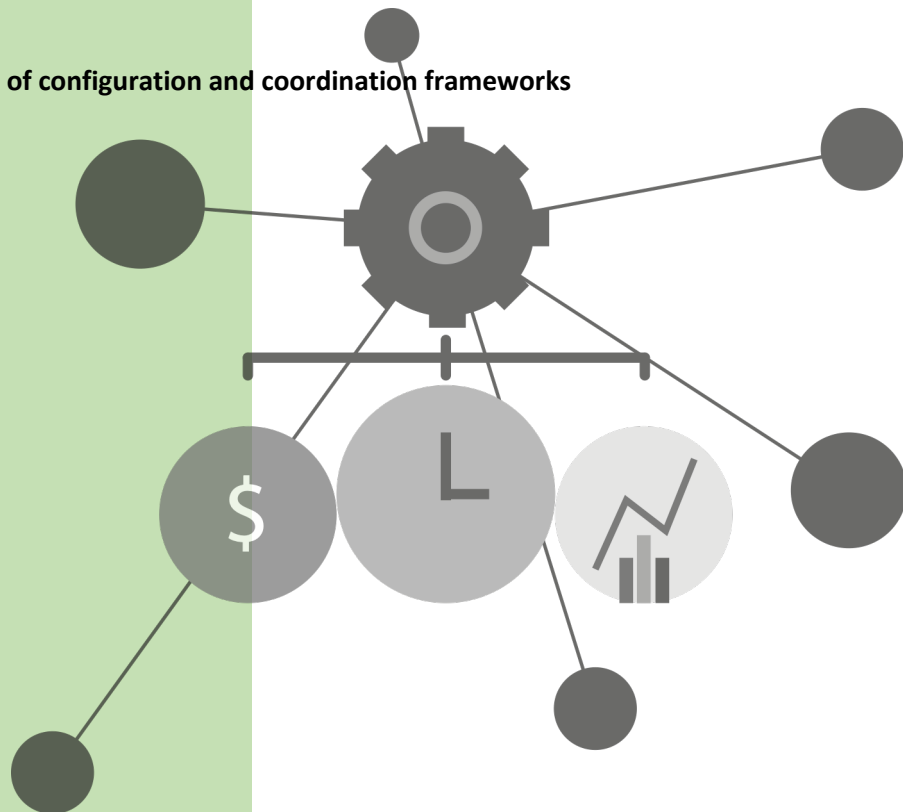


# MANUFACTURING FOOTPRINT OPTIMISATION OF MULTINATIONAL CORPORATIONS

a discourse analysis of configuration and coordination frameworks



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**- fortune favours the prepared mind -**

*Louis Pasteur*

## SUMMARY

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In this summary, a short, but complete description of the research will be given. This will disclose information on the introduction, theory, methodology, analysis, observations, conclusion and recommendations. However, the entire research should be read, to comprehend the full thesis and its impact.

### *Introduction*

In the last ten years, starting after the economic crisis, the manufacturing footprint optimisation (MFO) models have started to make an appearance. These models attempt to combine the multiple fields of research, such as operations management, business strategy, logistics, but also economic geography, towards a whole and inclusive analysis method for all the important characteristics for the network of a multinational corporation. Currently, some literature reviews (Cheng and Johansen, 2012; Netland and Aspelund, 2014) have been written acknowledging this development. They stated in their reviews multiple new research opportunities, for example the recommendation to conduct more research on the possibilities for structured processes in network optimisation considering an integrated approach regarding all fields of research (Cheng et al., 2015). To understand where future research should focus on, it is important to know how these models have established themselves.

The way the topic of this thesis influences and is relevant for the global society is shown more clearly in figure 1.

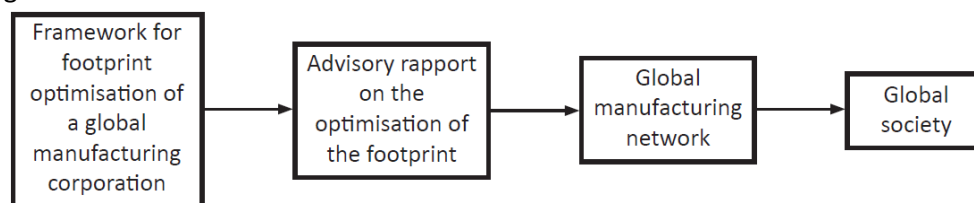


Figure 1 Societal relevance

This relevance leads to the following research question:

*How did the framework of manufacturing footprint optimisation establish itself as a key practice in the business sector worldwide and what is its significance?*

To answer this question, multiple sub questions are formed to come to the right conclusion:

1. Which characteristics does the current MFO framework contain and where do they derive from?
2. Who are important actors influencing this framework?
3. How is the framework applied in current corporations and industries?

### *Theoretical framework*

To conduct this research, discourse analysis will be used as a theory and methodology.

Firstly, discourse analysis 'seeks to uncover the social mechanisms that maintain structures and rules of validity over statements about particular people, animals, plants, things, events, and places' (Waite, 2010). Therefore, Foucault is 'attempting to develop, through his understanding of how power operates, a more distinctive and subtle way of analysing' (Wylie, 2015). Discourse is this power and everyday practice. To use discourse analysis in this thesis is to recognise how power operates in these frameworks by analysing the articles written about them. With more knowledge about the different forms of power within the framework, it will become clear how the tool has established itself in practice.

Secondly and consequently, we ourselves are the effects of discourse. According to Wylie (2015), perhaps Foucault's most notable achievement is to show that 'categories often assumed to be universal, natural or objectively definable, are in fact the products of particular discursive practices'. They are socially constructed. This could perhaps also be said about the MFO- framework.

The use of rationales will be helpful in uncovering the discourses in the MFO- framework. A rationale can be described as a set of reasons, or a logical basis for a course of action, or a belief. Therefore, it could be stated that rationales form the assumptions or causal stories, behind the reasoning of certain steps in the MFO framework and the conclusions drawn from its analysis.

### *Methodology*

To execute the discourse analysis, the 'Strategies for Doing Discourse Analysis' will be followed (Rose, 2001). This guideline consists of the following elements: the choice of source materials or texts; suspending pre-existing categories, which means becoming reflexive; familiarisation, which is absorbing yourself in and thinking critically about the social context of your texts; coding twice- once for organisation and again for interpretation; keeping in mind how power, knowledge, and persuasion work, investigate your texts for 'effects of truth'; taking notice of 'resilience and rupture', i.e. inconsistencies within your texts and lastly silence. Silence as discourse and discourses that silence.

The guideline is important to follow during the research since it provides a researcher with reminders, but not strict rules, to conduct the research thorough, accurately and without bias. The discourse analysis is executed on the academic articles, as well as the observations in practice, to research if and which differences occur between the two.

### *Analysis*

The discourse analysis will be executed on literature in which these models are discussed, and observations made during an internship at BCI Global, a consultancy corporation in Nijmegen, which is providing advice to a multinational corporation that wants to analyse and optimise their network.

The literature analysis leads to the following results;

- The important characteristics in the models are costs and risks. The different characteristics lead to the rationale of competitiveness, which has partially established the MFO- models as we currently know them;
- Actors involved with the models are of course the people who develop and use them: researchers and managers. Yet, both actors look towards the changes in the business climate as an important actor in the establishment of the MFO tools (Cheng and Johansen, 2013, pg. 1353);
- Lastly the models in practice were discussed. Established and developed to be more effective and efficient, originating from the need directly out of the field, proves this to be also the greatest difficulty.

The observation analysis leads to the following results;

- Competitiveness would be the main rationale for the establishment of the MFO model at BCI Global. With most of these changes, the business climate could be different in the future and to maintain a profitable corporation, its footprint should change as well, to remain this way;
- Efficiency is an important rationale;

- Quality aspects, or otherwise interpreted as sustainability or corporate responsibility, should be concerned as an important rationale, however, it is not. Even though this is mentioned in the vision and strategy of corporation S., BCI hardly acts upon this vision.

### *Conclusion*

The conclusion starts with the answering of the sub questions and this provides the opportunity to answer the main research question:

Three rationales come from this discourse analysis, who together, established the manufacturing footprint optimisation models as a key practice in the business sector worldwide:

1. Competitiveness

Mentioned multiple times by all literature, as well as BCI Global, staying relevant in the business climate is necessary to 'survive' and be a profitable and viable corporation. By analysing and optimising the network, using the MFO model, this is possible.

2. Possession of power

While only touched upon lightly, possibly silenced by those with power, it is critical to repeat the notion of who influences who in the business climate. By being part of the network, large corporations have power over the network and can therefore steer the business climate in the direction they please. Controlling the manufacturing network and the power (and money) which comes with that. This also has overlap with the rationale of staying competitive.

3. Efficiency

Lastly, efficiency is a rationale in the establishment of MFO- models due to the need to reduce risks in the network, but also incorporate other characteristics, such as customer delivery time. With the inspiration coming directly from practice, the reason for being more efficient is always present.

