transportation	Dec 04, 2014 13:56:00 - 14:39:00	43 min
		Admin	Dec 04, 2014 16:53:11 - 16:58:35	5 min
C 574	Private Sector	E-mails	Dec 04, 2014 16:58:42 - 17:02:59	4 min

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ID	Group	Activity	Date and time	Duration
C 574	Private Sector	Background research	Dec 04, 2014 17:03:04 - 17:06:01	3 min
C 589	Government	E-mails	Dec 04, 2014 17:07:09 - 17:08:47	2 min
C 581	Provincial Government	E-mails	Dec 05, 2014 05:55:32 - 05:58:14	3 min
C 583	Provincial Government	E-mails	Dec 05, 2014 05:58:25 - 06:01:02	3 min
C 176	Private Sector	E-mails	Dec 05, 2014 06:01:57 - 06:05:32	4 min
		Admin	Dec 05, 2014 06:08:19 - 06:10:38	2 min
C 597	Government	E-mails	Dec 05, 2014 06:38:39 - 06:44:54	6 min
C 596	Provincial Government	E-mails	Dec 05, 2014 06:49:29 - 06:58:09	9 min
C 597	Government	E-mails	Dec 05, 2014 06:59:19 - 07:02:05	3 min
C 614	Government	Phone calls	Dec 05, 2014 09:35:14 - 09:36:23	1 min
C 443	Provincial Government	Phone calls	Dec 05, 2014 09:36:43 - 09:41:54	5 min
		Admin	Dec 05, 2014 09:42:25 - 09:54:06	12 min
C 443	Provincial Government	E-mails	Dec 05, 2014 09:54:13 - 09:56:52	3 min
C 597	Government	E-mails	Dec 05, 2014 09:57:34 - 10:01:31	4 min
C 615	Provincial Government	E-mails	Dec 05, 2014 10:03:03 - 10:09:33	7 min
C 579	Provincial Government	Transportation	Dec 05, 2014 10:15:00 - 11:05:00	50 min
C 579	Provincial Government	Meetings	Dec 05, 2014 11:05:00 - 12:48:00	1:43 h
C 443	Provincial Government	Transportation	Dec 05, 2014 12:48:00 - 13:15:00	27 min
C 443	Provincial Government	Meetings	Dec 05, 2014 14:02:00 - 14:10:51	9 min
C 589	Government	E-mails	Dec 05, 2014 16:53:58 - 16:55:37	2 min
C 583	Provincial Government	E-mails	Dec 07, 2014 12:21:20 - 12:31:26	10 min
		Admin	Dec 08, 2014 08:52:01 - 08:54:27	2 min
C 182	Provincial Government	E-mails	Dec 08, 2014 08:54:32 - 08:56:43	2 min
C 86	Private Sector	E-mails	Dec 08, 2014 08:57:58 - 09:01:01	3 min
C 614	Government	Phone calls	Dec 08, 2014 14:13:43 - 14:15:47	2 min
C 614	Government	E-mails	Dec 08, 2014 14:16:22 - 14:19:00	3 min
C 209	Private Sector	Phone calls	Dec 08, 2014 14:19:59 - 14:23:53	4 min
C 617	Private Sector	E-mails	Dec 08, 2014 14:24:02 - 14:26:02	2 min
C 467	Private Sector	E-mails	Dec 08, 2014 14:26:41 - 14:28:19	2 min
C 615	Provincial Government	E-mails	Dec 08, 2014 14:29:10 - 14:30:19	1 min
C 467	Private Sector	E-mails	Dec 08, 2014 15:10:34 - 15:12:58	2 min
D 216	Government	Calculating	Dec 08, 2014 15:19:22 - 15:54:35	35 min
C 263	Academia	E-mails	Dec 08, 2014 15:54:51 - 16:01:29	7 min
C 467	Private Sector	E-mails	Dec 08, 2014 16:01:49 - 16:02:07	0 min
C 544	Private Sector	E-mails	Dec 08, 2014 16:15:25 - 16:16:19	1 min
C 263	Academia	E-mails	Dec 08, 2014 16:22:32 - 16:29:57	7 min
C 617	Private Sector	E-mails	Dec 08, 2014 16:30:07 - 16:30:52	1 min

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ID	Group	Activity	Date and time	Duration
C 263	Academia	E-mails	Dec 09, 2014 06:12:24 - 06:14:32	2 min
C 263	Academia	E-mails	Dec 09, 2014 09:43:48 - 09:44:51	1 min
C 182	Provincial Government	E-mails	Dec 09, 2014 17:15:15 - 17:15:46	1 min
C 543	Academia	E-mails	Dec 09, 2014 17:16:00 - 17:16:40	1 min
C 580	Provincial Government	E-mails	Dec 09, 2014 17:17:08 - 17:18:47	2 min
C 618	Provincial Government	E-mails	Dec 09, 2014 17:18:52 - 17:27:43	9 min
C 615	Provincial Government	E-mails	Dec 10, 2014 06:34:04 - 06:34:55	1 min
C 320	Private Sector	E-mails	Dec 10, 2014 06:35:12 - 06:36:49	2 min
C 320	Private Sector	Background research	Dec 10, 2014 06:36:53 - 06:40:39	4 min
C 628	Provincial Government	E-mails	Dec 10, 2014 06:41:17 - 06:42:21	1 min
C 263	Academia	Phone calls	Dec 10, 2014 09:40 min - 09:41:00	1 min
C 263	Academia	E-mails	Dec 10, 2014 09:51:08 - 09:51:58	1 min
D 97	Academia	Calculating	Dec 10, 2014 10:02:03 - 12:42:32	2:40 h
C 263	Academia	Transportation	Dec 10, 2014 13:06:00 - 14:04:00	58 min
C 263	Academia	Meetings	Dec 10, 2014 14:04:00 - 16:28:00	2:24 h
C 263	Academia	Transportation	Dec 10, 2014 16:36:00 - 17:31:00	55 min
C 229	Government	E-mails	Dec 11, 2014 10:35:20 - 10:42:23	7 min
C 263	Academia	E-mails	Dec 11, 2014 10:42:42 - 10:53:23	11 min
		Admin	Dec 11, 2014 10:53:36 - 11:12:45	19 min
C 615	Provincial Government	E-mails	Dec 11, 2014 11:13:18 - 11:13:54	1 min
C 606	Academia	E-mails	Dec 11, 2014 11:14:07 - 11:15:20	1 min
C 544	Private Sector	E-mails	Dec 11, 2014 11:27:30 - 11:31:18	4 min
C 629	Private Sector	E-mails	Dec 11, 2014 11:31:23 - 11:34:23	3 min
C 630	Private Sector	E-mails	Dec 11, 2014 11:34:34 - 11:40:08	6 min
C 618	Provincial Government	E-mails	Dec 11, 2014 11:42:46 - 11:46:07	3 min
C 618	Provincial Government	E-mails	Dec 11, 2014 13:38:10 - 13:39:09	1 min
		Admin	Dec 12, 2014 10:59:03 - 11:15:00	16 min
C 618	Provincial Government	E-mails	Dec 12, 2014 11:15:57 - 11:17:25	1 min
C 229	Government	E-mails	Dec 12, 2014 11:22:02 - 11:28:22	6 min
C 630	Private Sector	E-mails	Dec 12, 2014 11:28:41 - 11:39:19	11 min
D 243	Private Sector	Reading	Dec 12, 2014 11:39:25 - 11:44:27	5 min
C 544	Private Sector	E-mails	Dec 12, 2014 11:44:57 - 11:52:47	8 min
C 618	Provincial Government	E-mails	Dec 12, 2014 13:34:17 - 13:35:25	1 min
C 632	Government	Background research	Dec 12, 2014 13:37:14 - 13:39:57	3 min
D 244	Government	Reading	Dec 12, 2014 13:40:01 - 14:11:44	32 min
C 632	Government	E-mails	Dec 12, 2014 14:11:50 - 14:28:13	16 min
		Background research	Dec 12, 2014 14:30:33 - 14:57:59	27 min

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ID	Group	Activity	Date and time	Duration
C 624	Private Sector	E-mails	Dec 12, 2014 14:58:10 - 15:00:47	3 min
C 626	Private Sector	E-mails	Dec 12, 2014 15:00:55 - 15:05:45	5 min
C 627	Private Sector	E-mails	Dec 12, 2014 15:05:55 - 15:07:06	1 min
C 625	Private Sector	E-mails	Dec 12, 2014 15:07:12 - 15:09:14	2 min
C 633	Private Sector	E-mails	Dec 12, 2014 15:09:20 - 15:13:36	4 min
C 634	Private Sector	E-mails	Dec 12, 2014 15:13:42 - 15:14:28	1 min
C 635	Private Sector	E-mails	Dec 12, 2014 15:14:48 - 15:17:39	3 min
C 560	Private Sector	Background research	Dec 12, 2014 15:17:46 - 15:22:03	4 min
C 556	Private Sector	E-mails	Dec 12, 2014 15:23:02 - 15:23:39	1 min
C 619	Private Sector	E-mails	Dec 12, 2014 15:23:47 - 15:25:53	2 min
C 622	Private Sector	E-mails	Dec 12, 2014 15:25:58 - 15:29:48	4 min
C 479	Private Sector	E-mails	Dec 12, 2014 15:29:55 - 15:32:29	3 min
C 561	Private Sector	E-mails	Dec 12, 2014 15:32:39 - 15:33:59	1 min
C 558	Private Sector	E-mails	Dec 12, 2014 15:34:10 - 15:34:52	1 min
C 563	Private Sector	E-mails	Dec 12, 2014 15:35:00 - 15:35:48	1 min
C 159	Private Sector	E-mails	Dec 12, 2014 15:35:56 - 15:37:09	1 min
C 621	Private Sector	E-mails	Dec 12, 2014 15:37:23 - 15:39:54	3 min
C 557	Private Sector	E-mails	Dec 12, 2014 15:40 min - 15:41:06	1 min
C 559	Private Sector	E-mails	Dec 12, 2014 15:41:12 - 15:43:35	2 min
C 637	Private Sector	E-mails	Dec 12, 2014 15:43:55 - 15:46:27	3 min
C 636	Private Sector	E-mails	Dec 12, 2014 15:46:32 - 15:47:17	1 min
C 638	Private Sector	E-mails	Dec 12, 2014 15:47:22 - 15:49:26	2 min
C 562	Private Sector	E-mails	Dec 12, 2014 15:49:36 - 15:50:45	1 min
C 623	Private Sector	E-mails	Dec 12, 2014 15:50:55 - 15:51:56	1 min
C 639	Private Sector	E-mails	Dec 12, 2014 15:53:05 - 15:56:40	4 min
C 640	Private Sector	E-mails	Dec 12, 2014 15:56:58 - 16:07:16	10 min
C 557	Private Sector	E-mails	Dec 12, 2014 16:07:23 - 16:08:24	1 min
C 619	Private Sector	E-mails	Dec 12, 2014 16:08:30 - 16:09:44	1 min
C 638	Private Sector	E-mails	Dec 12, 2014 16:09:48 - 16:12:02	2 min
C 622	Private Sector	E-mails	Dec 12, 2014 16:12:44 - 16:13:59	1 min
C 571	Private Sector	E-mails	Dec 12, 2014 16:19:49 - 16:21:12	1 min
C 610	Private Sector	E-mails	Dec 12, 2014 16:21:18 - 16:24:56	4 min
C 530	Private Sector	E-mails	Dec 12, 2014 16:25:16 - 16:25:46	1 min
C 607	Private Sector	E-mails	Dec 12, 2014 16:25:55 - 16:27:32	2 min
C 611	Private Sector	E-mails	Dec 12, 2014 16:27:40 - 16:31:04	3 min
C 569	Private Sector	E-mails	Dec 12, 2014 16:31:23 - 16:33:40	2 min
C 636	Private Sector	E-mails	Dec 12, 2014 16:34:07 - 16:37:10	3 min

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ID	Group	Activity	Date and time	Duration
C 641	Private Sector	Background research	Dec 12, 2014 16:37:14 - 16:39:29	2 min
C 567	Private Sector	E-mails	Dec 12, 2014 16:40:15 - 16:41:49	2 min
C 495	Private Sector	E-mails	Dec 12, 2014 16:42:19 - 16:43:12	1 min
C 568	Private Sector	Background research	Dec 12, 2014 16:43:32 - 16:44:48	1 min
C 625	Private Sector	E-mails	Dec 12, 2014 16:45:29 - 16:46:08	1 min
C 642	Private Sector	E-mails	Dec 12, 2014 16:46:15 - 16:47:55	2 min
C 608	Private Sector	E-mails	Dec 12, 2014 16:48:09 - 16:49:44	2 min
C 612	Private Sector	E-mails	Dec 12, 2014 16:50:29 - 16:52:29	2 min
C 642	Private Sector	E-mails	Dec 12, 2014 17:21:53 - 17:22:26	1 min
C 320	Private Sector	E-mails	Dec 12, 2014 17:22:59 - 17:24:21	1 min
C 636	Private Sector	E-mails	Dec 12, 2014 17:25:06 - 17:26:04	1 min
C 640	Private Sector	E-mails	Dec 12, 2014 17:26:12 - 17:27:24	1 min
C 566	Private Sector	E-mails	Dec 12, 2014 17:27:37 - 17:29:22	2 min
C 572	Private Sector	E-mails	Dec 12, 2014 17:29:30 - 17:31:20	2 min
C 528	Private Sector	E-mails	Dec 12, 2014 17:31:33 - 17:32:13	1 min
C 573	Private Sector	E-mails	Dec 12, 2014 17:32:34 - 17:34:46	2 min
C 570	Private Sector	E-mails	Dec 12, 2014 17:35:08 - 17:36:08	1 min
C 609	Private Sector	E-mails	Dec 12, 2014 17:36:48 - 17:40:07	3 min
		Admin	Dec 13, 2014 10:48:08 - 10:49:05	1 min
		Background research	Dec 13, 2014 10:49:07 - 10:59:33	10 min
C 650	Private Sector	E-mails	Dec 13, 2014 10:59:47 - 11:02:06	2 min
C 649	Private Sector	E-mails	Dec 13, 2014 11:02:09 - 11:03:04	1 min
C 648	Private Sector	E-mails	Dec 13, 2014 11:03:07 - 11:05:21	2 min
C 647	Private Sector	E-mails	Dec 13, 2014 11:05:25 - 11:06:14	1 min
C 646	Private Sector	E-mails	Dec 13, 2014 11:06:18 - 11:09:19	3 min
C 645	Private Sector	E-mails	Dec 13, 2014 11:17:24 - 11:18:41	1 min
C 644	Private Sector	E-mails	Dec 13, 2014 11:18:44 - 11:19:51	1 min
C 643	Private Sector	E-mails	Dec 13, 2014 11:19:57 - 11:20:48	1 min
C 474	Private Sector	E-mails	Dec 13, 2014 11:21:09 - 11:22:31	1 min
C 613	Private Sector	E-mails	Dec 13, 2014 11:22:47 - 11:25:04	2 min
		Background research	Dec 13, 2014 11:26:36 - 11:31:53	5 min
C 536	Private Sector	E-mails	Dec 13, 2014 11:32:31 - 11:34:22	2 min
C 604	Private Sector	E-mails	Dec 13, 2014 11:34:48 - 11:37:20	3 min
C 546	Private Sector	E-mails	Dec 13, 2014 11:37:35 - 11:39:54	2 min
		Background research	Dec 13, 2014 11:42:05 - 11:49:54	8 min
C 451	Private Sector	E-mails	Dec 13, 2014 11:49:59 - 11:54:31	5 min
C 654	Private Sector	E-mails	Dec 13, 2014 11:54:40 - 11:55:45	1 min