### *Recommendations*

For the execution of research, determination of the scope from the beginning is an important point, since it sets the definitive research topic and question. Without it, executing the research itself becomes problematic and serious delays can occur. However, it must stay iterative, since new insights affect the research constantly. Also, the data collection is a point of interest. This must be done thoroughly and of all the different combinations of keywords must be recorded to create a full picture of the available articles. Lastly, the way of coding could be improved in future research. With double coding, first on topic and secondly on meaning, a more in-depth understanding could be possible.

Future research topics within the scope of manufacturing footprint optimisation models should focus more on sustainability, operational flexibility and computational correctness of the models in comparison with practice. Other research opportunities could also focus on new models, not further expanding the existing ones, with the current economic models and globalisation as foundation, but models which can lead multinational corporations towards a sustainable and green future.

The research is completed with a personal reflection on the internship, the research period and the process of writing the thesis.

## PREFACE

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This is the thesis: 'Manufacturing Footprint Optimisation of multinational corporations- a discourse analysis of configuration and coordination frameworks', which has been written as a conclusion of the master's degree 'Economic Geography' at Radboud University in Nijmegen.

In cooperation with the consultancy corporation BCI Global, located in Nijmegen, this research was executed during an internship period and written in the time after the internship. A project at the corporation of 'Starkey' was the motive to learn more about this topic. With the help of the corporation supervisors, René Buck and Mathijs Pronk, and University supervisors, Arnoud Lagendijk and Simone Pekelsma, the research question and research method was formulated. From March until September 2018, during the internship, the data was gathered. After this period, the analysis, conclusion and recommendations were written, all leading up to the result currently present here. This research was difficult, due to a complex topic, relatively new to all involved, a new research method to me personally and some struggles with the scope of the research concerning all supervisors and myself. However, conducting this research has allowed me to learn a great deal more about this topic, but also, and perhaps more importantly, about planning, perseverance and working together with multiple stakeholders with different interests. Fortunately, all supervisors were very willing to help, answer questions and discuss the findings to provide me with feedback.

I would like to thank all the supervisors for their guidance and support during this process. To all my other colleagues at BCI Global: thank you for all the help (and coffee) you have given me during this process. Especially the Starkey project team: It was always very helpful to discuss my ideas and findings with you. Lastly, thank you to all my family and friends, you kept me positive and motivated when I needed the extra push, without which, this would have been even more challenging.

I hope you enjoy your reading,

Neeltje de Hoop

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## CHAPTER 1 INTRODUCTION

In this first chapter, the topic of manufacturing footprint optimisation models will be explained, the relevance of this thesis will be argued, and the research question will be presented, after this, the further course of this research will be explained in the reading guide.

### 1.1 Incitement

International business is of all times, for example, when thinking of the VOC or WIC, international business and trade created time of prosper, a 'Golden Age', in the Netherlands. Business today is more international than ever. Where first, a corporation would have a manufacturing facility from where they would distribute the products to the market, this process has become much more detailed and complicated. 'During the past decades, both international trade and foreign direct investment (FDI) have increased explosively, resulting in the globalisation of markets and further leading to the widespread restructuring of manufacturing systems' (Cheng, et al., 2015). So now, a corporation has, due to globalisation and trading many options to manufacture their goods. Resources could come from different countries, coming together in one factory location, from which it would be dispersed to the markets, manufacturing could take place near the market, or half fabricates could be distributed to a market, where then the assemblage would take place in proximity to the customer. Different network phenotypes are described by Abele et al. (2008) to help adjust their locations, or in other words, their manufacturing footprint, comply with the business strategy. This not only shows that international business is changing, but also corporations are changing, due to the current business climate.

'In today's competitive and rapidly changing environment manufacturing corporations face an increased challenge to design, produce and distribute products for a global market and simultaneously manage its global network of operations as efficiently as possible' (Olhager et al., 2014). So, as the manufacturing footprints of these corporations become more global, more aspects have to be taken into an account, becoming more intricate and the design of these networks becoming more critical for the competitiveness of these corporations (Olhager et al., 2014). Over the last two decades, research on structure and organisation of multinationals has shifted from a focus on the one-to-one headquarters- subsidiaries relationship toward a focus on managing a network of units (Kogut, 1989). Together with practice, also research shifted towards a network- approach. This shift in paradigm is recognised by Rudberg and Olhager (2003) 'a multinational company has to adopt a structure and an organisation that allows the company to respond to the conflicting and ever-increasing demands of its global customers' (Prahalad and Doz, 1987; Bartlett and Ghosal, 1989 in Cheng, et al., 2015). Important with this paradigm is the use of a network approach to research the business of multinational corporations to stay competitive and relevant in a global business environment. The definition of network used in this thesis will be as described as a manufacturing network, 'the manufacturing plants of the corporation, the distribution system that is owned by the corporation, and all transportation within this network. In addition, markets and important suppliers need to be incorporated in an extended view' (Cheng et al., 2011; Olhager et al., 2014). This means an extensive view of the corporation, with all the aspects mentioned in the definition above will be taken into an account when analysing the footprint.

Many articles are written on the expansion of corporations, development of new plants and their typology and location of these plants, creating distribution lines between plant and customer, all on

plant level (Cheng et al., 2015; Vereecke et al., 2006). Simultaneously, research is expanding our knowledge on growing corporations, searching and expanding towards new global markets, gaining competitive advantages abroad and foreign direct investments (FDI) (Porter, 1986). With all these new insights coming together, and adopting the network approach, the creation of a global footprint including all factors, global manufacturing networks started to influence new research and the concept of manufacturing footprint optimisation (MFO) tools started to make an entrance. These tools can be explained best as a method to analyse and often optimise the manufacturing network of a corporation (Cheng, et al., 2015; Olhager et al., 2015; Schuh et al., 2014). Multiple different methods exist, and these tools can have many forms, which will be elaborated on later in the research.

Consultancy corporations see business in these expanding corporations: first in finding new locations, then optimising these individual plants with methods as performance optimisation, cost savings, allocation towards more advantageous locations (BCI Global, 2018). The corporations keep improving their models and strategies to stay in business, just like the multinational corporations they're aiding and have also adopted a network approach. Now, more MFO tools are being used in practice and developed and perfected also along the way. This development changed the outlook on multinational corporations and their manufacturing operations: a network approach is used, and smarter tools are developed to analyse and optimise these detailed manufacturing footprints. This is also the starting point of this research.

## **1.2 The internship**

Buck Consultants Internationals (BCI) or BCI Global (the globally used corporation name), a consultancy corporation founded in Nijmegen, in the Netherlands is a corporation which offers advice on many different topics related with market research, supply chain management, location selection. Within the department of Footprint optimisation, Location strategy and Site selection (FLS), a new framework is now being developed to improve the advice they offer their clients. These clients are multinational corporations from differing industries, but mostly located in the automotive, medical technology and chemical technology sector. During the time spent at the internship working in this department, their framework was applied to a real case and this process generated the idea for this topic. The framework they currently use and want to upgrade is also taken account in the analysis of this thesis.

## **1.3 Research statement**

Within this research statement, the general motive for the research will be discussed first. After this the scientific relevance and lastly the societal relevance will be stated.

### **1.3.1 Motive for the research**

Changes in the global economy cause corporations to change and adapt, by which they affect the daily lives of the global society. Corporations change and grow to stay competitive and try to sell their products to more customers. They want to gain access to new markets with more buyers and make more profit. Due to this, multinational corporations scattered over the world arise with complex networks of different location and supply chains between suppliers, manufacturers and customers.

How they change, select new locations, define plant roles, improve strategies and reduce production costs has been widely covered in scientific literature and debated on by multiple scholars and consultants. This is also the case for the study on supply chains and their optimisation, flexibility and durability. Articles and books are however mostly written from an operations management, business strategy or logistics angle, not from the field of economic geography (Cheng, et al., 2015). This will also be visible in the resources use for the discourse analysis. Furthermore, are these sources focusing on a small aspect in a widely connected subject (Cheng et al., 2015). For example, how to reduce labour costs while retaining product quality, or how to create a fast and safe supply chain between locations, but adaptable and flexible when it comes to unforeseen risks. In the beginning this was only focused on plant level improvements. Later research and experience showed that the analysis on network-level has more positive effects and can gain more competitive advantage. With the earlier mentioned shift in paradigm from a headquarters- subsidiaries relationship towards a network approach within corporation development and analysis, and the newly developed topic of MFO tools to analyse and optimise this process, this generated new research interests. For example, multiple MFO tools are being developed, some tools are for specific fields of business, or a specific type of corporation, within different tools some characteristics could be more important than others, which creates a different outcome, more characteristics can be taken into an account in one tool than the other, or different methodologies are used. This development in research is the primary motive for this research.

### 1.3.2 Scientific relevance

In the last ten years, starting after the economic crisis, the MFO tools have started to make an appearance, which have attempted to combine the multiple fields of research (operations management, business strategy, logistics, but also economic geography) towards a whole and inclusive analysis method for all the important characteristics in these fields at once, for a corporation. Combining these previously named fields of research and stating their connection as related and interdependent, has distinguished this specific approach, but also created a research gap. Not much research has been executed on how all these different characteristics or variables can be gathered, measured, compared and analysed to create the complete optimised network model (Cheng et al., 2015; Netland and Aspelund, 2013; Olhager et al., 2014; Rudberg and Olhager, 2003).

Currently, a few literature reviews have been written acknowledging this gap and stated in their reviews multiple new research opportunities, for example the recommendation to develop the knowledge about the possibilities for structured processes for network optimisation considering an integrated approach regarding all fields of research (Cheng et al., 2015). Also, where possible challenges would lie, or what possible best practices could be. Since the review was published in 2015, just 4 years ago, with these questions for more standard insights in the subject, shows the newness of the topic and lack of knowledge regarding. With this thesis, more insight can lead to a greater understanding of the topic of MFO frameworks, especially from an economic geography background, where location studies for expanding multinational corporations is already an important subject (Coe et al., 2008). This insight would more specifically be expanding the common knowledge on which characteristics are currently important in the MFO tools, who relevant actors are influencing these frameworks of analysis and how exactly they are used in practice.

The competitive advantage to gain with this new analysis method of manufacturing networks is great. This is also acknowledged by consultancy corporations, who create their own frameworks and

methods to generate business and use this to optimise the network of a multinational corporation. This way, they can use their expertise to advise corporations on their current network, strategy and how to move towards a profitable future. This is also done by Universities, for instance Cambridge, who set up the Institute for Manufacturing and organise courses in 'Making the right things in the right places' (IfM Cambridge University, 2007). This also supports the scientific relevance for this topic, when not only consultancies, but also universities are developing methods to use in practice.

### 1.3.3 Societal relevance

The way the topic of this thesis influences and is relevant for the global society is shown more clearly in figure 1. The way the different models or frameworks are constructed, and the different characteristics included, affect the global society through the advisory reports of consultancy corporations, universities or other organisations, which then impact the structure of the network of the multinational corporation involved. The location of these corporations, who are in the end based upon the usage and advice of these network optimisation frameworks, influences the daily lives of the people who work there and benefit from the proximity of the corporation.

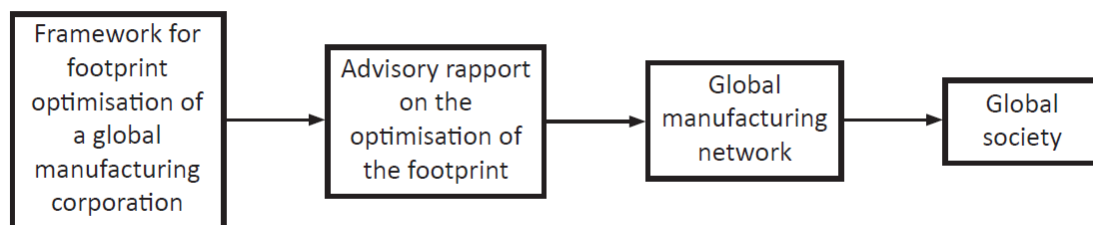


Figure 2 Societal relevance

For instance, a multinational corporation chooses to allocate a plant based upon the results from an advice from the analysis, the circumstances of society in one location would deteriorate. People would lose their jobs, so incomes will be lost, benefits must be paid instead by the government, while tax incomes will also be missed by this government. Another location, however, will benefit from the move of the plant.

How to make places interesting, which characteristics are important and included in these frameworks of analysis is a topic of interest for global society, since they would want to benefit from the advantages new business locations could bring to them.

## 1.4 Research questions

The objective of this research is to explore how these different fields of expertise and academic literature have come together and shaped the MFO frameworks there are today. What was important in this process? Which powers have influenced this? Are some fields of research or characteristics overlooked? With this aim, the following research question is formulated:

*How did the framework of manufacturing footprint optimisation establish itself as a key practice in the business sector worldwide?*

To answer this question, multiple sub questions are formed to come to the right conclusion:

1. Which characteristics does the current MFO framework contain and where do they derive from?
2. Who are important actors influencing this framework?
3. How is the framework applied in current corporations and industries?

With these questions, a complete image will be sketched of what characteristics the framework consists, which elements make it a framework and by which rationales this whole is kept together.

### **1.5 Reading guide**

Important to note are the different definitions used throughout the articles and in this thesis. Where all sources use multiple words and definitions for subjects as 'global' or 'international', and 'manufacturing' or 'production', the same words will be used throughout the thesis, with the exception from direct quotes, to simplify the reading. Global will be used instead of international, since this defines multiple locations all over the world, whereas international is often used to indicate a relation between two. Manufacturing will be used instead of production, since this implies the making of goods from raw materials, as well as assemblage. Lastly, the word corporation will be used in this thesis, instead of firm or company, because it describes best the 'association of individuals, created by law or under the authority of law, having a continuous existence independent of the existence of its members, and powers and liabilities distinct from those of its members' (Dictionary.com, 2019).

With this reading guide completing the chapter, the introduction states the topic, relevance and research question of this research. The reading guide will provide further information on what will be discussed in which chapter. In chapter 2, following on the next page, the theoretical framework will be explained. Touching upon structuralism and post- structuralism and thoroughly explaining discourse analysis, the chosen theory in this thesis. The methodology involved will be discussed in chapter 3. All the difficulties that come with discourse analysis are stated here and leading up to the operationalisation of the research question and sub questions in the conclusion of the chapter. The analysis itself will follow in chapter 4. Here all the articles, written by scholars and corporations, together with the observations made in the internship will be discussed and compared to the theory of chapter 2. This will all lead to the answering of the research question and sub questions in chapter 5, the conclusion. Some further recommendations will also be made in this chapter, for future research, as well as for the internship corporation and other consultancies.

## CHAPTER 2 THEORETICAL FRAMEWORK

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In this research, the establishment and application of the manufacturing footprint optimisation framework is central. How it came into being, which changes were made over time and which insights and actors caused these changes, but also how the framework is used in the analysis of a multinational corporation. To do so, the theory and accompanying methodology of 'Discourse Analysis' will be applied to this topic. While there are many views on the subject and ways to conduct the research, a key author on this topic is Michel Foucault, so therefore, this is also the starting point of this theoretical frame.

### 2.1 Structuralism and post- structuralism

Foucault started as a structuralist, describing the different 'layers' or epistemes of knowledge-systems in his book 'Archaeology of knowledge' (1969). 'All specific types of knowledge at that period are shaped by the episteme. The episteme defines what is possible and impossible for anyone to think in that period' (Inglis and Thorpe, 2012). In a certain timeframe, or part of history, or even the present, our knowledge is influenced by the current episteme. Which would imply that progression, in knowledge, or science, is, in fact, a myth. There would be no progression, 'only the successive replacement of one episteme by another' (Inglis and Thorpe, 2012).

The second important notion in his book involved the study of particular forms of knowledge that existed during that particular time. These forms of knowledge, or sciences, claim to be objective, but are discourses, which only confirm their own truths. 'A discourse creates the very things that it purports to study' (Inglis and Thorpe, 2012). By studying the MFO- frameworks for example, it creates the framework as a construct and confirms the existence. By doing so, power is given to this object. People could believe its importance, credibility or perhaps deviance. According to Foucault 'knowledge is power, and power is knowledge', since the two are interdependent. In upcoming sections, the concept of discourse and power will be further elaborated on.

Later in time, Foucault adjusted his method of archaeology towards genealogy, a concept introduced by Friedrich Nietzsche. Genealogy also studies dominant truths in time, but influenced by post-structuralism it is more concerned with the 'multiplicity and instability of meanings', rather than the patterns and categorisation of the discourse (Inglis and Thorpe, 2012). Moreover, post- structuralism is concerned with and suspicious of bold statements and simple explanations for things (Wylie, 2015). Such as a single model or framework which can provide the optimal footprint for all manufacturing locations of a multinational corporation. By using genealogical research, it can be proved that 'the idea or discourse is not unified but is actually made up of many different sources' (Inglis and Thorpe, 2012). The discourse of the MFO- framework would therefore consist of many different sources, which can be researched, providing the data needed to answer the questions of this thesis. These can be many different sources and many different MFO- frameworks could exist simultaneously. Post- structuralism argues that founding knowledge either on pure experience, phenomenology or on systematic structures, structuralism is impossible. Both should be taken into an account.

Inglis and Thorpe (2012), state that 'genealogy also shows that the ways in which ideas become widely accepted are not necessary or inevitable, but ... purely accidental and random'. This would mean that our ideas or discourses, accepted as truths, could have been very much different than how

they are now. We think about and accept the MFO- framework as it is, improve it in its current form, add to it, or change it in its current form, but the discourse of the MFO- framework as such, is accepted as truth, but could in fact be based on coincidental historical facts.