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ID	Group	Activity	Date and time	Duration
C 653	Private Sector	E-mails	Dec 13, 2014 11:55:49 - 11:57:26	2 min
C 652	Private Sector	E-mails	Dec 13, 2014 11:57:31 - 11:59:59	2 min
C 651	Private Sector	E-mails	Dec 13, 2014 12:00:03 - 12:01:31	1 min
D 190	Academia	Reading	Dec 13, 2014 14:20:43 - 14:24:34	4 min
		Background research	Dec 13, 2014 14:24:39 - 14:30:05	5 min
C 296	Private Sector	E-mails	Dec 13, 2014 14:30:14 - 14:31:08	1 min
C 655	Private Sector	E-mails	Dec 13, 2014 14:31:16 - 14:32:59	2 min
C 255	Private Sector	E-mails	Dec 13, 2014 14:33:10 - 14:34:19	1 min
C 452	Private Sector	E-mails	Dec 13, 2014 14:34:29 - 14:36:27	2 min
		Admin	Dec 14, 2014 08:31:23 - 08:38:21	7 min
D 97	Academia	Calculating	Dec 14, 2014 08:38:25 - 08:46:51	8 min
		Admin	Dec 14, 2014 09:55:58 - 11:19:26	1:23 h
C 101	Private Sector	E-mails	Dec 14, 2014 21:16:34 - 21:23:48	7 min
C 656	Private Sector	E-mails	Dec 14, 2014 21:24:42 - 21:36:40	12 min
C 657	Private Sector	E-mails	Dec 14, 2014 21:36:57 - 21:40:06	3 min
C 658	Private Sector	E-mails	Dec 14, 2014 21:40:23 - 21:41:56	2 min
D 166	Academia	Reading	Dec 15, 2014 05:49:51 - 06:39:45	50 min
C 659	Private Sector	E-mails	Dec 15, 2014 06:39:52 - 06:41:48	2 min
		Background research	Dec 15, 2014 06:45:58 - 06:52:02	6 min
		Admin	Dec 15, 2014 06:52:17 - 08:03:30	1:11 h
C 618	Provincial Government	Transportation	Dec 15, 2014 09:07:00 - 09:57:00	50 min
C 618	Provincial Government	Meetings	Dec 15, 2014 09:57:00 - 12:23:42	2:27 h
		Admin	Dec 15, 2014 12:26:35 - 12:40:05	14 min
		Background research	Dec 15, 2014 13:26:02 - 13:29:54	4 min
C 618	Provincial Government	Background research	Dec 15, 2014 13:32:03 - 13:36:47	5 min
C 663	Provincial Government	Background research	Dec 15, 2014 13:36:49 - 13:42:07	5 min
C 660	Provincial Government	Background research	Dec 15, 2014 13:42:19 - 13:44:51	3 min
		Admin	Dec 15, 2014 13:50 min - 14:05:00	15 min
C 686	Provincial Government	Meetings	Dec 15, 2014 14:21:00 - 14:47:00	26 min
C 618	Provincial Government	Transportation	Dec 15, 2014 14:47:00 - 15:33:00	46 min
		Admin	Dec 15, 2014 16:44:47 - 16:59:11	14 min
C 665	Provincial Government	E-mails	Dec 15, 2014 16:59:23 - 17:14:01	15 min
C 663	Provincial Government	Background research	Dec 15, 2014 17:18:24 - 17:27:40	9 min
C 663	Provincial Government	E-mails	Dec 15, 2014 17:27:45 - 17:32:05	4 min
C 657	Private Sector	E-mails	Dec 16, 2014 06:49:11 - 06:49:40	0 min
C 495	Private Sector	Background research	Dec 16, 2014 06:49:50 - 06:51:32	2 min
C 659	Private Sector	E-mails	Dec 16, 2014 06:52:13 - 06:53:17	1 min

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ID	Group	Activity	Date and time	Duration
C 546	Private Sector	E-mails	Dec 16, 2014 06:53:30 - 06:54:16	1 min
C 693	Private Sector	E-mails	Dec 16, 2014 06:54:53 - 07:00:19	5 min
C 648	Private Sector	E-mails	Dec 16, 2014 07:02:05 - 07:02:40	1 min
C 694	Private Sector	E-mails	Dec 16, 2014 07:02:50 - 07:05:59	3 min
C 613	Private Sector	E-mails	Dec 16, 2014 07:13:35 - 07:14:20	1 min
C 629	Private Sector	E-mails	Dec 16, 2014 09:04:03 - 09:05:42	2 min
D 245	Private Sector	Reading	Dec 16, 2014 09:05:46 - 09:13:10	7 min
D 245	Private Sector	Calculating	Dec 16, 2014 09:13:13 - 09:15:51	3 min
		Admin	Dec 16, 2014 09:18:55 - 09:29:32	11 min
C 618	Provincial Government	E-mails	Dec 16, 2014 16:45:40 - 16:57:00	11 min
C 479	Private Sector	Background research	Dec 17, 2014 08:17:02 - 08:18:00	1 min
C 644	Private Sector	E-mails	Dec 17, 2014 08:18:21 - 08:19:57	2 min
C 650	Private Sector	E-mails	Dec 17, 2014 08:20:04 - 08:20:38	1 min
C 608	Private Sector	E-mails	Dec 17, 2014 08:20:56 - 08:23:27	3 min
C 182	Provincial Government	E-mails	Dec 17, 2014 08:24:43 - 08:30:50	6 min
C 629	Private Sector	E-mails	Dec 17, 2014 08:31:09 - 08:32:33	1 min
C 661	Private Sector	E-mails	Dec 17, 2014 08:34:04 - 08:45:27	11 min
C 608	Private Sector	E-mails	Dec 17, 2014 08:45:58 - 08:46:41	1 min
C 629	Private Sector	E-mails	Dec 17, 2014 08:47:03 - 08:48:24	1 min
C 695	Private Sector	E-mails	Dec 17, 2014 08:48:30 - 08:51:02	3 min
C 182	Provincial Government	E-mails	Dec 17, 2014 09:16:24 - 09:16:58	1 min
C 675	Provincial Government	Phone calls	Dec 17, 2014 09:18:00 - 09:21:00	3 min
C 615	Provincial Government	Transportation	Dec 17, 2014 09:22:00 - 09:55:00	33 min
C 246	City of Cape Town	Phone calls	Dec 17, 2014 10:46:05 - 10:57:01	11 min
C 615	Provincial Government	Meetings	Dec 17, 2014 09:55:00 - 11:03:00	1:08 h
		Admin	Dec 17, 2014 11:28:37 - 11:36:06	7 min
C 675	Provincial Government	E-mails	Dec 17, 2014 11:41:48 - 11:47:21	6 min
C 597	Government	E-mails	Dec 17, 2014 11:47:51 - 11:57:26	10 min
C 443	Provincial Government	E-mails	Dec 17, 2014 11:58:14 - 12:02:56	5 min
C 63	Academia	E-mails	Dec 17, 2014 12:03:27 - 12:05:48	2 min
C 565	Private Sector	E-mails	Dec 17, 2014 12:07:00 - 12:07:59	1 min
C 224	Provincial Government	E-mails	Dec 17, 2014 12:08:27 - 12:18:50	10 min
C 432	Government	E-mails	Dec 17, 2014 12:20 min - 12:26:42	7 min
C 662	Private Sector	E-mails	Dec 17, 2014 16:36:21 - 16:38:00	2 min
C 644	Private Sector	E-mails	Dec 18, 2014 13:18:50 - 13:19:45	1 min
D 246	Private Sector	Reading	Dec 18, 2014 13:20:01 - 13:39:30	19 min
C 695	Private Sector	E-mails	Dec 18, 2014 13:39:36 - 13:47:09	8 min

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ID	Group	Activity	Date and time	Duration
C 583	Provincial Government	E-mails	Dec 18, 2014 13:47:24 - 13:50:44	3 min
C 596	Provincial Government	E-mails	Dec 18, 2014 13:51:18 - 13:53:01	2 min
C 660	Provincial Government	Background research	Dec 18, 2014 14:19:58 - 14:22:49	3 min
C 660	Provincial Government	E-mails	Dec 18, 2014 14:35:34 - 14:37:13	2 min
C 666	Private Sector	E-mails	Dec 18, 2014 14:37:37 - 14:41:05	3 min
C 538	Private Sector	E-mails	Dec 18, 2014 14:41:29 - 14:45:02	4 min
C 664	City of Cape Town	E-mails	Dec 18, 2014 14:45:16 - 14:51:00	6 min
C 663	Provincial Government	Background research	Dec 18, 2014 15:01:19 - 15:08:02	7 min
C 657	Private Sector	E-mails	Dec 19, 2014 09:16:20 - 09:18:22	2 min
C 663	Provincial Government	E-mails	Dec 19, 2014 09:23:51 - 09:28:30	5 min
D 194	Provincial Government	Reading	Dec 19, 2014 09:29:02 - 09:52:35	24 min
C 630	Private Sector	E-mails	Dec 19, 2014 09:54:14 - 09:59:12	5 min
C 224	Provincial Government	E-mails	Dec 19, 2014 10:05:29 - 10:07:03	2 min
C 579	Provincial Government	E-mails	Dec 19, 2014 10:07:56 - 10:16:07	8 min
C 595	Provincial Government	E-mails	Dec 19, 2014 10:25:06 - 10:31:10	6 min
C 702	Academia	E-mails	Dec 19, 2014 10:34:59 - 10:44:39	10 min
C 664	City of Cape Town	E-mails	Dec 19, 2014 10:46:08 - 10:48:17	2 min
C 474	Private Sector	E-mails	Dec 19, 2014 10:48:39 - 10:55:03	6 min
C 579	Provincial Government	E-mails	Dec 19, 2014 10:56:22 - 11:00:45	4 min
C 432	Government	E-mails	Dec 19, 2014 11:00:52 - 11:02:08	1 min
C 536	Private Sector	E-mails	Dec 19, 2014 11:02:26 - 11:08:58	7 min
C 664	City of Cape Town	E-mails	Dec 19, 2014 11:58:51 - 12:00:43	2 min
C 663	Provincial Government	E-mails	Dec 19, 2014 15:18:32 - 15:20:22	2 min
C 663	Provincial Government	E-mails	Dec 19, 2014 16:12:18 - 16:13:10	1 min
C 650	Private Sector	Phone calls	Dec 23, 2014 14:07:00 - 14:10 min	3 min
D 95	City of Cape Town	Reading	Dec 30, 2014 08:56:19 - 08:59:55	4 min
D 95	City of Cape Town	Reading	Dec 30, 2014 09:21:55 - 10:15:57	54 min
C 597	Government	E-mails	Jan 05, 2015 11:18:54 - 11:22:42	4 min
C 664	City of Cape Town	Background research	Jan 07, 2015 06:34:00 - 06:41:32	8 min
C 662	Private Sector	E-mails	Jan 07, 2015 06:53:31 - 06:56:03	3 min
C 281	Provincial Government	E-mails	Jan 07, 2015 07:00:24 - 07:05:32	5 min
C 664	City of Cape Town	Transportation	Jan 07, 2015 08:48:00 - 09:57:00	1:09 h
C 664	City of Cape Town	Meetings	Jan 07, 2015 09:57:00 - 11:09:50	1:13 h
D 166	Academia	Reading	Jan 07, 2015 11:10:27 - 11:48:22	38 min
C 664	City of Cape Town	Transportation	Jan 07, 2015 11:48:29 - 13:11:00	1:23 h
D 203	Academia	Reading	Jan 07, 2015 15:02:43 - 15:11:37	9 min
C 281	Provincial Government	E-mails	Jan 08, 2015 08:00:01 - 08:01:51	2 min