With the transition from structuralism towards post- structuralism, other views on the building of knowledge in society and culture were formulated, mainly because of the contributions of Foucault (Inglis and Thorpe, 2012). For example, who has power and influences our society and how the foundation of this knowledge can help with this. Or if put in an MFO light, who influences the development of this tool and with which sources is the knowledge based? How come these actors have gained this power? 'Post-structuralism remains a highly influential resource for theorizing academic research today' (Inglis and Thorpe, 2012). This background on structuralism and post-structuralism forms the initial thinking on which discourse analysis is based. Discourse analysis is together with deconstruction, one of the two mostly used approaches of post-structural thinking (Wylie, 2015). In this thesis, it will be used to analyse the data about MFO- frameworks.

## 2.2 Discourse

The word discourse can have multiple meanings and interpretations, depending on the field of study. In linguistics for instance, discourse is the passages of writing or speech, through which people communicate. In geography however, the definition of discourse, which is used most, relies on the work of Foucault. Waitt (2010), determines that Foucault does not clarify one definition, but 'three overlain explanations of discourse can be identified':

1. All meaningful statements or texts that have effects on the world;
2. A group of statements that appear to have a common theme that provide them with a unified effect;
3. The rules and structures that underpin and govern the unified, coherent, and forceful statements that are produced.

Combining all these explanations, a discourse is a social system determining all the possible statements that can be made in a field of interest, in a particular moment. Or as Wylie (2015) describes it in the spirit of Foucault 'the totality of utterances, actions and events which constitute a given field or topic. To define discourse more towards geography, Wylie (2015, pg. 379) uses a statement by Gregory (1994, pg. 11), which says 'discourse refers to all the ways in which we communicate with one another, to that vast networks of signs, symbols and practices through we make our world(s) meaningful'.

The discourse determines what is meaningful and what not in a certain situation. It does not account to something as true or false, but valid or invalid. Discourse includes what counts as a topic, who can speak and how do we interpret what they say, how do we know what we know, and what counts as truth. From these questions, it is possible to conclude that Foucault was more interested in finding the preconditions that made these statements, than the content of the statement itself. This is also confirmed by Wylie (2015): 'a discourse is not *about* a certain topic; it *creates* the subject'. The discourse makes it 'exist as a consequential and meaningful set of beliefs, attitudes and everyday practices and performances' (Wylie, 2015). This can also be said about the topic of this thesis. It is acknowledged that the MFO- framework is here and affecting the world and its global society, but the research question and sub questions are constructed around where the characteristics or

discourses surrounding the framework derive from, who influences the framework, so where the power lies and, who uses it, what is accepted as truth and used as method of analysis in practice.

This current discourse, for instance the MFO- framework, is also known as a discursive formation, a set of statements governed by shared rules and are characterized by dispersion, rather than coherence and unity (Waite, 2010). Scholars may not agree on the content of the MFO- framework: a plant level view or network level, some characteristics included or excluded, or certain methods of analysis used to form the analysis and optimisation. However, they agree on the existence of the structure itself, the concept, the value of the tool and the information it provides them. Their arguments are based on information from similar sources from accepted fields of science. Some statements, arguments or problems fall outside boundaries of the accepted rules and can therefore be seen as invalid. An economic geographer, for instance, proving the importance of a new characteristic within the MFO- framework, will not use a poem to do so. This source of information is not a valid discourse in the field of geography.

Foucault was interested in what discourse does, or the discursive practice. Not just how it represents the world, but also how it changes the world (Waite, 2010). Discourse constructs or shapes the very thing that it describes. It is not just words, but it is bound up in change and institutions, which influence the world, social reality and within the topic of this thesis: global society. For example, a discourse surrounding the MFO- framework now is that the MFO tools are an academic subject, to be developed and studied by scholars and universities. This gives power to these actors. To understand the discourse, it is thus important to understand it in the sense of power.

### **2.3 Power**

The concept of power is a construct Foucault was always interested in within his research and what is also an important part of this thesis. Which actors influenced and still influence the establishment of the MFO- framework today. Where power is seen as a negative force in its effects by Marxism, concentrated in the hands of a minority and, exercised over life instead of being part of life, oppressing the working class by the rich and elite, Foucault is opposed to this idea (Foucault, 1977, pg. 155 in Wylie, 2015). As Inglis and Thorpe (2012) describe Foucault's ideas in their book, 'power does not repress something that already existed (in their example the biological sex, in ours, the MFO-framework)'. Power is creative and through discourse, new forms of the subject can be created, 'which then can infiltrate the subjectivities of those people they are directed at'. So, with the use of power by these actors, the MFO- framework is established the way it is today, and this is an ongoing process within the discourse of today. And, as Foucault (1981, pg. 93) states, 'power is everywhere, not because it embraces everything, but because it comes from everywhere'. Therefore, the actors could be anywhere too. These will be undiscovered, possibly together with the discourse, in the articles about these MFO- tools.

Another point implied by Foucault, why power is creative and not oppressive, is that it produces resistance to itself (Inglis and Thorpe, 2012). With the creation of a new subject with a certain discourse, the formation of a reverse discourse is also made possible', those oppressed by that discourse also gain power with this creation. Marxist thinkers replied to this statement that Foucault ignores the importance of class-based domination, but within this thesis, it would be of importance to include all who have power over the MFO- framework.

## 2.4 Discourse Analysis

The explanation of discourse by Foucault and the discussion of power versus discourse, inspired the analysis of this very construct, and the notion of two crucial points in using it (Wylie, 2015).

Firstly, discourse analysis 'seeks to uncover the social mechanisms that maintain structures and rules of validity over statements about particular people, animals, plants, things, events, and places' (Waite, 2010). Therefore, Foucault is 'attempting to develop, via his understanding of how power operates, a more distinctive and subtle way of analysing' (Wylie, 2015). Foucault uses the example of gender and how male and female are considered normal in our society. Not because we are forced so, but because we ourselves believe. We exercise this power over ourselves. Discourse is this power and everyday practice. To use discourse analysis in this thesis is to recognise how power operates in these frameworks by analysing the articles written about them. With more knowledge about the different forms of power within the framework, it will become clear how the tool has established itself in practice.

The second point is that, consequently, we ourselves are the effects of discourse. According to Wylie (2015), perhaps Foucault's most notable achievement is to show that 'categories often assumed to be universal, natural or objectively definable, are in fact the products of particular discursive practices'. They are socially constructed. This could perhaps also be said about the MFO- framework. It has become real and meaningful within this cultural and historical context and considered to be so, because of this discourse. With the use of discourse analysis, these contexts and actors using power, will be researched. Or as Wylie (2015) states it: 'Discourse analysis is a critical method which seeks to describe how certain identities and narratives are produced, privileged, sometimes naturalised and normalised'. Therefore, using discourse analysis in this thesis would be useful. In other words, the discourse analysis could clarify the current discursive practices with its focus on power and the source of it, and so the establishment of the MFO- tools.

There are, on the other hand, several critiques on discourse analysis as a theory with its accompanying methodology. Widdowson (1995a, 1995b), one of the most notable ones according to Sriwimon and Zilli (2017) 'argues that many of the concepts and analytical models are vague'. The most common critiques on the analysis are that: texts are arbitrarily selected; texts are limited in length, which leads to concerns over representativeness of the texts selected; and there are limitations and difficulties in drawing any conclusion (Schegloff, 1997; Sharrock and Anderson, 1991; Stubbs, 1997; Verschueren, 2001; Wetherell, 1998 in Sriwimon and Zilli, 2017). Though with the help of thorough procedures and strong methodological grounding, discourse analysis 'can help increase the ability to describe texts and bring out the ideologies concealed in texts (Machin and Mayr, 2012 in Sriwimon and Zilli, 2017). The other critiques mentioned can be overcome and will be further elaborated on in chapter 3, where the research method will be discussed.

## 2.5 Using rationales

With using discourse analysis, as mentioned before, the aim is to clarify the underlying constructs and discourses which helped establishing the MFO- framework as it is today. An example of this theory is the article by Uyarra et al. (2017). A critical literature review is executed in this research on the topic of public procurement and local innovation; and they used the concept of 'rationales' to clarify the underlying mechanisms, to underline the importance of conversations in the promotion of innovation. In this thesis, the topic and outcomes of their research is not of any importance on the

conclusion. The use of rationales, however, could be helpful in uncovering the discourses in the MFO-framework.