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ID	Group	Activity	Date and time	Duration
C 662	Private Sector	E-mails	Jan 08, 2015 08:02:14 - 08:04:10	2 min
D 176	Private Sector	Calculating	Jan 08, 2015 10:32:20 - 11:22:06	50 min
C 583	Provincial Government	E-mails	Jan 08, 2015 12:23:47 - 12:29:40	6 min
C 694	Private Sector	E-mails	Jan 08, 2015 12:29:53 - 12:32:21	2 min
C 662	Private Sector	E-mails	Jan 08, 2015 13:03:30 - 13:04:40	1 min
D 176	Private Sector	Calculating	Jan 08, 2015 13:18:53 - 14:45:48	1:27 h
C 385	Government	E-mails	Jan 08, 2015 14:46:45 - 15:00:04	13 min
D 251	Government	Reading	Jan 08, 2015 15:00:59 - 15:30:29	30 min
D 176	Private Sector	Calculating	Jan 08, 2015 15:31:01 - 15:43:20	12 min
C 467	Private Sector	E-mails	Jan 08, 2015 15:43:41 - 15:46:35	3 min
C 176	Private Sector	E-mails	Jan 08, 2015 16:46:51 - 16:54:14	7 min
D 229	Private Sector	Reading	Jan 08, 2015 17:03:17 - 17:23:18	20 min
D 229	Private Sector	Calculating	Jan 08, 2015 17:23:46 - 17:39:44	16 min
C 292	Academia	E-mails	Jan 08, 2015 17:39:54 - 17:46:16	6 min
C 604	Private Sector	E-mails	Jan 09, 2015 08:48:44 - 08:50:42	2 min
C 281	Provincial Government	E-mails	Jan 09, 2015 08:51:56 - 08:53:42	2 min
C 320	Private Sector	E-mails	Jan 09, 2015 08:53:52 - 08:54:41	1 min
C 695	Private Sector	E-mails	Jan 09, 2015 08:54:59 - 08:58:15	3 min
C 604	Private Sector	E-mails	Jan 09, 2015 08:59:17 - 09:00:23	1 min
C 176	Private Sector	E-mails	Jan 09, 2015 09:00:32 - 09:01:33	1 min
C 695	Private Sector	E-mails	Jan 09, 2015 09:02:15 - 09:03:00	1 min
C 598	Government	Phone calls	Jan 09, 2015 09:06:45 - 09:12:09	5 min
C 206	Government	Background research	Jan 09, 2015 09:12:32 - 09:17:45	5 min
C 206	Government	Phone calls	Jan 09, 2015 09:17:49 - 09:19:18	1 min
C 206	Government	Phone calls	Jan 09, 2015 09:19:22 - 09:27:16	8 min
C 706	Government	E-mails	Jan 09, 2015 09:27:20 - 09:28:25	1 min
C 707	Government	Phone calls	Jan 09, 2015 09:28:34 - 09:29:02	0 min
C 708	Government	Phone calls	Jan 09, 2015 09:29:16 - 09:31:13	2 min
C 708	Government	Phone calls	Jan 09, 2015 09:31:17 - 09:33:15	2 min
C 709	Government	Phone calls	Jan 09, 2015 09:33:28 - 09:37:15	4 min
C 709	Government	E-mails	Jan 09, 2015 09:37:22 - 09:55:24	18 min
C 709	Government	E-mails	Jan 09, 2015 11:57:04 - 11:58:44	2 min
C 709	Government	E-mails	Jan 09, 2015 12:49:09 - 12:49:48	1 min
C 710	Government	E-mails	Jan 09, 2015 12:49:54 - 12:52:58	3 min
		Admin	Jan 09, 2015 15:02:40 - 15:45:52	43 min
C 710	Government	E-mails	Jan 09, 2015 15:48:14 - 15:56:14	8 min
		Admin	Jan 09, 2015 17:06:53 - 17:57:52	51 min

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ID	Group	Activity	Date and time	Duration
		Admin	Jan 10, 2015 07:33:20 - 07:57:13	24 min
		Admin	Jan 10, 2015 10:21:13 - 12:35:46	2:15 h
		Admin	Jan 10, 2015 17:09:00 - 17:40:58	32 min
C 662	Private Sector	Transportation	Jan 12, 2015 08:33:00 - 08:48:00	15 min
C 662	Private Sector	Meetings	Jan 12, 2015 08:48:00 - 09:30 min	42 min
C 662	Private Sector	Transportation	Jan 12, 2015 09:30 min - 09:52:00	22 min
C 662	Private Sector	Background research	Jan 12, 2015 10:05:27 - 10:10:33	5 min
C 385	Government	Background research	Jan 12, 2015 10:13:18 - 10:20:43	7 min
C 710	Government	Meetings	Jan 12, 2015 10:20:50 - 10:29:25	9 min
C 116	Government	Phone calls	Jan 12, 2015 10:35:45 - 10:42:43	7 min
C 713	Government	E-mails	Jan 12, 2015 10:43:07 - 10:46:20	3 min
C 694	Private Sector	E-mails	Jan 12, 2015 10:48:05 - 10:48:53	1 min
C 583	Provincial Government	E-mails	Jan 12, 2015 11:22:19 - 11:25:03	3 min
C 597	Government	E-mails	Jan 12, 2015 11:32:33 - 11:34:25	2 min
		Admin	Jan 12, 2015 11:58:04 - 12:28:35	31 min
C 642	Private Sector	E-mails	Jan 12, 2015 12:39:34 - 12:40:45	1 min
C 606	Academia	E-mails	Jan 12, 2015 12:41:02 - 12:42:01	1 min
C 639	Private Sector	E-mails	Jan 12, 2015 12:42:09 - 12:44:22	2 min
C 536	Private Sector	E-mails	Jan 12, 2015 12:45:43 - 12:47:03	1 min
C 283	Government	Background research	Jan 12, 2015 12:47:20 - 12:48:23	1 min
C 283	Government	E-mails	Jan 12, 2015 12:48:26 - 12:50:19	2 min
C 714	Government	E-mails	Jan 12, 2015 12:52:02 - 12:52:56	1 min
C 606	Academia	E-mails	Jan 12, 2015 15:06:10 - 15:07:37	1 min
C 292	Academia	E-mails	Jan 12, 2015 17:51:21 - 17:52:11	1 min
C 642	Private Sector	E-mails	Jan 13, 2015 06:35:10 - 06:35:42	1 min
C 606	Academia	E-mails	Jan 13, 2015 06:35:49 - 06:36:54	1 min
C 467	Private Sector	E-mails	Jan 13, 2015 06:37:32 - 06:38:10	1 min
C 662	Private Sector	E-mails	Jan 13, 2015 08:37:12 - 08:39:24	2 min
C 176	Private Sector	E-mails	Jan 13, 2015 11:10:32 - 11:11:31	1 min
C 650	Private Sector	E-mails	Jan 13, 2015 11:12:25 - 11:13:17	1 min
C 6	Academia	E-mails	Jan 13, 2015 19:32:58 - 19:34:03	1 min
C 717	Private Sector	E-mails	Jan 13, 2015 19:34:13 - 19:36:20	2 min
C 176	Private Sector	Transportation	Jan 15, 2015 09:09:00 - 09:48:00	39 min
C 176	Private Sector	Meetings	Jan 15, 2015 09:48:00 - 11:33:00	1:45 h
C 176	Private Sector	Transportation	Jan 15, 2015 11:33:00 - 12:28:00	55 min
C 176	Private Sector	E-mails	Jan 16, 2015 07:32:34 - 07:38:36	6 min
C 181	Provincial Government	E-mails	Jan 16, 2015 08:35:22 - 08:45:35	10 min

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ID	Group	Activity	Date and time	Duration
C 263	Academia	E-mails	Jan 19, 2015 05:38:19 - 06:30:47	52 min
C 119	Government	E-mails	Jan 19, 2015 06:31:23 - 06:33:32	2 min
C 617	Private Sector	E-mails	Jan 19, 2015 06:33:44 - 06:35:08	1 min
C 16	Academia	E-mails	Jan 19, 2015 06:35:38 - 06:40:02	4 min
C 8	Academia	E-mails	Jan 19, 2015 06:40:10 - 06:43:52	4 min
C 92	City of Cape Town	E-mails	Jan 19, 2015 07:58:55 - 08:04:45	6 min
C 67	Government	E-mails	Jan 19, 2015 08:06:21 - 08:13:36	7 min
C 119	Government	E-mails	Jan 19, 2015 08:16:13 - 08:19:35	3 min
C 710	Government	E-mails	Jan 19, 2015 08:19:49 - 08:28:49	9 min
C 119	Government	E-mails	Jan 19, 2015 08:40:23 - 08:44:00	4 min
C 92	City of Cape Town	E-mails	Jan 19, 2015 08:49:34 - 08:52:52	3 min
C 67	Government	E-mails	Jan 19, 2015 13:44:29 - 13:44:59	1 min
C 119	Government	E-mails	Jan 19, 2015 13:46:22 - 13:47:28	1 min
C 536	Private Sector	E-mails	Jan 19, 2015 17:09:36 - 17:12:18	3 min
C 614	Government	E-mails	Jan 19, 2015 17:13:34 - 17:14:49	1 min
C 16	Academia	E-mails	Jan 20, 2015 08:29:45 - 08:33:22	4 min
C 663	Provincial Government	Background research	Jan 20, 2015 11:29:17 - 11:30:54	2 min
C 607	Private Sector	E-mails	Jan 20, 2015 11:31:22 - 11:31:58	1 min
C 694	Private Sector	E-mails	Jan 20, 2015 11:34:56 - 11:36:02	1 min
C 632	Government	E-mails	Jan 20, 2015 11:52:22 - 11:54:02	2 min
D 176	Private Sector	Calculating	Jan 21, 2015 15:08:09 - 15:44:35	36 min
C 92	City of Cape Town	E-mails	Jan 21, 2015 16:17:22 - 16:23:05	6 min
C 467	Private Sector	E-mails	Jan 21, 2015 16:23:17 - 16:24:56	2 min
		Admin	Jan 22, 2015 08:54:38 - 09:17:49	23 min
C 92	City of Cape Town	E-mails	Jan 22, 2015 09:20:41 - 09:32:47	12 min
		Admin	Jan 22, 2015 09:45:34 - 10:04:39	19 min
C 467	Private Sector	E-mails	Jan 22, 2015 13:35:35 - 13:38:24	3 min
		Admin	Jan 22, 2015 14:39:40 - 15:13:23	34 min
		Admin	Jan 22, 2015 15:42:36 - 16:33:10	51 min
C 92	City of Cape Town	E-mails	Jan 22, 2015 17:10:32 - 17:11:38	1 min
C 467	Private Sector	E-mails	Jan 22, 2015 17:11:46 - 17:13:20	2 min
C 176	Private Sector	E-mails	Jan 22, 2015 17:13:54 - 17:14:47	1 min
		Admin	Jan 22, 2015 17:46:14 - 18:11:02	25 min
		Admin	Jan 22, 2015 18:47:42 - 19:10:45	23 min
		Admin	Jan 22, 2015 21:35:24 - 22:15:30	40 min
		Admin	Jan 23, 2015 06:15:35 - 07:10:52	55 min
		Admin	Jan 23, 2015 08:21:28 - 09:05:02	44 min

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ID	Group	Activity	Date and time	Duration
D 176	Private Sector	Calculating	Jan 24, 2015 16:06:51 - 16:34:47	28 min
		Admin	Jan 25, 2015 13:50:22 - 13:58:13	8 min
C 263	Academia	E-mails	Jan 29, 2015 10:00:55 - 10:12:36	12 min
C 175	Academia	E-mails	Jan 29, 2015 10:12:45 - 10:15:46	3 min
C 536	Private Sector	E-mails	Jan 29, 2015 10:15:56 - 10:16:32	1 min
C 604	Private Sector	E-mails	Jan 29, 2015 10:16:38 - 10:17:30	1 min
C 536	Private Sector	E-mails	Jan 29, 2015 18:20:19 - 18:22:49	3 min
C 604	Private Sector	E-mails	Jan 29, 2015 18:22:56 - 18:23:15	0 min
C 536	Private Sector	E-mails	Jan 30, 2015 10:00:14 - 10:01:39	1 min
C 246	City of Cape Town	E-mails	Jan 30, 2015 15:01:50 - 15:03:39	2 min
C 292	Academia	E-mails	Jan 30, 2015 15:05:54 - 15:06:32	1 min
C 92	City of Cape Town	E-mails	Feb 01, 2015 15:43:13 - 15:46:14	3 min
C 92	City of Cape Town	E-mails	Feb 03, 2015 11:12:15 - 11:14:54	3 min
C 92	City of Cape Town	E-mails	Feb 03, 2015 11:48:36 - 11:50:37	2 min
C 92	City of Cape Town	E-mails	Feb 04, 2015 11:32:49 - 11:35:59	3 min
C 107	City of Cape Town	E-mails	Feb 04, 2015 11:36:08 - 11:39:10	3 min
C 92	City of Cape Town	E-mails	Feb 04, 2015 13:08:54 - 13:09:44	1 min
C 92	City of Cape Town	E-mails	Feb 04, 2015 14:21:26 - 14:25:02	4 min
C 710	Government	E-mails	Feb 04, 2015 14:48:32 - 14:50:15	2 min
C 176	Private Sector	E-mails	Feb 04, 2015 15:42:50 - 15:47:20	5 min
D 250	Government	Calculating	Feb 04, 2015 15:47:28 - 16:08:51	21 min
C 467	Private Sector	E-mails	Feb 04, 2015 16:09:11 - 16:15:25	6 min
C 92	City of Cape Town	E-mails	Feb 05, 2015 08:46:11 - 08:49:48	4 min
D 250	Government	Calculating	Feb 05, 2015 08:50:04 - 09:23:10	33 min
D 60	Government	Calculating	Feb 05, 2015 09:23:20 - 09:40:42	17 min
C 710	Government	E-mails	Feb 05, 2015 09:40:51 - 09:42:00	1 min
D 250	Government	Calculating	Feb 05, 2015 09:42:56 - 09:57:59	15 min
C 709	Government	E-mails	Feb 05, 2015 09:58:07 - 10:06:27	8 min
C 119	Government	E-mails	Feb 06, 2015 06:24:04 - 06:29:36	6 min
C 424	Academia	E-mails	Feb 06, 2015 06:29:43 - 06:34:48	5 min
C 662	Private Sector	E-mails	Feb 06, 2015 06:35:19 - 06:37:04	2 min
C 536	Private Sector	Transportation	Feb 06, 2015 11:20 min - 11:38:00	18 min
C 536	Private Sector	Meetings	Feb 06, 2015 11:38:00 - 12:14:00	36 min
C 536	Private Sector	Transportation	Feb 06, 2015 12:27:00 - 12:37:00	10 min
C 536	Private Sector	Background research	Feb 06, 2015 12:45:02 - 12:51:31	6 min
D 255	Private Sector	Reading	Feb 06, 2015 12:51:38 - 13:09:29	18 min
C 424	Academia	E-mails	Feb 06, 2015 14:59:51 - 15:03:26	4 min

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ID	Group	Activity	Date and time	Duration
C 424	Academia	E-mails	Feb 06, 2015 15:17:00 - 15:17:30	1 min
C 263	Academia	E-mails	Feb 07, 2015 07:04:47 - 07:09:26	5 min
D 60	Government	Calculating	Feb 09, 2015 09:03:18 - 09:33:28	30 min
C 176	Private Sector	E-mails	Feb 09, 2015 09:33:36 - 09:43:35	10 min
C 467	Private Sector	Phone calls	Feb 09, 2015 09:43:45 - 09:47:18	4 min
C 718	Government	Phone calls	Feb 09, 2015 09:47:29 - 09:52:25	5 min
C 719	Government	Phone calls	Feb 09, 2015 09:54:52 - 09:55:54	1 min
C 467	Private Sector	Phone calls	Feb 09, 2015 09:57:52 - 09:59:40	2 min
D 60	Government	Calculating	Feb 09, 2015 10:01:50 - 10:50:23	49 min
C 467	Private Sector	E-mails	Feb 09, 2015 10:50:45 - 11:09:48	19 min
C 719	Government	Phone calls	Feb 09, 2015 11:10:22 - 11:11:25	1 min
D 256	City of Cape Town	Reading	Feb 09, 2015 11:44:34 - 12:19:05	35 min
C 720	Government	Background research	Feb 09, 2015 12:19:36 - 12:22:18	3 min
C 720	Government	Phone calls	Feb 09, 2015 12:22:22 - 12:23:58	2 min
C 720	Government	Phone calls	Feb 09, 2015 12:24:03 - 12:28:54	5 min
C 720	Government	Phone calls	Feb 09, 2015 12:28:58 - 12:31:04	2 min
C 243	Academia	E-mails	Feb 09, 2015 12:31:58 - 12:35:31	4 min
C 720	Government	Phone calls	Feb 09, 2015 12:35:40 - 12:40:57	5 min
C 467	Private Sector	Phone calls	Feb 09, 2015 12:50:01 - 12:57:59	8 min
C 720	Government	E-mails	Feb 09, 2015 14:29:07 - 14:48:49	20 min
C 467	Private Sector	E-mails	Feb 09, 2015 14:48:54 - 15:05:28	17 min
D 210	Academia	Reading	Feb 09, 2015 15:06:06 - 15:11:39	6 min
C 176	Private Sector	E-mails	Feb 09, 2015 15:11:52 - 15:15:24	4 min
C 424	Academia	E-mails	Feb 09, 2015 15:16:10 - 15:21:27	5 min
C 176	Private Sector	E-mails	Feb 09, 2015 15:21:44 - 15:28:19	7 min
C 719	Government	Phone calls	Feb 09, 2015 15:29:03 - 15:36:17	7 min
C 424	Academia	E-mails	Feb 09, 2015 15:37:34 - 15:37:43	0 min
C 721	Government	Phone calls	Feb 09, 2015 15:39:01 - 15:54:24	15 min
C 176	Private Sector	E-mails	Feb 09, 2015 15:55:52 - 16:02:05	6 min
C 176	Private Sector	E-mails	Feb 09, 2015 19:54:37 - 20:00:05	5 min
D 60	Government	Calculating	Feb 09, 2015 21:25:22 - 22:02:39	37 min
C 176	Private Sector	E-mails	Feb 09, 2015 22:03:19 - 22:11:23	8 min
D 60	Government	Calculating	Feb 09, 2015 22:12:47 - 22:30:03	17 min
D 250	Government	Calculating	Feb 10, 2015 16:20:57 - 16:40:46	20 min
C 467	Private Sector	E-mails	Feb 10, 2015 16:40:53 - 16:48:29	8 min
D 60	Government	Calculating	Feb 10, 2015 16:48:36 - 17:15:20	27 min
C 467	Private Sector	E-mails	Feb 10, 2015 17:16:18 - 17:29:17	13 min

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ID	Group	Activity	Date and time	Duration
C 292	Academia	E-mails	Feb 10, 2015 17:31:55 - 17:35:51	4 min
C 467	Private Sector	Phone calls	Feb 10, 2015 17:57:55 - 17:59:57	2 min
C 467	Private Sector	E-mails	Feb 10, 2015 18:03:45 - 18:16:20	13 min
C 292	Academia	E-mails	Feb 11, 2015 09:09:58 - 09:10:49	1 min
C 176	Private Sector	E-mails	Feb 11, 2015 10:03:37 - 10:29:21	26 min
C 467	Private Sector	E-mails	Feb 11, 2015 10:29:28 - 10:35:02	6 min
C 467	Private Sector	E-mails	Feb 11, 2015 11:32:54 - 11:35:24	3 min
C 176	Private Sector	E-mails	Feb 11, 2015 11:35:34 - 11:39:18	4 min
C 467	Private Sector	E-mails	Feb 11, 2015 11:39:43 - 11:41:41	2 min
C 346	City of Cape Town	Background research	Feb 13, 2015 08:51:02 - 09:00:55	10 min
C 346	City of Cape Town	E-mails	Feb 13, 2015 09:00:59 - 09:03:42	3 min
D 257	Private Sector	Reading	Feb 13, 2015 12:40:20 - 13:07:15	27 min
D 257	Private Sector	Calculating	Feb 16, 2015 15:08:27 - 15:41:50	33 min
D 60	Government	Calculating	Feb 18, 2015 10:29:29 - 10:36:03	7 min
C 119	Government	E-mails	Feb 18, 2015 10:36:09 - 10:43:16	7 min
C 720	Government	E-mails	Feb 18, 2015 10:43:47 - 10:44:49	1 min
C 92	City of Cape Town	E-mails	Feb 18, 2015 10:50:27 - 11:15:54	25 min
C 182	Provincial Government	E-mails	Feb 18, 2015 11:22:41 - 11:35:43	13 min
C 705	Provincial Government	Phone calls	Feb 18, 2015 11:42:46 - 11:47:09	4 min
C 703	Provincial Government	E-mails	Feb 18, 2015 11:50:24 - 11:56:15	6 min
C 702	Academia	E-mails	Feb 18, 2015 11:56:21 - 11:58:29	2 min
C 666	Private Sector	E-mails	Feb 18, 2015 12:01:52 - 12:04:19	2 min
C 724	Private Sector	E-mails	Feb 18, 2015 12:04:47 - 12:07:10	2 min
C 725	Private Sector	E-mails	Feb 18, 2015 13:55:26 - 13:57:35	2 min
D 257	Private Sector	Calculating	Feb 18, 2015 14:24:48 - 14:35:18	11 min
C 726	Academia	Background research	Feb 18, 2015 14:39:47 - 14:45:39	6 min
C 703	Provincial Government	E-mails	Feb 18, 2015 14:50:15 - 15:09:09	19 min
C 92	City of Cape Town	E-mails	Feb 18, 2015 15:09:18 - 15:18:19	9 min
C 275	Academia	E-mails	Feb 18, 2015 15:36:58 - 15:46:15	9 min
C 346	City of Cape Town	Background research	Feb 18, 2015 15:51:11 - 15:58:20	7 min
C 726	Academia	Background research	Feb 18, 2015 15:58:37 - 16:01:19	3 min
C 727	City of Cape Town	E-mails	Feb 18, 2015 16:04:39 - 16:08:39	4 min
C 346	City of Cape Town	E-mails	Feb 18, 2015 16:08:48 - 16:09:38	1 min
C 92	City of Cape Town	E-mails	Feb 18, 2015 16:30:12 - 16:35:25	5 min
C 703	Provincial Government	E-mails	Feb 18, 2015 16:35:41 - 16:39:34	4 min
C 92	City of Cape Town	E-mails	Feb 18, 2015 21:25:27 - 21:26:33	1 min
C 720	Government	E-mails	Feb 18, 2015 21:26:39 - 21:33:39	7 min

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ID	Group	Activity	Date and time	Duration
C 263	Academia	E-mails	Feb 19, 2015 06:40:58 - 06:49:22	8 min
C 728	Government	E-mails	Feb 19, 2015 09:47:22 - 09:50:06	3 min
C 726	Academia	Meetings	Feb 19, 2015 10:13:00 - 10:35:24	22 min
C 729	Academia	Background research	Feb 19, 2015 10:35:37 - 10:38:28	3 min
C 729	Academia	E-mails	Feb 19, 2015 10:38:34 - 10:52:16	14 min
C 726	Academia	E-mails	Feb 19, 2015 10:52:22 - 10:53:51	1 min
C 432	Government	E-mails	Feb 19, 2015 10:54:06 - 10:58:11	4 min
C 432	Government	E-mails	Feb 19, 2015 12:55:42 - 12:56:35	1 min
C 729	Academia	E-mails	Feb 19, 2015 14:31:48 - 14:35:20	4 min
C 733	Government	E-mails	Feb 19, 2015 14:36:00 - 14:46:28	10 min
C 182	Provincial Government	E-mails	Feb 19, 2015 16:25:21 - 16:32:10	7 min
C 703	Provincial Government	E-mails	Feb 20, 2015 10:02:35 - 10:06:08	4 min
C 725	Private Sector	E-mails	Feb 20, 2015 10:31:18 - 10:33:32	2 min
C 725	Private Sector	E-mails	Feb 20, 2015 11:19:49 - 11:20:33	1 min
C 467	Private Sector	E-mails	Feb 20, 2015 11:22:21 - 11:37:16	15 min
C 92	City of Cape Town	E-mails	Feb 20, 2015 11:39:13 - 11:42:23	3 min
C 119	Government	E-mails	Feb 20, 2015 11:42:44 - 11:45:35	3 min
D 252	Private Sector	Calculating	Feb 20, 2015 11:45:47 - 12:02:37	17 min
C 695	Private Sector	E-mails	Feb 20, 2015 12:02:46 - 12:06:31	4 min
C 92	City of Cape Town	E-mails	Feb 20, 2015 12:10:15 - 12:13:05	3 min
C 734	Academia	Meetings	Feb 20, 2015 12:26:33 - 12:50:26	24 min
C 726	Academia	E-mails	Feb 20, 2015 12:50:33 - 12:52:33	2 min
C 726	Academia	E-mails	Feb 20, 2015 13:06:57 - 13:07:09	0 min
C 695	Private Sector	E-mails	Feb 20, 2015 14:16:42 - 14:20:29	4 min
C 735	Government	Background research	Feb 20, 2015 14:21:30 - 14:31:46	10 min
C 735	Government	Phone calls	Feb 20, 2015 14:31:52 - 14:33:45	2 min
C 735	Government	Phone calls	Feb 20, 2015 14:33:50 - 14:35:44	2 min
C 735	Government	Phone calls	Feb 20, 2015 14:36:51 - 14:37:59	1 min
C 703	Provincial Government	Phone calls	Feb 20, 2015 14:38:27 - 14:39:34	1 min
C 292	Academia	E-mails	Feb 20, 2015 14:40:16 - 14:44:37	4 min
C 695	Private Sector	E-mails	Feb 20, 2015 14:52:18 - 14:54:38	2 min
C 292	Academia	E-mails	Feb 20, 2015 14:55:01 - 14:55:14	0 min
C 695	Private Sector	E-mails	Feb 20, 2015 14:57:54 - 14:58:52	1 min
D 257	Private Sector	Reading	Feb 20, 2015 14:59:00 - 15:03:20	4 min
C 655	Private Sector	Phone calls	Feb 20, 2015 15:03:30 - 15:06:01	3 min
C 655	Private Sector	Phone calls	Feb 20, 2015 15:06:06 - 15:06:56	1 min
C 655	Private Sector	Phone calls	Feb 20, 2015 15:07:01 - 15:10:36	4 min

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ID	Group	Activity	Date and time	Duration
C 737	Private Sector	E-mails	Feb 20, 2015 15:10:46 - 15:17:25	7 min
C 736	Private Sector	Phone calls	Feb 20, 2015 15:17:40 - 15:20:02	2 min
C 703	Provincial Government	Phone calls	Feb 20, 2015 15:20:28 - 15:21:49	1 min
C 738	Private Sector	Phone calls	Feb 20, 2015 15:24:22 - 15:32:08	8 min
C 703	Provincial Government	Phone calls	Feb 20, 2015 15:33:49 - 15:34:41	1 min
C 296	Private Sector	Phone calls	Feb 20, 2015 15:38:13 - 15:40:33	2 min
C 695	Private Sector	E-mails	Feb 20, 2015 15:42:52 - 15:44:58	2 min
C 737	Private Sector	E-mails	Feb 20, 2015 15:45:38 - 15:46:42	1 min
C 741	Private Sector	E-mails	Feb 20, 2015 15:46:48 - 15:54:44	8 min
C 740	Private Sector	Phone calls	Feb 20, 2015 15:55:10 - 15:56:59	2 min
C 717	Private Sector	Phone calls	Feb 20, 2015 15:58:17 - 16:01:00	3 min
C 740	Private Sector	Phone calls	Feb 20, 2015 16:08:52 - 16:11:37	3 min
C 741	Private Sector	E-mails	Feb 20, 2015 16:14:49 - 16:21:34	7 min
C 742	Private Sector	Phone calls	Feb 20, 2015 16:22:55 - 16:23:25	1 min
C 730	Academia	Phone calls	Feb 20, 2015 16:26:38 - 16:27:25	1 min
C 743	Academia	E-mails	Feb 20, 2015 16:27:31 - 16:30:48	3 min
C 703	Provincial Government	Phone calls	Feb 20, 2015 16:42:27 - 16:44:26	2 min
C 743	Academia	E-mails	Feb 20, 2015 17:33:32 - 17:39:42	6 min
C 744	Government	E-mails	Feb 20, 2015 17:39:55 - 17:52:25	13 min
D 60	Government	Calculating	Feb 20, 2015 18:42:23 - 18:59:21	17 min
D 60	Government	Calculating	Feb 20, 2015 19:02:53 - 19:21:33	19 min
C 741	Private Sector	E-mails	Feb 20, 2015 19:21:45 - 19:24:46	3 min
D 60	Government	Calculating	Feb 20, 2015 19:25:06 - 19:40:34	15 min
C 741	Private Sector	E-mails	Feb 20, 2015 19:40:40 - 19:49:37	9 min
D 60	Government	Calculating	Feb 20, 2015 19:50:32 - 20:39:38	49 min
D 257	Private Sector	Background research	Feb 21, 2015 07:59:15 - 08:06:16	7 min
C 292	Academia	E-mails	Feb 21, 2015 08:06:26 - 08:07:22	1 min
C 734	Academia	E-mails	Feb 21, 2015 08:07:33 - 08:11:08	4 min
D 257	Private Sector	Background research	Feb 21, 2015 10:33:00 - 10:57:46	25 min
D 257	Private Sector	Reading	Feb 21, 2015 10:57:59 - 11:02:48	5 min
Total				**344:40 h**

Table F.1: Full activity log

Appendix G

Travel Log

Full list with travel movements, in chronological order.