A rationale can be described as a set of reasons or a logical basis for a course of action or a belief. Therefore, it could be stated that rationales form the assumptions or causal stories, behind the reasoning of certain steps in the MFO framework and the conclusions drawn from its analysis. With the use of the 'problematisation', these constructs can be uncovered, questioned and possibly enhanced or improved, when more knowledge is made visible. Uyarra et al. (2017) argue that 'growing literature has laid out the rationales for using public procurement to promote innovation, assessing its impacts as well as identifying the underlying practices and barriers with their effective implementation. However, the geographical dimension of these practices is seldom discussed.' This fragment shows that the missing geographical dimension is the problematisation of their research. They then suggest a new concept as a solution to this problematisation, 'the idea of conversations' and propose this as an analytical framework with a more spatially sensitive approach. With empirical examples from existing literature, they argue the relevance for this new idea and the improvement it would make for innovation (Uyarra et al., 2017). They explored the underlying idea of 'how distance and space dynamics shape the development of knowledge underpinning such innovations' and came up with this new concept, changing the idea of public procurement to promote innovation. They did this by noticing the differences in the literature on regional innovation and PPI. The latter 'has paid little attention to the spatial dimensions of user producer interactions' (Uyarra et al., 2017). Therefore, it would be important for articles on MFO- frameworks as well to analyse them well and be critical on differences, choices made by scholars and discover the underlying rationales. Especially in other (neighbouring) fields of research to discover possible new constructs and insights to footprint optimisation frameworks.

As in the research of Uyarra et al. (2017), rationales can be explicit, actively promoted and their importance confirmed by scholars and existing literature, used in practice or mentioned by the actors involved. However, these rationales can also be implicit, perhaps derived from less reliable data sources. In the analysis, it would be important to be alerted on this difference.

Therefore, by using discourse analysis, which means the notions of power constructs mentioned in earlier sections and recognizing the rationales in the literature on the existing MFO- frameworks, it is the purpose of this thesis to analyse establishment of the MFO- framework in practice.

## CHAPTER 3 METHODOLOGY

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In this thesis, a qualitative research method will be used to execute the research. As Creswell (2013) quotes Denzin and Lincoln (2011) in his book to define this kind of research:

*'Qualitative research consists of a set of interpretive, material practices that make the world visible. What this entails, which steps will be taken and what resources are used will be explained in this chapter. These practices transform the world. They turn the world into a series of representations, including field notes, interviews, conversations, photographs, recordings, and memos to the self. At this level, qualitative research involves an interpretative, naturalistic approach to the world. This means that qualitative researchers study things in their natural settings, attempting to make sense of, or interpret phenomena in terms of the meanings people bring to them.'*

Creswell (2013) himself uses a more applied version of a definition, but all scholars agree on the importance of the interpretive and naturalistic approach, together with the meaning behind the object of study. Important is to note that qualitative research is often used when a 'complex, detailed understanding of the issue' is needed (Creswell, 2013). This can be executed by critical reading, talking to the actors involved and observing situations in which, in this case the MFO- framework, is used. Netland and Aspelund (2014) state in their findings on multi-plant improvement programmes, that 'the complexity of the topic makes it hard to model and test relationships through survey data, so researchers prefer in-depth studies'. This could be said for this research as well. In this chapter, the methods used to follow discourse theory will be further elaborated on, together with the data recording, analysing process, strategy for validating the findings and concludes with the operationalisation of the research questions.

### 3.1 Performing discourse analysis

To accomplish a (Foucauldian) discourse analysis, as explained in the previous chapter, there is no precise method to follow. Waitt (2010) stated in the chapter he wrote in 'Qualitative Research Methods in Human Geography, by Hay (2010), that Foucault himself struggled with writing about 'how to' execute discourse theory. 'He feared that a methodological template would become too formulaic and reductionist.' By making a template to follow, important information could be missed and left uninterpreted. Even though this view makes the approach of discourse analysis a bit vague and uncomprehensive, many scholars agree with Foucault. As Waitt (2010) describes: 'some scholars argue that guidelines undermine the potential of discourse analysis'. Phillips and Hardy (2002) view a methodological framework as a limitation to customise, Potter (1996) sees discourse analysis as a craft skill, Gill (1996) also views a framework as an inhibition for rigorous scholarship, Duncan (1987) argues that using discourse analysis is as human intellect, and Burman and Parker (1993) argue that it would be understood as too systematic, mechanical and formulaic.

Even though these arguments make a strong case, discourse analysis is seen as difficult to execute without potential bias or error, especially with first time users. Therefore, 'Rose (2001) provides seven stages through which the technique moves' (Waitt, 2010). By using these steps, a guideline is offered to use as a starting point of this analysis. 'A rigid discourse analysis can minimise or completely eliminate the potential bias in data selection' (Sriwimon and Zilli, 2017). Though this will not provide a rigid, strict and constructed analysis, it will provide with enough guidance to prevent potential bias in data selection. This is because the seven stages provide the researcher with tips on

how to stay reflective and keep an open mind, and with critical feedback on their taken steps. Since this is the first discourse analysis for the researcher and every researcher has a specific background which could easily and unintentionally lead to biases, the seven steps will be used as a tool in executing the analysis.

Strategies for Doing Discourse Analysis (Rose, 2001):

1. Choice of source materials or texts.

Different genres of text can be written with different aims for different audiences. This is important to understand and keep in mind, while analysing the fragments. 'Each source will be produced, circulated, and displayed by means of a particular technology (such as printing, painting, photography, hand-writing or e-mail)' (Waitt. 2010). Depending on the genre of textual sources and the variety of these sources, the background information is necessary for interpretation. It can also be possible that a strong variety of genres creates a better understanding of the common discourse.

2. Suspend pre-existing categories: become reflexive.

Foucault (1969) noted that all 'pre-existing forms of continuity, all these syntheses that are accepted without question, must remain in suspense'. Existing categories could be true, false, valid or invalid, however, they construct the possible outcomes of the analysis. As Waitt (2010) also states 'Foucault acknowledges this is request is an impossible task ..., since all knowledge is socially constructed'. It is though important to be self-critical to be able to have an open understanding of the discourse.

3. Familiarisation: absorbing yourself in and thinking critically about the social context of your texts.

Making yourself familiar with the text and the social production of it, is essential for the critical understanding of its content and circumstances while it was written. Waitt (2010) underlines the importance of understanding the authorship, technology and intended audience. 'Foucault understood discourses to be grounded within social networks in which groups are empowered and disempowered relative to one another'. Some groups may have power over others and could therefore be seen as more truthful, factual or reliable sources. The main point made by Foucault about how knowledge is established, is that all texts are the outcome of a process of power within a social context. For this reason, background information on how the text was established is this important.

Authorship, technology and the intended audience are the 3 important topics in researching the social context, power relations and background of the texts. This information will be gathered from critical reading, as well as the interviews, with questions specially designed to find out the circumstances in which the text was written.

4. Coding: once for organisation and again for interpretation.

Waitt (2010) emphasizes two types of coding used in (Foucauldian) discourse analysis: once for organisation, to describe the different information in the text, and once for interpretation, where analytical codes are used to provide more insights 'into why an individual or collective holds particular sets of ideas by which they make sense of place,

themselves and others'. With the organisation, or descriptive analysis of the text, it is helpful to use four category labels: context (where, when and who), practices (events, interconnections and actions), attitudes (statements of judgements) and experiences (statements of feelings). Codes will be listed per category and important to note is that coding is always an iterative process. During the coding process, codes can change, become more detailed or formed into groups.

5. Power, knowledge, and persuasion: investigate your texts for 'effects of truth'.  
In the previous chapter, the relation between power and knowledge as viewed by Foucault is discussed, and how this relation is underpinned by discursive structures. 'The sets of ideas that typically inform dominant or common-sense understandings of and interconnections between people, places, plants, animals, and things' (Waite, 2010). Foucault refers to discursive structures as the 'effects of truth'. This because they possess a subtle social power which can make certain ideas, attitudes or practices seem common sense. With executing discourse analysis, it is thus important to keep in mind 'the institutional dynamics and the social context of a text' (Waite, 2010). This because, as the examples of sexuality or scientific knowledge show, 'relatively powerful groups in society were able to naturalise meanings, attitudes and practices towards another social group'. In relation to this, certain sets of ideas become accepted as common knowledge, in performing discourse analysis, it is important to be critical about what information is understood as valid. This can be affected by the use of technologies used in the production of the text, the legitimisation by making use of research methods, such as statistics, or categories of spokespersons who acknowledge it.
6. Resilience and rupture: take notice of inconsistencies within your texts.  
With the understanding of Foucault's discursive structures in mind, these structures appear to be fixed knowledge and eternal. However, there is always the possibility to change or challenged. 'An essential part of doing discourse analysis is to be alert to possible contradictions and ambiguities in texts' (Waite, 2010). By staying alert and critical, new information can be found in statements, which can 'rupture conventional ideas ... and reposition humans' (Head and Muir, 2006).
7. Silence: silence as discourse and discourses that silence.  
Within discourse analysis, silence operates on two levels (Foucault, 1969). Identifying these silences is integral with this method and requires existential background research. Firstly, silence as discourse can be considered as the social circumstances the author is in and the authority he or she has to 'speak'. It is important to be mindful of voices who might be silenced and to consider context such as gender, age, class, ability, sexuality and race. Secondly, a privileged or dominant discourse can silence other ideas of the world. These discourses can act as a system of power, sustaining a set of relationships and meanings that effectively silenced indigenous people (Waite, 2010). These silences are not easily noticed and to interpret them will also require identification of the temporal and spatial social structures. Critical evaluation and research are again necessary to uncover this possible context within the texts. With the interpretation of silences, it important to also understand the background of the researcher and keep in mind the potential for bias.