Cost for transport was only entered when direct costs were incurred (train tickets and car fuel). Per-kilometer fuel expense was set at R1.34 after measuring fuel usage and cost during several trips.

Date	Time	Total Time	Mode	Distance	Speed	Cost
Sep 01, 2014	13:02 - 14:27	1:25 h	Car	50.40 km	35.6 km/h	R67.54
Sep 01, 2014	15:28 - 16:50	1:22 h	Car	50.40 km	36.9 km/h	R67.54
Sep 05, 2014	14:17 - 14:56	39 min	Car	19.20 km	29.5 km/h	R25.73
Sep 05, 2014	15:56 - 16:44	48 min	Car	19.20 km	24.0 km/h	R25.73
Sep 15, 2014	13:06 - 13:53	47 min	Car	39.30 km	50.2 km/h	R52.66
Sep 15, 2014	15:26 - 16:06	40 min	Car	35.40 km	53.1 km/h	R47.44
Sep 17, 2014	09:44 - 09:57	13 min	Bicycle	2.40 km	11.1 km/h	
Sep 17, 2014	11:00 - 11:59	59 min	Bicycle	13.50 km	13.7 km/h	
Sep 17, 2014	13:02 - 13:43	41 min	Bicycle	9.20 km	13.5 km/h	
Sep 18, 2014	08:27 - 09:07	40 min	Car	13.10 km	19.7 km/h	R17.55
Sep 18, 2014	10:20 - 10:30	10 min	Car	2.00 km	12.0 km/h	R2.68
Sep 18, 2014	14:22 - 14:43	21 min	Car	11.20 km	32.0 km/h	R15.01
Sep 23, 2014	09:24 - 10:02	38 min	Bicycle	12.60 km	19.9 km/h	
Sep 23, 2014	11:24 - 11:55	31 min	Bicycle	8.80 km	17.0 km/h	
Sep 25, 2014	09:19 - 09:59	40 min	Bicycle	10.80 km	16.2 km/h	
Sep 25, 2014	12:15 - 12:47	32 min	Bicycle	8.40 km	15.8 km/h	
Sep 26, 2014	13:12 - 13:28	16 min	Bicycle	3.00 km	11.3 km/h	
Sep 26, 2014	15:05 - 15:35	30 min	Bicycle	7.60 km	15.2 km/h	
Sep 30, 2014	09:38 - 10:27	49 min	Train	16.00 km	19.6 km/h	R10.50

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Table G.1 – *Continued from previous page*

Date	Time	Total Time	Mode	Distance	Speed	Cost
Sep 30, 2014	11:40 - 12:42	1:02 h	Train	16.00 km	15.5 km/h	R10.50
Sep 30, 2014	12:43 - 12:59	16 min	Bicycle	4.10 km	15.4 km/h	
Oct 01, 2014	07:50 - 08:13	23 min	Bicycle	6.60 km	17.2 km/h	
Oct 01, 2014	09:37 - 10:19	42 min	Bicycle	15.40 km	22.0 km/h	
Oct 01, 2014	11:23 - 11:32	9 min	Bicycle	2.30 km	15.3 km/h	
Oct 01, 2014	13:11 - 13:39	28 min	Bicycle	12.00 km	25.7 km/h	
Oct 01, 2014	15:13 - 15:17	4 min	Bicycle	1.10 km	16.5 km/h	
Oct 01, 2014	18:20 - 18:59	39 min	Bicycle	11.90 km	18.3 km/h	
Oct 02, 2014	08:37 - 09:24	47 min	Bicycle	12.80 km	16.3 km/h	
Oct 02, 2014	10:21 - 12:01	1:39 h	Bicycle	12.80 km	7.8 km/h	
Oct 02, 2014	12:07 - 13:18	1:11 h	Car	50.20 km	42.4 km/h	R67.27
Oct 02, 2014	14:30 - 15:37	1:07 h	Car	50.20 km	45.0 km/h	R67.27
Oct 06, 2014	11:06 - 11:58	52 min	Bicycle	13.70 km	15.8 km/h	
Oct 06, 2014	12:50 - 13:32	42 min	Bicycle	13.70 km	19.6 km/h	
Oct 07, 2014	09:35 - 10:20	45 min	Bicycle	14.50 km	19.3 km/h	
Oct 07, 2014	11:48 - 12:29	41 min	Bicycle	11.80 km	17.3 km/h	
Oct 08, 2014	10:13 - 10:47	33 min	Bicycle	10.80 km	19.6 km/h	
Oct 08, 2014	18:17 - 18:34	17 min	Bicycle	4.80 km	16.9 km/h	
Oct 09, 2014	13:55 - 14:20	25 min	Bicycle	8.00 km	19.2 km/h	
Oct 09, 2014	15:02 - 15:39	36 min	Bicycle	10.40 km	17.3 km/h	
Oct 17, 2014	11:45 - 11:56	11 min	Bicycle	2.40 km	13.1 km/h	
Oct 17, 2014	12:54 - 13:03	9 min	Bicycle	2.40 km	16.0 km/h	
Oct 20, 2014	09:20 - 10:10	50 min	Car	24.80 km	29.8 km/h	R33.23
Oct 20, 2014	11:17 - 11:36	19 min	Car	10.00 km	31.6 km/h	R13.40
Oct 20, 2014	12:21 - 12:47	26 min	Car	18.60 km	42.9 km/h	R24.92
Oct 23, 2014	09:42 - 09:59	17 min	Bicycle	4.40 km	15.5 km/h	
Oct 23, 2014	10:36 - 10:49	13 min	Bicycle	2.50 km	11.5 km/h	
Oct 24, 2014	13:42 - 14:00	18 min	Bicycle	4.70 km	15.7 km/h	
Oct 24, 2014	15:29 - 15:40	11 min	Bicycle	2.10 km	11.5 km/h	
Oct 30, 2014	09:51 - 10:00	9 min	Car	4.70 km	31.3 km/h	R6.30
Oct 30, 2014	11:49 - 12:00	11 min	Car	4.60 km	25.1 km/h	R6.16
Nov 07, 2014	13:47 - 14:23	36 min	Bicycle	12.00 km	20.0 km/h	
Nov 07, 2014	15:20 - 15:52	32 min	Bicycle	9.50 km	17.8 km/h	
Nov 20, 2014	12:06 - 12:40	34 min	Car	18.00 km	31.8 km/h	R24.12
Nov 20, 2014	14:18 - 14:47	29 min	Car	15.00 km	31.0 km/h	R20.10
Nov 21, 2014	09:09 - 10:21	1:12 h	Car	70.00 km	58.3 km/h	R93.80

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Table G.1 – *Continued from previous page*

Date	Time	Total Time	Mode	Distance	Speed	Cost
Nov 21, 2014	11:58 - 12:27	29 min	Car	41.80 km	86.5 km/h	R56.01
Nov 28, 2014	09:47 - 10:28	40 min	Bicycle	12.30 km	18.5 km/h	
Dec 01, 2014	13:14 - 13:50	37 min	Car	41.80 km	67.8 km/h	R56.01
Dec 01, 2014	15:15 - 15:50	35 min	Car	45.30 km	77.7 km/h	R60.70
Dec 04, 2014	12:33 - 13:06	33 min	Bicycle	8.80 km	16.0 km/h	
Dec 04, 2014	13:56 - 14:39	43 min	Bicycle	10.70 km	14.9 km/h	
Dec 05, 2014	10:15 - 11:05	50 min	Car	51.80 km	62.2 km/h	R69.41
Dec 05, 2014	12:48 - 13:15	27 min	Car	13.50 km	30.0 km/h	R18.09
Dec 10, 2014	13:06 - 14:04	58 min	Car	59.10 km	61.1 km/h	R79.19
Dec 10, 2014	16:36 - 17:31	55 min	Car	53.30 km	58.1 km/h	R71.42
Dec 15, 2014	09:07 - 09:57	50 min	Car	56.00 km	67.2 km/h	R75.04
Dec 15, 2014	14:47 - 15:33	46 min	Car	56.00 km	73.0 km/h	R75.04
Dec 17, 2014	09:22 - 09:55	33 min	Bicycle	12.40 km	22.5 km/h	
Jan 07, 2015	08:48 - 09:57	1:09 h	Car	55.90 km	48.6 km/h	R74.91
Jan 07, 2015	11:48 - 13:11	1:23 h	Car	50.70 km	36.7 km/h	R67.94
Jan 12, 2015	08:33 - 08:48	15 min	Car	8.60 km	34.4 km/h	R11.52
Jan 12, 2015	09:30 - 09:52	22 min	Car	12.60 km	34.4 km/h	R16.88
Jan 15, 2015	09:09 - 09:48	39 min	Bicycle	12.80 km	19.7 km/h	
Jan 15, 2015	11:33 - 12:28	55 min	Bicycle	18.00 km	19.6 km/h	
Feb 06, 2015	11:20 - 11:38	18 min	Bicycle	6.30 km	21.0 km/h	
Feb 06, 2015	12:27 - 12:37	10 min	Bicycle	6.30 km	37.8 km/h	
Total			**46:43 h**	**1455.3 km**	**31.2 km/h**	**R1,431.62**

Table G.1: Travel log

Appendix H

Dissertation Time Log

Throughout this project I have logged most of the time spent on the different activities. In addition to the fieldwork, this includes reading relevant literature, meetings to understand the methodology and to define my project, development of the MFA Tools website, and writing of this dissertation. In this Appendix an overview is provided of all these activities. First, details are provided of the principal activities, followed by a list of programming activities (for the MFA Tools website). A summary breakdown of all time spent on this project is provided in the last section.

H.1 Main activities

These activities include all work done aside from the fieldwork and programming work. The following different activity types are identified:

- **Reading**: reading of relevant literature in preparation of this work.
- **Meetings**: in-person meetings or telephone conversations with experts in the field and fellow students to better understand the methodology and define the scope and objectives of this research.
- **MFA Tools - correspondence**: (mostly e-mail) correspondence with other people about the MFA Tools website and its content. This also includes correspondence with other universities in search of other students engaging in similar research.
- **MFA Tools - content**: adding content (mostly literature) to the MFA Tools website.
- **MFA Tools - promote site**: a short e-mail campaign to promote the MFA Tools website.
- **Writing**: writeup of this document, and all activities directly related to it (e.g. formatting).

Table H.1 provides a log of all main activities. Some shortcomings apply. Initially, I only registered duration and date of meetings (and not the exact time slot). Furthermore, in the first months I would keep track of approximate reading times. In July 2014 I started more carefully tracking exact start and end times of these activities. Finally, time related to writing (and presenting) the proposal was not tracked. This likely took an estimated 10-20 hours.

Type	Date	Duration
Reading - Reshaping Urban Infrastructure	Mar 31, 2013 10:12 - 11:52	1:40 h
Reading - A global typology of cities : classification...	Apr 10, 2013 15:40 - 16:10	30 min
Reading - Urban metabolism of Paris and its...	Apr 10, 2013 14:14 - 16:24	2:10 h
Reading - The Energetic Metabolism of Societies:...	Apr 20, 2013 10:08 - 10:13	5 min
Meetings - Understanding Methodology	Apr 24, 2013 00:00 - 00:00	30 min
Reading - Material use in the European Union...	Apr 24, 2013 06:57 - 07:17	20 min
Reading - Economy-wide material flow accounts...	Apr 24, 2013 05:49 - 07:19	1:30 h
Reading - Energy and material flow through...	Apr 24, 2013 08:41 - 08:51	10 min
Reading - The study of urban metabolism and...	Apr 24, 2013 07:36 - 08:56	1:20 h
Reading - The Energetic Metabolism of Societies:...	Apr 24, 2013 08:58 - 09:08	10 min
Reading - Approaches for quantifying the...	Apr 24, 2013 08:58 - 09:08	10 min
Reading - Methodology and Indicators of Economy-wide...	Apr 24, 2013 08:53 - 09:08	15 min
Reading - Urban metabolism - Methodological...	Apr 24, 2013 08:58 - 09:08	10 min
Reading - Approaches for quantifying the...	Apr 24, 2013 08:58 - 09:08	10 min
Reading - The changing metabolism of cit...	Apr 26, 2013 13:03 - 13:13	10 min
Reading - Comparison of energy flow accounting,...	Apr 27, 2013 05:00 - 05:10	10 min
Reading - A critical review of the development...	Apr 27, 2013 05:21 - 05:41	20 min
Reading - Abel Wolman's 'the metabolism of...	Apr 27, 2013 05:55 - 06:10	15 min
Reading - The metabolism of cities	Apr 27, 2013 06:12 - 06:13	1 min
Reading - The ecological footprint of Cape...	May 29, 2013 10:31 - 11:21	50 min
Meetings - Understanding Methodology	May 31, 2013 00:00 - 00:00	1:00 h
Reading - A review towards assessing the...	Jun 04, 2013 04:28 - 05:08	40 min
Reading - The Landscape Pattern Surrounding...	Jun 07, 2013 07:46 - 10:26	2:40 h
Reading - Analysis on Characteristics of...	Aug 16, 2013 04:32 - 04:52	20 min
Reading - Data quality management for life...	Sep 10, 2013 14:18 - 14:58	40 min
Reading - Multi-user test of the data quality...	Sep 12, 2013 08:02 - 08:17	15 min
Reading - Material flow accounting and a...	Oct 02, 2013 12:28 - 13:58	1:30 h
Reading - Material Flow Analysis on the Regional...	Oct 02, 2013 13:57 - 14:07	10 min
Reading - Developing the urban metabolism...	Oct 07, 2013 11:18 - 11:38	20 min
Reading - The metabolism of cities	Nov 05, 2013 10:12 - 11:42	1:30 h
Meetings - Understanding Methodology	Dec 05, 2013 11:00 - 11:30	30 min
Meetings - Understanding Methodology	Dec 05, 2013 12:30 - 12:55	25 min
Meetings - Understanding Methodology	Mar 13, 2014 10:00 - 10:35	35 min
Reading - Uncertainty in Material Flow A...	May 12, 2014 07:41 - 07:51	10 min
Reading - A Material Flow Accounting Case...	May 12, 2014 08:29 - 08:49	20 min
Reading - Systematic Evaluation of Uncertainty...	May 13, 2014 11:19 - 12:29	1:10 h

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Type	Date	Duration
Meetings - Understanding Methodology	May 14, 2014 00:00 - 00:00	30 min
Reading - The Austrian P budget as a basis...	May 15, 2014 04:10 - 04:40	30 min
Reading - Material Flow Analysis of plastic...	May 15, 2014 04:35 - 05:00	25 min
Reading - Combined MFA-LCA for Analysis of...	May 20, 2014 13:09 - 13:39	30 min
Reading - Life cycle attribute assessmen...	May 23, 2014 13:14 - 13:59	45 min
Reading - Material Flow Analysis of the City...	May 25, 2014 14:15 - 14:45	30 min
Reading - Cambio Climático y el Metabolismo...	Jun 02, 2014 11:08 - 12:18	1:10 h
Meetings - Understanding Methodology	Jun 05, 2014 11:00 - 11:40	40 min
Reading - Beyond the Green Bubble	Jun 10, 2014 12:04 - 12:14	10 min
Reading - Economy-wide Material Flow Accounts...	Jun 10, 2014 10:42 - 12:42	2:00 h
Reading - How uncertain are estimates of...	Jun 10, 2014 12:33 - 12:43	10 min
Reading - The role of washing machines in...	Jun 10, 2014 11:47 - 12:47	1:00 h
Reading - Resource Use in Small Island S...	Jun 16, 2014 13:40 - 14:40	1:00 h
Reading - Reducing energy and material flows...	Jun 27, 2014 10:44 - 11:04	20 min
Reading - Book Review: Practical handbook...	Jun 28, 2014 17:36 - 17:51	15 min
Meetings - Understanding Methodology	Jul 02, 2014 00:00 - 00:00	40 min
Reading - 'Urban ecological security':...	Jul 07, 2014 14:39 - 16:09	1:30 h
Reading - Analysis of regional material flows:...	Jul 09, 2014 11:22 - 11:32	10 min
Reading - Economy-wide Material Flow Accounts...	Jul 10, 2014 13:14 - 13:29	15 min
Reading - Economy-wide Material Flow Accounting...	Jul 11, 2014 08:50 - 09:50	1:00 h
Reading - Local Studies Manual: A researcher's...	Jul 14, 2014 10:13 - 11:36	1:23 h
Reading - Local Studies Manual: A researcher's...	Jul 15, 2014 08:33 - 09:02	29 min
Reading - Carbon Footprinting of Cities and...	Jul 15, 2014 09:08 - 09:22	14 min
Reading - Materials use across world reg...	Jul 15, 2014 15:05 - 15:20	15 min
MFA Tools - content	Jul 22, 2014 08:35 - 09:30	54 min
MFA Tools - content	Jul 22, 2014 15:19 - 15:57	38 min
MFA Tools - content	Jul 22, 2014 16:20 - 17:12	52 min
MFA Tools - content	Jul 22, 2014 17:39 - 17:39	1 min
Reading - Society's Metabolism: The...	Jul 23, 2014 08:29 - 09:29	1:00 h
Reading - Society's Metabolism: The...	Jul 24, 2014 09:44 - 10:58	1:14 h
MFA Tools - content	Jul 24, 2014 11:42 - 12:05	23 min
Reading - Approaches for quantifying the...	Jul 25, 2014 10:35 - 11:54	1:19 h
MFA Tools - content	Jul 25, 2014 15:28 - 16:56	1:28 h
MFA Tools - content	Jul 28, 2014 08:53 - 11:03	2:10 h
MFA Tools - content	Aug 01, 2014 15:35 - 16:03	28 min
Reading - Approaches for quantifying the...	Aug 04, 2014 11:01 - 12:08	1:07 h
MFA Tools - content	Aug 07, 2014 08:34 - 08:50	15 min

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Type	Date	Duration
Reading - Urban metabolism - Methodological...	Aug 07, 2014 08:53 - 09:53	1:00 h
Reading - Material Flow Analysis on the Regional...	Aug 11, 2014 10:36 - 11:21	45 min
MFA Tools - content	Aug 12, 2014 05:32 - 06:08	36 min
MFA Tools - correspondence	Aug 12, 2014 06:34 - 06:38	4 min
MFA Tools - promote site	Aug 12, 2014 16:11 - 16:17	7 min
MFA Tools - promote site	Aug 12, 2014 17:35 - 19:43	2:08 h
Reading - Material flows and energy analysis...	Aug 13, 2014 06:07 - 06:12	5 min
MFA Tools - promote site	Aug 13, 2014 05:59 - 06:18	18 min
Reading - Sustainable Resource Managemen...	Aug 14, 2014 07:22 - 08:22	1:00 h
Reading - Sustainable Resource Managemen...	Aug 15, 2014 14:47 - 15:22	35 min
Reading - Sustainable Resource Managemen...	Aug 17, 2014 09:11 - 10:41	1:30 h
Reading - Sustainable Resource Managemen...	Aug 18, 2014 10:34 - 11:37	1:02 h
MFA Tools - correspondence	Aug 19, 2014 08:04 - 08:17	13 min
MFA Tools - correspondence	Aug 19, 2014 10:27 - 10:29	2 min
MFA Tools - content	Aug 19, 2014 14:13 - 14:58	45 min
Reading - Sustainable Resource Managemen...	Aug 19, 2014 16:11 - 16:29	18 min
Meetings - Understanding Methodology	Aug 21, 2014 15:02 - 15:51	49 min
MFA Tools - correspondence	Aug 25, 2014 11:29 - 12:13	44 min
Writing	Aug 28, 2014 07:49 - 08:35	46 min
MFA Tools - correspondence	Aug 28, 2014 14:03 - 15:04	1:01 h
MFA Tools - correspondence	Aug 28, 2014 15:13 - 15:43	29 min
MFA Tools - content	Aug 29, 2014 11:19 - 11:36	18 min
MFA Tools - correspondence	Aug 29, 2014 11:37 - 11:52	16 min
MFA Tools - correspondence	Aug 29, 2014 11:53 - 11:54	2 min
MFA Tools - correspondence	Aug 29, 2014 11:56 - 12:13	17 min
Reading - A handbook of industrial ecolo...	Aug 29, 2014 12:26 - 12:41	15 min
MFA Tools - content	Aug 29, 2014 12:39 - 12:49	11 min
MFA Tools - correspondence	Aug 29, 2014 17:15 - 17:22	7 min
Reading - Sustainable Urban Metabolism	Aug 30, 2014 08:57 - 10:27	1:30 h
MFA Tools - content	Aug 30, 2014 20:30 - 21:20	50 min
MFA Tools - content	Aug 30, 2014 21:20 - 22:09	49 min
MFA Tools - content	Aug 31, 2014 05:50 - 07:29	1:39 h
MFA Tools - content	Aug 31, 2014 16:23 - 16:42	19 min
Reading - Towards assessing the metabolism...	Sep 01, 2014 12:29 - 12:57	28 min
MFA Tools - correspondence	Sep 02, 2014 05:43 - 05:43	1 min
Reading - Sustainable Urban Metabolism	Sep 02, 2014 11:12 - 12:07	55 min
MFA Tools - correspondence	Sep 03, 2014 10:33 - 11:05	32 min

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Type	Date	Duration
MFA Tools - correspondence	Sep 03, 2014 11:15 - 11:24	9 min
MFA Tools - content	Sep 03, 2014 11:51 - 12:01	10 min
Meetings - Understanding Methodology	Sep 05, 2014 11:30 - 12:16	45 min
MFA Tools - correspondence	Sep 05, 2014 18:15 - 18:17	2 min
Reading - A material flow analysis of wood...	Sep 08, 2014 16:43 - 17:03	20 min
Reading - Material Flow Analysis on the Regional...	Sep 09, 2014 09:30 - 10:22	52 min
MFA Tools - content	Sep 09, 2014 11:09 - 11:22	12 min
Reading - Sustainable Urban Metabolism	Sep 09, 2014 10:53 - 11:23	30 min
MFA Tools - correspondence	Sep 10, 2014 15:26 - 15:42	16 min
MFA Tools - correspondence	Sep 11, 2014 14:05 - 14:12	8 min
MFA Tools - correspondence	Sep 11, 2014 16:53 - 16:55	2 min
MFA Tools - content	Sep 11, 2014 16:55 - 17:34	40 min
Reading - Sustainable Urban Metabolism	Sep 12, 2014 11:43 - 12:48	1:05 h
MFA Tools - content	Sep 14, 2014 07:31 - 07:50	19 min
MFA Tools - correspondence	Sep 15, 2014 17:27 - 17:28	1 min
MFA Tools - promote site	Sep 16, 2014 06:59 - 07:00	1 min
MFA Tools - correspondence	Sep 17, 2014 10:03 - 10:08	6 min
MFA Tools - correspondence	Sep 19, 2014 12:59 - 13:01	2 min
Reading - Sustainable Resource Managemen...	Sep 21, 2014 08:40 - 09:45	1:05 h
MFA Tools - correspondence	Sep 22, 2014 12:25 - 12:47	22 min
Reading - Sustainable Resource Managemen...	Sep 23, 2014 14:59 - 16:54	1:55 h
MFA Tools - correspondence	Sep 24, 2014 15:42 - 15:44	2 min
MFA Tools - correspondence	Sep 25, 2014 21:37 - 21:51	14 min
MFA Tools - correspondence	Oct 03, 2014 08:32 - 08:42	11 min
MFA Tools - correspondence	Oct 05, 2014 11:04 - 11:13	9 min
MFA Tools - correspondence	Oct 05, 2014 11:13 - 11:17	4 min
MFA Tools - correspondence	Oct 06, 2014 15:41 - 16:00	20 min
MFA Tools - correspondence	Oct 07, 2014 08:23 - 08:25	2 min
Reading - Economy-wide Material Flow Accounts...	Oct 14, 2014 11:28 - 11:48	20 min
MFA Tools - correspondence	Oct 15, 2014 11:37 - 11:40	2 min
MFA Tools - correspondence	Oct 17, 2014 15:23 - 15:28	4 min
MFA Tools - correspondence	Oct 20, 2014 06:23 - 06:55	32 min
MFA Tools - promote site	Oct 21, 2014 11:55 - 12:12	17 min
MFA Tools - correspondence	Oct 23, 2014 16:45 - 17:00	15 min
MFA Tools - correspondence	Oct 28, 2014 09:56 - 10:00	4 min
MFA Tools - correspondence	Oct 28, 2014 10:00 - 10:04	4 min
Reading - The weight of nations-material...	Oct 28, 2014 10:59 - 11:11	12 min

Continued on next page

Type	Date	Duration
MFA Tools - correspondence	Nov 14, 2014 11:00 - 11:16	16 min
MFA Tools - correspondence	Nov 14, 2014 19:05 - 19:06	2 min
Meetings - Understanding Methodology	Nov 18, 2014 11:00 - 12:00	1:00 h
MFA Tools - correspondence	Nov 25, 2014 17:13 - 17:17	3 min
Writing	Dec 04, 2014 10:34 - 11:02	27 min
MFA Tools - content	Dec 05, 2014 20:07 - 20:41	33 min
MFA Tools - content	Dec 07, 2014 12:31 - 12:57	26 min
Writing	Dec 08, 2014 16:17 - 16:22	5 min
MFA Tools - correspondence	Dec 10, 2014 06:42 - 06:58	16 min
MFA Tools - content	Dec 10, 2014 06:58 - 06:58	
MFA Tools - content	Dec 10, 2014 06:58 - 08:18	1:19 h
MFA Tools - correspondence	Dec 11, 2014 11:16 - 11:21	4 min
MFA Tools - correspondence	Dec 12, 2014 07:46 - 08:39	54 min
Writing	Dec 15, 2014 14:05 - 14:21	16 min
MFA Tools - content	Dec 16, 2014 11:47 - 13:58	2:12 h
Reading - Mainstreaming Urban Metabolism:...	Dec 16, 2014 16:36 - 17:11	35 min
Writing	Dec 20, 2014 09:39 - 09:51	13 min
Reading - Escalating trends in the urban...	Dec 20, 2014 13:20 - 13:27	7 min
Writing	Dec 20, 2014 17:31 - 18:03	32 min
Writing	Dec 21, 2014 07:43 - 08:24	41 min
Writing	Dec 21, 2014 16:49 - 17:50	1:01 h
Reading - Mainstreaming Urban Metabolism	Dec 22, 2014 07:51 - 08:00	9 min
Reading - The changing metabolism of cit...	Dec 22, 2014 08:14 - 09:02	48 min
Reading - The energy and mass balance of...	Dec 23, 2014 05:21 - 06:16	55 min
Writing	Dec 23, 2014 06:02 - 06:16	15 min
Writing	Dec 23, 2014 10:26 - 10:27	1 min
Writing	Dec 23, 2014 16:13 - 16:51	38 min
Reading - Urban Food Access: A study of the...	Dec 26, 2014 11:58 - 12:13	15 min
Writing	Dec 26, 2014 11:37 - 12:13	36 min
Reading - The Landscape Pattern Surrounding...	Dec 27, 2014 08:06 - 08:26	20 min
Writing	Dec 27, 2014 08:54 - 09:32	38 min
MFA Tools - correspondence	Dec 27, 2014 10:22 - 10:23	1 min
Writing	Dec 27, 2014 10:43 - 10:52	9 min
Writing	Dec 27, 2014 11:16 - 11:21	5 min
Writing	Dec 27, 2014 11:43 - 12:25	42 min
Writing	Dec 27, 2014 15:25 - 16:03	38 min
Writing	Dec 27, 2014 16:10 - 17:09	59 min