How the different sources will be collected, recorded and analysed will be further elaborated on in the following sections of this chapter, with these seven steps in mind. This step of the methodology, the operationalisation of the research questions, is essential for the analysis. First, the role, the background and objectivity and subjectivity of the researcher will be discussed, since this could possibly impact the data collection and overall outcome thesis.

### **3.2 Role of the researcher**

With the obtained understanding of the relation between power and knowledge, within qualitative research and especially discourse analysis, it is important to provide more information on who the researcher is and how this background could have an influence on the analysis in this thesis.

According to Hay (2010) knowledge is directly and indirectly powerful. It is directly powerful through the impact it has on policies made by government and other organisation who enforce power. It is indirectly powerful through the image there might rise from the conclusions of the research. Besides the power the knowledge in this thesis possesses, there is also a power relation between the researcher and subject. In the case of this research, where interviews will be conducted with scholars, or managers from consultancy corporations, who designed MFO- frameworks and models, there is an asymmetrical power relationship between interviewee and interviewer. This is the same case with the observations made in the internship corporation. The researcher is the intern, a master's student, young and not yet graduated, and though fully submerged in the subject, not a professional of many years or a scholar on this topic. This power cannot be eliminated from the research, since it exists in all social relations (Hay, 2010), so this could influence the reaction of interviewees, the interpretation of the researcher and through that, the overall thesis.

With all these different power relations influencing the researcher, it is important to understand objectivity in research is not possible. Through the social nature of this research, there will be interactions between the researcher and participants, and also an interactive relation between the researcher and the process of data collection and interpretation (Hay, 2010). These two components of objectivity are not attainable, so therefore this research (if not all research) is subjective, 'since we all bring personal histories and perspectives to research (Hay, 2010). Especially in discourse analysis, where the background and understandings of the researcher, critical view of the world all help to create the critical analysis of the text. Where subjectivity plays a role, so does intersubjectivity. 'This refers to the meanings and interpretations of the world created, confirmed, or disconfirmed as a result of interactions (language and action) with other people within specific contexts' (Hay, 2010). This means the data collection and analysis is subjected to the interview between the researcher and the participant, together with the personal characteristics and social position of the researcher.

Critical reflexivity is a strategy to take these factors into an account. However, it is never possible to completely detach from a personal background and social network, this process helps to become more aware and be critical of the analysis made. Different questions will be asked before beginning the research, during the writing and interpreting, and after the data collection, to remain critical and aware of subjectivity. To protect the research integrity in this thesis, by influences from biases, power relations with the internship organisation, possible interests of the university or the different MFO- frameworks and models involved, open and transparent communication between all those involved is key, according to Hay (2010). This, together with critical reflexivity and being aware of the

researchers' own background. With the use of a research diary, this will all be documented and made available for better understanding of the analysis and conclusions in the end.

#### *Short description of the researchers' background*

The ability to interpret certain text elements, notions from the interviews and situations from the observations made within the internship depend firstly whether the researcher is considered an 'insider or outsider'. Both positions bring positive factors with them which can help with interpretation and observation. When being an insider, 'people are more likely to talk to you freely, and you are more likely to understand what they are saying, because you share their outlook on the world' (Hay, 2010). However, being an outsider can also benefit the research. It could mean that interviewees try to make an effort in order to articulate certain methods used, characteristics involved and actors to include. Who had influence on the development process?

Regarding both these advantages, I would however say I am an insider as well as an outsider. I have emerged myself in the subject of MFO- frameworks and models, I have read and analysed multiple articles, models, books and reviews and am an Economic Geography student with a minor in Strategic Business Management and Marketing, so possess any background knowledge on the subject. Perhaps this could give me an insight to also the 'business side' of these consultancy corporations and MFO- frameworks. Therefore, I could be considered an insider. However, taken every characteristic into an account, I may not be an insider to every interviewee. Characteristics as race, gender, age, socio-economic status, could all have an influence on the perception of the other person and therefore the kind of answers given and analysed.

Describing myself, I would say I am a young Dutch woman, 27 years old and from West-European descent. Born and raised in a rural area in the South of the Netherlands in a loving family with a mother, father and brother. This could be characterised as a privileged and rich upbringing, which will influence my personal view and social constructs, whether I try to be as critical as possible or not. To be as objective as possible, it is important to describe what the procedure of the data collection was for this research and which decisions were made in the process. This will be discussed in the following section.

### **3.3 Data collection**

The different articles and models discussed in the discourse analysis are gathered in the data collection procedure. These sources were gathered using different tools. Most importantly websites and online libraries were used: Web of Science, Science Direct, Scopus and Google (Scholar). This to make sure all licenses available for these sources were optimally used and all available articles and existing models were found. However, to know if this goal is achieved, is impossible.

With the help of desk review search tactics, existing literature reviews and the most common journals which publish these articles, many different sources were found. These include models developed by universities and scholars, but also other consultancy agencies, such as BCI.

Different use of search words within the different engines, was an important tactic to find as much articles as possible. Differentiation in terms, combinations of certain words and "snowballing" through articles to get to other used sources and inspiration, all lead to the finding of all these different sources. The used search words and combinations were: global production network, international manufacturing network, manufacturing footprint, global production footprint,

international manufacturing framework, global production framework, global production model, international manufacturing model, manufacturing optimisation model, global production analysis, global/ international network design and some of these words were used individually or combined, all to enhance the possibility to find all the available data.

These different articles were read and sorted into preliminary categories, from this a more in-depth discourse analysis could take place on the specific topic of manufacturing footprint optimisation models and literature. This will be further elaborated on in chapter 4.

In order to confirm the findings, fill in gaps where needed and create a more in depth understanding of the background of the models, observations will be made within the internship corporation regarding the use of the model in practice. This will create a triangulated base of data for this research and contribute to the validation of the overall conclusions (and recommendations for BCI).

As mentioned in the chapter before, discourse analysis is not just studying the written text, but 'a discourse encompasses texts, speeches, dialogues, ways of thinking and actions; bodily practices, habits, gestures, etc.' (Wylie, 2015). This means that together with the articles and observations for extra information and background, tones of speech and interpretations are also important sources in the overall analysis. Especially the diary kept during the internship period provides this research with interesting observational insides in how the model is being developed and used within BCI.

### **3.4 Data recording procedures**

For this research, as well as for the internship, an extensive overview of all the articles and models used in the discourse analysis is made (Appendix I). This will provide the reader with a view of what the analysis is based on. The observations will be discussed with the literature results in the analysis and are handed in separately as primary sources. Together with the transcriptions of the short meetings with René Buck and Mathijs Pronk, my internship supervisors. Lastly, the research diary provides a concise summary of the days of my internship period and will be handed in as a separate document as well.

### **3.5 Data analysis procedures**

Since the discourse analysis has been elaborated on theoretically and methodologically with the extra points of interest, and will be further discussed in the analysis itself, this section will focus on the analysis procedures of the observations, leading towards the triangulation of all the data. This will conclude in the operationalisation. This will show how the analysis of this data will lead to the answering of the research question.

Where different methods of analyses use different approaches, they typically all begin with creating and organising the data. Then, the process proceeds in a general reading and memo-ing, to begin the process of making sense of the data. After this, there is a moment of description, or building towards a new theory in grounded theory (Creswell, 2013). In this research, coding will help to organise, categorise and make sense of all the available data. Different uses of coding are available. Open coding is used to develop new categories of information. With axial coding, these categories can be interconnected. Finally, with selective coding, a story can be built to connect these categories to form a statement or conclusion (Creswell, 2013). Open coding will be used to analyse the selected articles, the interviews executed while working at BCI and the research diary with observations. These codes will be used later to form categories, using axial coding. With these categories,

conclusions can be drawn from the texts, answering the related sub question. Together with the data from the interviews and observations, which will be discussed in chapter 5, all the sub questions can be answered. This will conclude in answering the main research question.

So, the discourse analysis together with the analysis of the interviews and observations will triangulate all the available data and form a reliable base to draw conclusions and answer the research question. The analysis of the interviews and observations will validate the findings in the discourse analysis and add more background information to answer the research question. In the following section, the research question with sub questions will be discussed once more, together with the operationalisation of these questions, to conclude on the methodology chapter in this research. To know which findings come from what data, are necessary to answer which question is crucial to prevent wrong conclusions.