Continued on next page

Type	Date	Duration
Writing	Dec 28, 2014 07:10 - 08:25	1:14 h
Writing	Dec 30, 2014 06:56 - 07:37	41 min
Writing	Dec 30, 2014 10:16 - 10:52	36 min
Writing	Dec 30, 2014 16:46 - 16:51	5 min
Writing	Dec 31, 2014 15:36 - 16:29	53 min
Writing	Jan 01, 2015 13:05 - 13:43	38 min
Writing	Jan 02, 2015 07:39 - 07:53	14 min
Writing	Jan 02, 2015 08:00 - 08:21	21 min
Writing	Jan 02, 2015 11:33 - 12:31	57 min
Writing	Jan 02, 2015 16:25 - 17:18	53 min
Writing	Jan 03, 2015 07:45 - 08:13	28 min
Writing	Jan 04, 2015 09:16 - 09:28	13 min
Writing	Jan 06, 2015 08:38 - 08:56	18 min
Writing	Jan 07, 2015 08:25 - 08:41	16 min
Writing	Jan 07, 2015 15:44 - 16:20	36 min
Writing	Jan 08, 2015 06:03 - 07:16	1:13 h
Writing	Jan 08, 2015 08:46 - 10:31	1:45 h
Writing	Jan 08, 2015 13:13 - 13:18	6 min
Writing	Jan 08, 2015 16:01 - 16:44	43 min
Writing	Jan 09, 2015 11:29 - 11:57	27 min
Writing	Jan 09, 2015 13:22 - 15:02	1:40 h
Writing	Jan 10, 2015 12:36 - 12:43	7 min
Writing	Jan 10, 2015 15:40 - 17:08	1:28 h
Writing	Jan 10, 2015 17:41 - 18:30	49 min
Writing	Jan 11, 2015 09:09 - 11:14	2:06 h
Writing	Jan 11, 2015 11:42 - 12:23	40 min
Writing	Jan 11, 2015 14:34 - 18:54	4:21 h
Writing	Jan 11, 2015 18:55 - 19:06	10 min
Writing	Jan 11, 2015 21:09 - 22:30	1:21 h
Writing	Jan 12, 2015 05:59 - 06:52	53 min
Writing	Jan 12, 2015 08:04 - 08:28	24 min
Writing	Jan 12, 2015 11:35 - 11:57	23 min
Writing	Jan 12, 2015 12:28 - 12:39	10 min
Writing	Jan 12, 2015 15:02 - 15:50	49 min
Writing	Jan 12, 2015 15:51 - 16:34	44 min
Writing	Jan 12, 2015 16:38 - 18:39	2:01 h
Writing	Jan 13, 2015 06:38 - 07:36	58 min

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Type	Date	Duration
Writing	Jan 13, 2015 08:41 - 11:00	2:19 h
Writing	Jan 13, 2015 11:16 - 12:05	49 min
MFA Tools - content	Jan 13, 2015 14:38 - 14:41	3 min
Writing	Jan 13, 2015 17:55 - 18:51	56 min
Writing	Jan 14, 2015 08:55 - 09:51	57 min
Writing	Jan 14, 2015 11:08 - 11:29	21 min
MFA Tools - content	Jan 14, 2015 11:40 - 12:00	21 min
MFA Tools - content	Jan 14, 2015 14:01 - 14:06	5 min
Writing	Jan 15, 2015 14:07 - 15:24	1:17 h
Writing	Jan 15, 2015 18:54 - 19:27	33 min
Writing	Jan 16, 2015 06:08 - 07:32	1:23 h
Writing	Jan 16, 2015 09:02 - 09:08	6 min
Writing	Jan 16, 2015 09:09 - 12:35	3:26 h
Writing	Jan 16, 2015 13:46 - 15:08	1:21 h
Writing	Jan 16, 2015 15:24 - 16:45	1:21 h
MFA Tools - content	Jan 17, 2015 06:27 - 06:30	4 min
Writing	Jan 18, 2015 06:43 - 08:04	1:21 h
Writing	Jan 18, 2015 09:47 - 10:31	45 min
Writing	Jan 18, 2015 20:11 - 21:18	1:07 h
Writing	Jan 19, 2015 09:40 - 09:50	10 min
Reading - Urban material flow analysis: An...	Jan 19, 2015 09:50 - 10:33	43 min
Writing	Jan 19, 2015 10:34 - 11:20	45 min
Writing	Jan 19, 2015 11:32 - 12:01	29 min
MFA Tools - correspondence	Jan 20, 2015 11:32 - 11:34	2 min
Writing	Jan 21, 2015 06:48 - 07:35	47 min
Writing	Jan 21, 2015 08:37 - 08:48	11 min
Reading - Urban metabolism of Paris and its...	Jan 21, 2015 11:27 - 11:53	26 min
Writing	Jan 21, 2015 11:46 - 11:53	6 min
Writing	Jan 21, 2015 14:25 - 15:06	42 min
Writing	Jan 22, 2015 06:12 - 06:52	39 min
Writing	Jan 22, 2015 08:18 - 08:54	36 min
Writing	Jan 22, 2015 10:05 - 10:40	35 min
Writing	Jan 23, 2015 09:05 - 10:33	1:28 h
Writing	Jan 23, 2015 11:47 - 12:12	25 min
Writing	Jan 23, 2015 13:49 - 14:01	12 min
Writing	Jan 23, 2015 17:02 - 17:43	41 min
Writing	Jan 23, 2015 17:43 - 18:11	28 min

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Type	Date	Duration
Writing	Jan 24, 2015 19:17 - 20:05	47 min
Writing	Jan 25, 2015 06:49 - 07:15	26 min
Writing	Jan 25, 2015 07:41 - 07:48	6 min
Writing	Jan 25, 2015 07:48 - 08:38	50 min
Writing	Jan 25, 2015 10:50 - 11:06	17 min
Writing	Jan 25, 2015 13:58 - 14:33	35 min
Writing	Jan 25, 2015 18:59 - 21:08	2:09 h
Writing	Jan 26, 2015 06:20 - 07:19	59 min
Writing	Jan 26, 2015 08:27 - 09:33	1:06 h
Writing	Jan 26, 2015 10:25 - 11:55	1:30 h
Writing	Jan 26, 2015 13:16 - 13:27	11 min
Writing	Jan 26, 2015 13:27 - 14:56	1:29 h
Writing	Jan 26, 2015 14:59 - 15:20	21 min
Reading - The importance of disaggregated...	Jan 29, 2015 10:26 - 10:32	6 min
Writing	Jan 29, 2015 10:32 - 10:47	15 min
Writing	Jan 30, 2015 15:06 - 15:59	53 min
Writing	Jan 31, 2015 06:48 - 07:08	20 min
Writing	Jan 31, 2015 07:54 - 08:41	48 min
Writing	Jan 31, 2015 10:01 - 11:43	1:42 h
Writing	Feb 01, 2015 06:26 - 07:30	1:04 h
Writing	Feb 01, 2015 15:46 - 16:44	57 min
Writing	Feb 02, 2015 06:54 - 07:21	27 min
Writing	Feb 03, 2015 06:02 - 06:46	44 min
Writing	Feb 03, 2015 11:15 - 11:46	32 min
Writing	Feb 03, 2015 20:11 - 20:50	39 min
Writing	Feb 03, 2015 21:01 - 21:58	57 min
Writing	Feb 04, 2015 06:59 - 07:30	32 min
Writing	Feb 04, 2015 09:21 - 10:57	1:35 h
Writing	Feb 04, 2015 14:51 - 15:41	50 min
Writing	Feb 04, 2015 21:20 - 22:12	52 min
Reading - Sustainable Urban Metabolism	Feb 06, 2015 08:34 - 10:04	1:30 h
Writing	Feb 06, 2015 13:10 - 13:23	13 min
Writing	Feb 06, 2015 13:25 - 14:11	46 min
MFA Tools - correspondence	Feb 07, 2015 06:35 - 06:43	8 min
Writing	Feb 07, 2015 06:46 - 07:04	18 min
Writing	Feb 07, 2015 10:01 - 11:30	1:29 h
Writing	Feb 07, 2015 12:03 - 12:13	10 min

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Type	Date	Duration
Writing	Feb 07, 2015 13:07 - 14:18	1:11 h
Writing	Feb 07, 2015 21:01 - 21:46	45 min
Writing	Feb 08, 2015 07:35 - 08:11	35 min
Writing	Feb 08, 2015 09:35 - 10:09	33 min
Writing	Feb 08, 2015 11:31 - 12:17	46 min
Writing	Feb 08, 2015 15:06 - 17:28	2:22 h
Writing	Feb 08, 2015 20:55 - 22:25	1:30 h
Writing	Feb 08, 2015 22:25 - 22:37	12 min
Writing	Feb 09, 2015 07:06 - 07:17	11 min
Writing	Feb 09, 2015 16:31 - 16:35	4 min
Writing	Feb 10, 2015 18:29 - 18:33	4 min
Writing	Feb 10, 2015 18:33 - 19:21	48 min
Writing	Feb 10, 2015 21:25 - 22:11	45 min
Writing	Feb 11, 2015 06:00 - 07:35	1:35 h
Writing	Feb 11, 2015 09:11 - 10:02	51 min
Writing	Feb 12, 2015 05:51 - 06:12	21 min
Writing	Feb 12, 2015 06:12 - 06:19	7 min
Writing	Feb 12, 2015 06:45 - 07:44	59 min
Writing	Feb 12, 2015 09:06 - 10:15	1:09 h
Writing	Feb 12, 2015 10:58 - 11:52	54 min
Writing	Feb 12, 2015 11:53 - 12:15	22 min
Writing	Feb 12, 2015 14:54 - 15:24	30 min
Writing	Feb 12, 2015 15:18 - 15:46	29 min
Writing	Feb 12, 2015 15:47 - 16:32	45 min
Writing	Feb 12, 2015 16:32 - 16:40	8 min
Writing	Feb 12, 2015 16:41 - 18:30	1:49 h
Writing	Feb 13, 2015 10:48 - 11:18	29 min
Writing	Feb 13, 2015 16:35 - 17:15	40 min
Writing	Feb 13, 2015 18:58 - 19:21	22 min
Writing	Feb 14, 2015 20:44 - 21:30	46 min
Writing	Feb 16, 2015 15:58 - 17:41	1:43 h
Writing	Feb 17, 2015 05:31 - 06:36	1:05 h
Writing	Feb 17, 2015 08:47 - 09:47	1:00 h
Writing	Feb 17, 2015 10:02 - 10:34	31 min
Writing	Feb 17, 2015 10:53 - 11:33	40 min
Writing	Feb 17, 2015 15:08 - 16:24	1:17 h
Writing	Feb 18, 2015 05:23 - 06:19	56 min

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Type	Date	Duration
Writing	Feb 19, 2015 06:50 - 07:34	44 min
Writing	Feb 19, 2015 11:08 - 11:40	32 min
Writing	Feb 19, 2015 13:20 - 13:57	37 min
Writing	Feb 19, 2015 14:01 - 14:31	30 min
Writing	Feb 19, 2015 15:42 - 16:25	42 min
Writing	Feb 19, 2015 16:32 - 17:21	49 min
Writing	Feb 19, 2015 17:37 - 18:55	1:17 h
Writing	Feb 20, 2015 06:12 - 07:06	54 min
Writing	Feb 20, 2015 08:07 - 10:02	1:55 h
Writing	Feb 20, 2015 18:24 - 18:31	7 min
Writing	Feb 20, 2015 18:36 - 18:42	6 min
Writing	Feb 20, 2015 20:41 - 02:01	5:19 h
Writing	Feb 21, 2015 07:54 - 07:58	4 min
Writing	Feb 21, 2015 11:07 - 12:48	1:41 h
Writing	Feb 21, 2015 16:44 - 17:44	1:00 h
Writing	Feb 21, 2015 17:46 - 18:33	47 min
Writing	Feb 21, 2015 18:54 - 19:35	42 min
Writing	Feb 22, 2015 08:06 - 08:17	11 min
Writing	Feb 22, 2015 08:17 - 08:28	11 min
Writing	Feb 22, 2015 09:45 - 12:13	2:28 h
Writing	Feb 22, 2015 12:13 - 14:18	2:05 h
Writing	Feb 22, 2015 15:49 - 19:05	3:16 h
Writing	Feb 22, 2015 21:58 - 23:28	1:30 h
Writing	Feb 22, 2015 23:29 - 00:00	31 min
Writing	Feb 23, 2015 05:12 - 06:10	58 min
Writing	Feb 23, 2015 06:11 - 06:44	34 min
Writing	Feb 23, 2015 06:45 - 07:08	24 min
Writing	Feb 23, 2015 07:16 - 07:30	14 min
Writing	Feb 23, 2015 07:31 - 08:01	29 min
Writing	Feb 23, 2015 08:08 - 08:14	6 min
Writing	Feb 23, 2015 08:17 - 10:22	2:05 h
Writing	Feb 23, 2015 10:23 - 10:52	29 min
Writing	May 19, 2015 11:06 - 12:13	1:07 h
Writing	May 19, 2015 16:12 - 18:58	2:47 h
Writing	May 20, 2015 10:35 - 11:10	35 min
Writing	May 20, 2015 11:23 - 12:31	1:08 h
Writing	May 20, 2015 13:24 - 15:29	2:05 h

Continued on next page

Type	Date	Duration
Writing	May 20, 2015 15:36 - 16:31	56 min
Writing	May 20, 2015 16:46 - 18:00	1:14 h
Writing	May 23, 2015 17:40 - 18:42	1:01 h
Writing	May 24, 2015 07:01 - 07:57	56 min
Writing	May 24, 2015 11:04 - 13:01	1:57 h
Writing	May 25, 2015 06:02 - 08:30	2:28 h
Total		**270:41 h**

Table H.1: Log of main activities

H.2 Development of MFA Tools

Table H.2 provides an overview of time spent on developing the MFA Tools website. This only includes time spent coding the website, and does not include time spent on other activities with regards to the site (like adding content or time spent on promoting the site).

Time was logged in every commit made to the git repository. As this is a public repository [1], the same log can be generate with the following command:

git log –pretty=format:‘%ai | %s‘ –until=‘2015-02-25‘

This log starts on August 31, 2014, which is the date the repository was placed on the Github website. The other commits date from when the website was still being set up and not yet made publicly available.

Each commit message ends with the duration either in minutes (format: mm) or in hours (format: hh:mm). Those commits lacking a number were either very insignificant, or they were part of the writing process (for instance, generating particular graphs or tables was added to the writing time, rather than to the website development time).