### **3.6 Operationalisation of the research question**

To conclude this chapter, it is important to discuss the operationalisation. As mentioned before, the discourse analysis of the literature, the interviews and the observations during the internship at BCI Global are the used data sources and their analysis will provide the findings which will lead to the answer of the research question. With operationalising the main question and sub questions, the variables will be defined, and this will allow the questions to be measured correctly. These measures are as unbiased as possible and will enable other researchers to replicate the research or perform their own sequential research.

In figure 2, the operationalisation model, visible on the following page, a clear overview is presented of the building blocks of this research. It starts with the subject of the research, the current discourse of MFO frameworks. This leads to the research question:

*How did the framework of manufacturing footprint optimisation establish itself as a key practice in the business sector worldwide?*

In other words, which rationales affect the current MFO framework, and have resulted in the used frameworks of today? And what is the importance of the frameworks in the current consultancy sector? To answer this question, the following 3 three sub questions are formed to come to the right conclusion:

- 1. Which characteristics does the current MFO framework contain and where do they derive from?*
- 2. Who are important actors executing their power over the MFO framework?*
- 3. How is the framework applied in current corporations and industries?*

The answering of these three sub questions is possible by the different data sources: the scientific literature on all the different models, the interviews and the observations made during the time at BCI Global, the internship corporation. With all the data sources, it is important that the 7 strategies of doing discourse analysis (Rose, 2001) are followed and repeated, to ensure an unbiased and valid research. Translating the 7 strategies to direct actions, to guarantee an unbiased and valid research, a more detailed research procedure was developed.

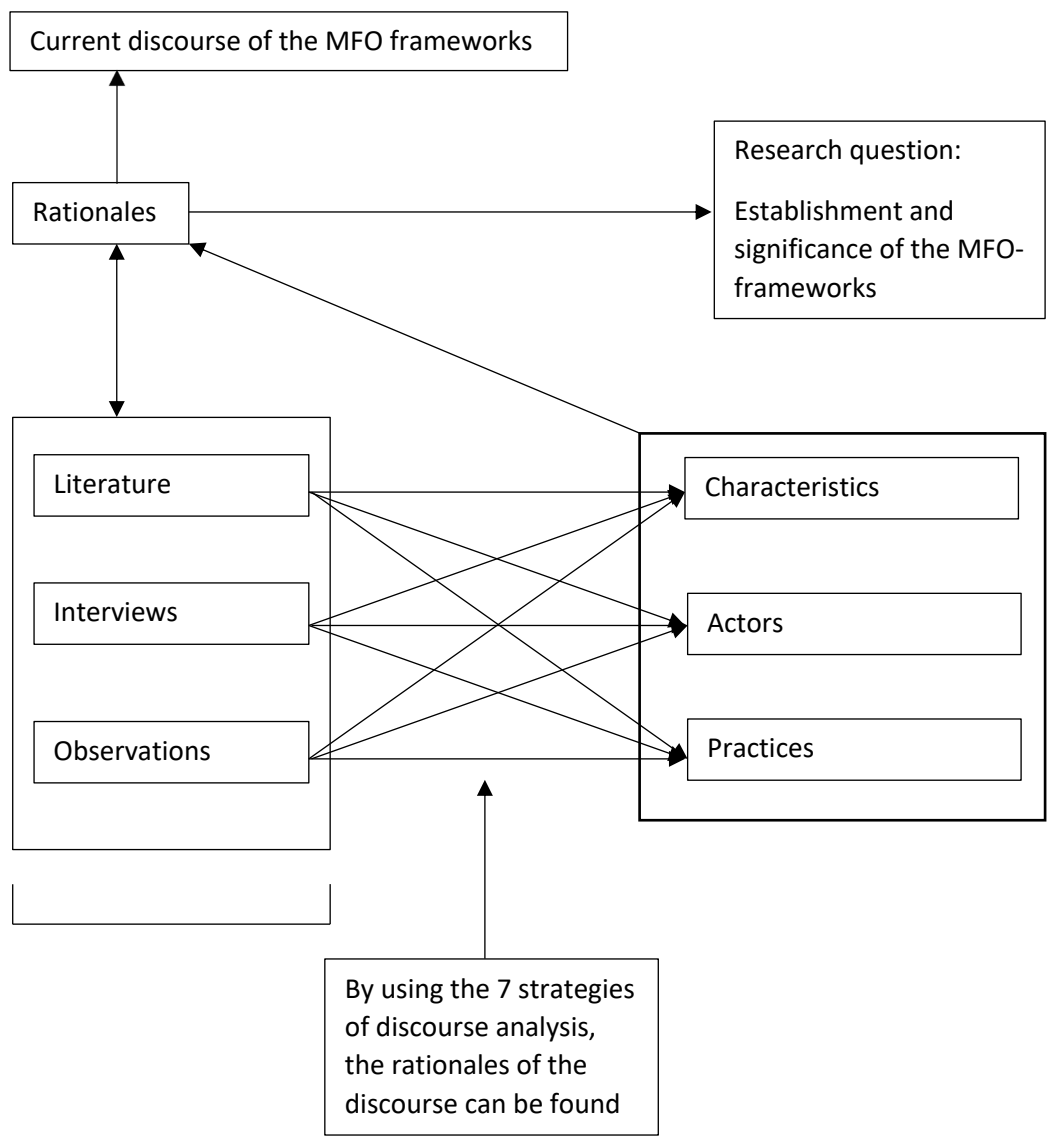


Figure 2 Operationalisation model

### 3.6.1 Research procedure

While starting the analysis of the selected articles, the first action is to determine the sources used to distribute the information. Why is this method chosen? Is it a typical method for that time period?

While reading it for the first time, it is then important to keep an open mind. No pre-existing judgements present. Read it with a blank mind and accept all the information for truth at first.

Read it then for a second time, however, now think critically about the author(s), the technology and the audience. Ask yourself the following questions:

- Under which circumstances is this written?
- In which time is this written? (for example, pre or post economic crisis)
- Who is this written for?
- What is its exact purpose?
- By who is it written and what is their reputation in society?

Understanding the social construct in which the text is produced is essential for the outcome.

The next step is to start coding. The 7-strategy method prescribes 2 different stages: first for organisation, secondly to think about the interpretation of the different codes. For organisation they propose to use the following labels: context (where, when and who), practices (events, interconnections and actions), attitudes (statements of judgements) and experiences (statements of feelings). However, in this research, the decision was made to select other labels for organisation, directly linked with the sub questions: characteristics (important aspects of the MFO models), actors (where, when and who is involved and what power do they possess?), practices (actions, empirical evidence or models used in business cases), rationales (reasons for assumptions or used methods) and discourses (current models or methods). So, first, important parts or sentences in the literature were coded and later they were assigned to a certain label or category. In figure 2 it is also visible that codes in literature, interviews and observations are used to gather all the data on characteristics, actors and practices. By using the 7 strategies (Rose, 2001) the data can be translated to analysis and conclusion of the thesis.

With the sub question about the different actors influencing the frameworks, the most common codes are interpreted as more powerful than others. Do they impact only the framework, or possibly the industry or the entire business climate? Some networks, models or outcomes could have inspired other experts in the field to develop or use certain frameworks, so perhaps they possess power too.

While coding, it is important to acknowledge these power constructs, existing knowledge and persuasion used in the data. The questions asked before are important in this part of the analysis. What are the current discourses in the time of the article? Who is it written by and what is their interest in publishing this piece of literature? Is the current discourse enable to change? And who are the influential and trusted actors driving this current discourse.

During reading and coding, it is vital to stay critical so see if inconsistencies in the texts appear. These can be the sign of discursive change. Another critical point while reading and coding, especially during the interpretation of the text, is to be alerted to the silencing of actors, more unknown discourses, or underlying rationales hidden behind the obvious ones. These could be unconscious rationales. They can be equally important to MFO frameworks, or perhaps even make new insights a possibility.

After the coding process, the different codes are gathered and organised within the different categories (characteristics, actors, practices, discourses, rationales). The codes are per category compared between the different authors, similarities and differences are noted, possible outcomes are written down in the research diary and gaps where data was expected are noticed as well. The appearance of certain authors, definitions, models and characteristics within these models are counted. These numbers of appearance speak for the acceptance of the discourse in society.

From the ordering of the codes within the categories, assumptions can be made by the researchers. These will be written in the analysis sorted per discovered rationale for each sub question. All these rationales supported by the data from the literature, interviews and observations will answer the research question: how the MFO frameworks have established themselves and what their significance is.

These strategies will be applied on the observations as well. What are the exact spoken words and by whom are they spoken? Who were present in the meeting? What is their function and background? With this information, a more in-depth view can be created for the observations at the internship corporation as well. So, their comparison of practice can be used in the analysis and conclusion of this research.

## CHAPTER 4 LITERATURE ANALYSIS

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In this chapter analysis of the scientific literature will be discussed, which will form part of the results of the discourse analysis of MFO frameworks.

### 4.1 Scope of the analysis

As mentioned before, this research is focused on the establishment of MFO- frameworks. How did these approaches, models or tools gain the importance they possess today in the current business climate?