[1] See: https://github.com/paulhoekman/mfa-tools

Date	Description	Duration (min.)
2014-07-07 11:27:18 +0200	Initial setup 50	50
2014-07-07 11:48:04 +0200	Figuring out what to do with the …20	20
2014-07-17 17:38:43 +0200	Import papers from JIE 108	108
2014-07-18 11:18:42 +0200	Scrape abstracts and keywords 50	50
2014-07-18 12:19:10 +0200	Keyword listings 10	10
2014-07-19 08:34:10 +0200	Work on import 29	29
2014-07-21 10:32:27 +0200	OPtion to tag papers 60	60
2014-07-21 11:30:53 +0200	Importing papers from KC 80	80
2014-07-25 17:08:43 +0200	Create list of publication parent …15	15
2014-07-28 16:07:40 +0200	Adding a homepage and some more 60	60
2014-07-28 20:46:01 +0200	Add paper 22	22
2014-07-29 10:34:47 +0200	New pages and adding to database 87	87
2014-07-29 13:28:37 +0200	Smooth scroll 13	13
2014-07-30 15:07:23 +0200	Add missing pages 64	64
2014-08-01 09:56:51 +0200	Collections page and management 36	36
2014-08-01 10:37:16 +0200	Enable dataset creation 37	37
2014-08-01 10:54:20 +0200	OMAT about section 17	17
2014-08-01 11:02:49 +0200	Links checking 8	8
2014-08-01 15:37:47 +0200	Set up connection	
2014-08-01 16:04:58 +0200	Change mail address 2	2
2014-08-01 16:06:35 +0200	Confirmation 2	2
2014-08-01 16:09:41 +0200	Change details publication 3	3
2014-08-01 16:10:28 +0200	Details 1	1
2014-08-04 05:30:15 +0200	Activation link	
2014-08-04 05:40:12 +0200	Activate and delete publications 10	10
2014-08-04 05:49:55 +0200	Add new tags 10	10
2014-08-04 05:50:33 +0200	Admin mode 1	1
2014-08-07 11:48:40 +0200	Show details	
2014-08-07 12:52:48 +0200	Change to august 2	2
2014-08-07 21:16:33 +0200	Adding mailing list option 20	20
2014-08-08 09:11:57 +0200	Search improvement 35	35
2014-08-08 15:45:10 +0200	Provide more links 18	18
2014-08-11 08:53:44 +0200	Loading the EUROSTAT categories 18	18
2014-08-11 10:18:35 +0200	Manage data in OMAT 80	80
2014-08-11 10:34:51 +0200	Further data management 8	8
2014-08-12 05:46:25 +0200	Add Google Analytics 6	6

Continued on next page

Date	Description	Duration (min.)
2014-08-12 06:06:46 +0200	Set up domain 3	3
2014-08-12 09:53:56 +0200	Improve OMAT 97	97
2014-08-12 17:16:45 +0200	Add screenshots 55	55
2014-08-12 17:22:11 +0200	Version history 5	5
2014-08-12 17:27:36 +0200	Copyright blurb 3	3
2014-08-12 17:29:11 +0200	Separate 2	2
2014-08-12 17:58:20 +0200	Create keyword list	
2014-08-12 18:00:09 +0200	Dashes	
2014-08-20 21:01:53 +0200	Set up new tables for tracking 31	31
2014-08-21 12:01:53 +0200	Restructuring of the database 110	110
2014-08-21 20:51:56 +0200	More OMAT settings 10	10
2014-08-22 06:55:05 +0200	Manage settings 30	30
2014-08-22 13:40:09 +0200	DQI implementation 3:45	225
2014-08-22 16:17:05 +0200	Contact management and more 2:00	120
2014-08-23 10:22:32 +0200	Debugging problem radio buttons 30	30
2014-08-23 11:52:47 +0200	Contact management 60	60
2014-08-23 18:46:48 +0200	Notes	
2014-08-23 20:02:12 +0200	Contact management 75	75
2014-08-23 20:53:29 +0200	Ajax contact management 23	23
2014-08-24 08:56:05 +0200	Source management 30	30
2014-08-24 10:37:24 +0200	New maintenance option 25	25
2014-08-24 20:59:52 +0200	Management of sources and contacts, …60	60
2014-08-25 09:20:25 +0200	Improve multiscale and source management 16	16
2014-08-25 09:38:25 +0200	Set up MFA type 6	6
2014-08-25 10:20:29 +0200	Activity log expansion 42	42
2014-08-26 14:12:19 +0200	Improving contact and source management 36	36
2014-08-26 16:37:14 +0200	Print material groups 24	24
2014-08-27 20:41:19 +0200	Set up file upload functionality 40	40
2014-08-28 15:22:56 +0200	Wish list changes	
2014-08-28 17:29:23 +0200	Random contact or source 6	6
2014-08-29 09:00:20 +0200	Properly linking referrals 8	8
2014-08-29 09:33:02 +0200	Manage comments for materials 33	33
2014-08-29 09:49:43 +0200	DQI reset 15	15
2014-08-29 10:05:04 +0200	Report with data 15	15
2014-08-29 13:26:41 +0200	Editing and managing publications 36	36
2014-08-29 13:34:56 +0200	Tweaks to editing publications 8	8
2014-08-29 13:49:14 +0200	Fix DQI setting and resetting 14	14

Continued on next page

Date	Description	Duration (min.)
2014-08-29 14:16:12 +0200	Report improvement 25	25
2014-08-31 09:58:06 +0200	Implementing PDO class 1:35	95
2014-08-31 11:06:55 +0200	PDO changes to code 69	69
2014-08-31 15:13:44 +0200	Further preparing for github upload 1:05	65
2014-08-31 15:16:17 +0200	Fixing collections page 2	2
2014-08-31 14:50:33 +0200	Initial commit	
2014-08-31 14:51:29 +0200	Add empty readme	
2014-08-31 15:19:43 +0200	Base structure of the site 3	3
2014-08-31 15:25:28 +0200	Housekeeping 2	2
2014-08-31 16:11:37 +0200	Instructions and database structure 45	45
2014-08-31 16:32:49 +0200	Github workflow details 5	5
2014-08-31 16:39:07 +0200	Adding links to github 2	2
2014-09-01 06:27:07 +0200	Add full log 6	6
2014-09-01 06:58:03 +0200	Fix bug in contacts and db class license 4	4
2014-09-01 12:30:39 +0200	Fixing foreign key 8	8
2014-09-02 05:42:04 +0200	Force UTF8 in PDO connection 6	6
2014-09-02 10:25:41 +0200	Properly format NULL values 3	3
2014-09-02 10:40:42 +0200	New field for contact referral …10	10
2014-09-02 17:19:17 +0200	Wrong foreign key 5	5
2014-09-02 18:20:38 +0200	Tab contacts per type 30	30
2014-09-03 10:47:02 +0200	Added list of papers by Hiroki Tanikawa …3	3
2014-09-03 11:14:33 +0200	Add link for source 4	4
2014-09-03 11:39:05 +0200	Fix last NULL value issue 2	2
2014-09-03 11:45:43 +0200	Add UNEP report to wish list 4	4
2014-09-03 15:03:16 +0200	Implement status settings for sources …40	40
2014-09-05 13:39:06 +0200	Fix foreign key reference 10	10
2014-09-08 16:41:31 +0200	Improve implementation of status 20	20
2014-09-09 11:09:28 +0200	Set up regional studies database 30	30
2014-09-09 14:09:14 +0200	Fix last change date 5	5
2014-09-11 11:45:02 +0200	Improve activity log and editing 35	35
2014-09-11 16:57:47 +0200	Fix query 2	2
2014-09-11 22:08:48 +0200	Add option to edit files 15	15
2014-09-12 05:43:53 +0200	Show list of files 15	15
2014-09-12 05:54:37 +0200	Improve table outline files 4	4
2014-09-14 07:34:52 +0200	Fix DOI test 2	2
2014-09-14 07:37:45 +0200	Fix strpos 3	3
2014-09-14 14:13:04 +0200	Implementing case study analysis 1:40	100

Continued on next page

Date	Description	Duration (min.)
2014-09-14 16:57:54 +0200	Improving details of case studies 10	10
2014-09-15 08:33:37 +0200	Implementation login functionality 2:00	120
2014-09-15 08:35:32 +0200	Settings change 2	2
2014-09-15 17:01:22 +0200	Fix small bugs 7	7
2014-09-16 21:50:31 +0200	Integrate additional tags 13	13
2014-09-16 21:52:15 +0200	Add WHERE clause 2	2
2014-09-19 18:48:52 +0200	Change order and focus on login 4	4
2014-09-20 06:04:57 +0200	Trim name 2	2
2014-09-20 12:45:50 +0200	Add new filters in worksheet 6	6
2014-09-22 07:32:19 +0200	Migrate server and make PHP 5.5 min…40	40
2014-09-22 12:12:39 +0200	Integration of indicators 3:40	220
2014-09-22 12:16:09 +0200	Returning the login pwd library 5	5
2014-09-22 12:25:49 +0200	Launch new version 10	10
2014-09-22 20:40:14 +0200	OMAT launch details 29	29
2014-09-22 22:05:01 +0200	Adding first part of documentation 25	25
2014-09-23 08:35:58 +0200	Create documentation for OMAT 2:30	150
2014-09-23 16:03:47 +0200	Abstract status 10	10
2014-09-23 17:41:19 +0200	Source and contact restructuring of lists 30	30
2014-09-24 19:15:51 +0200	Import of Eurostat data 30	30
2014-09-25 21:15:24 +0200	Create multipliers for scales 30	30
2014-09-25 21:37:10 +0200	Multiple entry of data 20	20
2014-09-25 21:43:59 +0200	Fix bug 2	2
2014-09-28 21:18:00 +0200	Setting up table reports 2:00	120
2014-09-29 08:14:45 +0200	Improve report of data 39	39
2014-09-30 09:05:47 +0200	Integrate double linking of contacts and sources 20	20
2014-09-30 19:09:13 +0200	Set up transport tracking and activity report 78	78
2014-10-03 08:31:33 +0200	Small changes	
2014-10-04 16:49:34 +0200	Create a travel report 16	16
2014-10-04 18:22:20 +0200	Loading Iceland data 45	45
2014-10-04 21:25:33 +0200	Finish loading Iceland and prepping graphs 52	52
2014-10-05 06:25:26 +0200	Create graphs for material groups 67	67
2014-10-05 06:27:41 +0200	Import Iceland 2	2
2014-10-05 06:29:08 +0200	Prevent from running in production 1	1
2014-10-05 07:40:03 +0200	Make project publicly available 39	39
2014-10-05 11:31:12 +0200	Checking functioning and change log 15	15
2014-10-07 07:50:16 +0200	Fix bug activity finish 2	2
2014-10-07 08:21:37 +0200	Allow for multiscale entry of data 30	30

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Date	Description	Duration (min.)
2014-10-09 11:05:27 +0200	Format date when saving 2	2
2014-10-09 13:46:59 +0200	Set up system of associating contacts …52	52
2014-10-10 06:33:02 +0200	Quick edit of contacts 45	45
2014-10-10 10:24:42 +0200	Improve mass classification 50	50
2014-10-10 17:26:42 +0200	New contact list structure 30	30
2014-10-11 07:00:11 +0200	Change presentation of contacts 50	50
2014-10-11 09:37:13 +0200	Re structure sources as well 60	60
2014-10-12 20:01:05 +0200	Reorganize new structure for sources …30	30
2014-10-13 07:32:09 +0200	Reorganizing time log and overview of …64	64
2014-10-13 11:59:26 +0200	Report on associated resources 45	45
2014-10-13 13:50:35 +0200	Coloring of resources in associated overview 10	10
2014-10-14 15:43:34 +0200	Better comment management 20	20
2014-10-28 12:26:00 +0200	Industry profiles setup 60	60
2014-11-06 20:04:47 +0200	CKeditor integration 15	15
2014-11-13 11:37:11 +0200	Industry integration 14	14
2014-11-14 08:24:22 +0200	Quick edit and tag deletion 7	7
2014-11-14 09:30:42 +0200	URL integration in contacts 4	4
2014-11-14 10:58:44 +0200	Improving referencing of projects ... 24	24
2014-11-20 11:49:32 +0200	Time logging for industries 26	26
2014-11-20 16:16:14 +0200	Also include sources time 5	5
2014-11-24 21:58:54 +0200	Industry implementation 1:10	70
2014-11-25 09:35:19 +0200	Industry delete option 2	2
2014-11-26 10:29:50 +0200	Industry comparison 40	40
2014-11-26 15:52:26 +0200	Sankey diagrams 1:30	90
2014-12-02 19:13:18 +0200	Create graphs of activities 30	30
2014-12-02 22:18:09 +0200	Material bar charts 35	35
2014-12-03 06:16:27 +0200	Debugging graph issues 15	15
2014-12-07 12:43:43 +0200	Changes to some overviews 8	8
2014-12-10 08:20:02 +0200	Newsletter details	
2014-12-12 07:45:02 +0200	View data tables 25	25
2014-12-14 12:09:07 +0200	Prep graphs for single year layout 32	32
2014-12-14 18:12:18 +0200	Further graph making 47	47
2014-12-14 20:28:51 +0200	Drawing pie charts 50	50
2015-01-02 12:05:11 +0200	Autosizing 5	5
2015-01-09 15:38:55 +0200	Changes to presentation	
2015-01-10 18:30:08 +0200	Functionality related to showing results	
2015-01-11 17:38:39 +0200	Reports useful for results	

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Date	Description	Duration (min.)
2015-01-12 18:38:58 +0200	Further prepping reports for use in results	
2015-01-17 06:32:33 +0200	Show abstracts 4	4
2015-01-17 10:51:42 +0200	HTML mail sending 4	4
2015-01-20 11:34:35 +0200	Wish list	
2015-01-27 08:19:06 +0200	Refinement for CT MFA	
2015-01-27 10:40:32 +0200	Fix totalling numbers 50	50
2015-02-25 08:09:44 +0200	Data not found message	
Total (minutes)		**5,367**
Total (hours)		**89:27 h**

Table H.2: Development time MFA Tools website

H.3 Total Dissertation Time Breakdown

Table H.3 summarizes the time spent on this dissertation. Each dissertation is unique, and the particular breakdown of time spent on this minor dissertation does not aim to be indicative for this type of work. However, it may provide some insights for planning and scheduling of similar work.

The MFA Tools website provided the technical back-end system used for administering my fieldwork. It also provided a place where I could collect and organize relevant literature. And lastly, it was a way for me to combine coding with my research efforts. The total time investment in the MFA Tools website should therefore be considered part preparation of the methodology, part understanding of the literature, and part hobby.

Type	Time
Reading	60:28 h
Meetings	7:24 h
MFA Tools - development	89:27 h
MFA Tools - correspondence	8:45 h
MFA Tools - content	19:00 h
MFA Tools - promote site	2:51 h
Data Collection	344:40 h
Writing	172:13 h
Total	**704:48 h**

Table H.3: Breakdown of all time spent on this dissertation