#### 4.1.1 Configuration and coordination

It must be mentioned that, when researching the improvement of a corporation, many different articles from many different fields arise. For this discourse analysis, a choice was made to focus on all approaches which comply to analysing the complete network. While some research focuses on improving just the manufacturing plants, Cheng et al. (2015) state that manufacturing strategy management literature contains much information on the individual plant, the different roles plants can have (Ferdows, 1998), or the distribution of goods between plants. Gradually, international manufacturing studies paid more attention to multi- plant discussions and showed a growing consensus around the idea that one of the most useful keys for understanding the complexity of the global economy is the concept of the network (Coe, Dicken and Hess, 2008). This change of discourse is said to have started in the late 1970s with the growing realisation among scholars of the need to manage no single factories, but multiple plant corporations (Cheng and Johansen, 2013).

This thesis will use discourse analysis on the articles who describe, present or review the MFO frameworks who describe both plant and the distribution in the network. Production and distribution. Or, as Porter (1986) distinguishes them: configuration and coordination. Configuration and coordination are closely related and so attempts have been to integrate the two, to achieve an overall view of the manufacturing network (Chen and Johansen, 2013; Porter, 1986; Shi and Gregory, 1998).

‘Configuration is about the global set-up of the corporation’ (Netland and Aspelund, 2014, pg. 391). This entails the locations, costs, production capacity, or in other words what resources to innovate, source, produce and sell for which markets when and where (figure 3). Coordination on the other hand (figure 4) is about the management or planning of the network. The effective and efficient distribution of knowledge and resources and the quality of the supply chain (Cheng et al., 2015; Netland and Aspelund, 2014).



Figure 3 Configuration

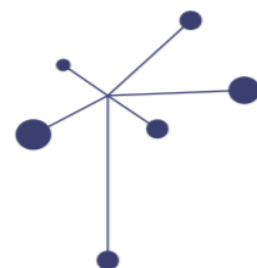


Figure 4 Coordination

Configuration and coordination of the network are always related, even if literature on optimisation decisions is mostly individually written. Attempts have been made to integrate the two issues to obtain an overall view of the global manufacturing network of a corporation (Porter, 1986; Shi and Gregory, 1998). Meijboom and Vos (1997) underline that ‘configuration and coordination aspects are often addressed in different branches of literature, and are, therefore, seldom integrated’ (Cheng, et

al., 2015, pg. 407). ‘The international business literature recognises that location choices can be decisive for successful international operations’. Configuration is addressed but approached as an investment decision. The rationale for this is the economic/marketing/ finance view of these studies. Operations management also examines location decisions, but the main focus is on logistical problems on the tactical or operational levels (Meijboom and Vos, 1997). With this statement, they are one of the first to combine configuration and coordination to an integrated approach. This because other literature and empirical evidence shows that location, coordination and planning are inadequately discussed in combination, however they always affect one another. Chew et al (1990) show that the improvement of the overall performance of multisite corporations depends on the local innovativeness of the plants, as well as on the interplant transfer of these local innovations. Flaherty (1986, 1996) adds to this the importance of coordination. She argues that the coordination of international operations in a network can improve cost and delivery performance and enhance the learning from the experiences of units in the network (Vereecke et al. 2006). Feldman et al., (2013, pg. 5696) summarize it perfectly when they state that ‘when the configuration of a network changes, the whole network needs to be evaluated regarding configuration and coordination’.

#### 4.1.2 Fields of research

The articles who are being analysed in this thesis and attribute configuration as well as coordination, come from a wide variety of research fields. Netland and Aspelund (2014, pg. 391) state in their article that they reviewed literature ‘over the last 14 years (1998-2012) from 15 top journals in the research fields of operations management, international business and general management’. These fields were important for this research as well, with the addition of supply chain management. Fisch and Zschoche (2012, pg. 1540, 1541) review articles from specifically the management and economic view. Both have a history in researching the effects of ‘prior international investments on the establishment of new foreign subsidiaries’, however, from the management background, they are not focused on production. This is the case with the economic view: recent studies show that multinational corporations take advantage of differences in costs between countries by organising their production in a cost- optimising geographic dispersion (Antràs and Helpman, 2004; Blinder, 2006; Grossman and Rossi- Hansberg, 2008).

Altogether, this analysis was made with the use of 20 different articles, published in 11 different journals.

As visible in figure 5, most of these come from operations management or production research and are written by well-established names in the field. All the journals are top journals in their field and have a

Journal Name	No. Articles
Journal of Operations Management	1
International Journal of Operations and Production Management	2
International Journal of Production Research	4
International Journal Production Economics	3
Journal of Operations Management	1
Omega	2
Procedia CIRP	3
Production Engineering Research & Development	1
Production Planning and Control	1
Strategic Management Journal	1
Supply Chain Management: An International Journal	1

Figure 5 Different journals

high ranking in the index of Web of Science. A few are from management journals and for this research 1 article is published in a supply chain management journal specifically. Some articles who are published in a journal of production research also mention supply chain management in their keywords. This does not affect the quality of the articles, however, can be directed to a niche in the

research field, even though these are neighbouring fields. It is interesting to mention though, since the background of the authors and the prospected audience is an important factor of critically reading and coding an article in discourse analysis. This will be further discussed in section 4.3.

The articles can also be categorised by their type. While analysing, 5 categories could be identified. In figure 6 the different types are visible, with the number of articles in the column behind the type. From the analysed articles, 2 are literature reviews on models.

Type of article	No. Articles
Literature review	2
Model research/ presentation	13
Research relationship networks- plant roles	2
Review and model presentation	1
International diversification	2

Figure 6 Type of article

These offer a broader view of the development of research and the business climate in a specific field. This could be the case since there are not many articles published on this specific topic, and mostly after 2012. This means not much time has passed since their publishing for many reviews to have been published. They are important though, since they provide more in-depth information on how the models established themselves as a practice. More than half the articles (13) are a model research or presentation, where one specific designed model is explained. These are published specially to present the model and show that this model would be the best for this specific situation, or overall the most innovative, flexible and smart framework to use. 1 article was first a short literature review and secondly followed with the presentation of their approach. This is a mix of the first two types combined. 2 of the articles explain more in-depth the relationship between networks and specific plant roles. Lastly, 2 of the articles provided a view on the benefits and pitfalls of international diversification. Is the current discourse and its accompanying rationales correct? These two types can be seen as interesting, since they provide more background information about the frameworks and with reasoning for the importance.

In the following sections, different aspects of the MFO frameworks will be discussed to discover how it established itself as a key practice in the business sector worldwide. Firstly, the different characteristics used in MFO frameworks will be elaborated on in section 4.2. Then, all the actors influencing the establishment of- and the MFO model itself will be discussed in 4.3 and lastly, in 4.4 the establishment of current practice will be discussed. Who influences who exactly? The observations from the internship period at BCI Global will be discussed here as well.

## 4.2 Characteristics of MFO frameworks

Now the framing of the articles is clear, and the background and type of the articles is discussed, it is important to elaborate on the content of the articles. In this section, the different characteristics of the models are discussed. Which factors are incorporated in the models and are important?

The success of a corporation is determined by its strategy. Its vision, ambition and execution. Which goals are set, and which performance indicators connected to those goals? In today's business climate, it all revolves around the numbers: revenue and profit margins. What are the costs and what are the risks?

### 4.2.1 Costs

When a corporation is successful in its home country, at some point, the growth stagnates, the entire market is reached, and the sales are optimised. However, our economic system, and with this the current discourse, is built on growth and the board or the investors want to see that the profits keep

growing. 'As a result of stagnation in their domestic markets, manufacturing corporations (increasing small and midsize enterprises (SMEs)) see themselves forced to guarantee their competitiveness by operating in international markets. For reasons of time, costs and specific requirements of customers, these international markets can no longer be supplied from the home location. Hence, local production frequently becomes the only option. This means that production linking different locations have to be set up and the production processes have to be adapted to suit the different conditions of those locations (Abele, et al., 2008). So, the corporation expands to one or more countries, inter- or multinationalises and controls now a whole network of different locations, with often different typologies as well (offices, manufacturing, distribution, warehousing, etc.).

The rationale for internationalisation, or globalisation, can according to Cheng and Johansen (2013, pg. 1352), be interpreted in different manors. 'The eclectic paradigm, described by Dunning (1988), which can be seen as a holistic framework which identifies and evaluates the significance of the factors influencing both the initial act of foreign production and the growth of such production'. This is being explained by early market entry theories, such as exporting or FDI (Colotla, 2003), the possession of advantages, like the economics of scale, cost or knowledge advantage and product differentiates (Hymer, 1976). Also, transaction cost (Williamson, 1971) was proposed, focusing on increasing efficiency in corporations through internalising foreign market trading into corporate international production or FDI. Contrarily, internationalisation can also be described as a sequence of stages (Colotla, Shi and Gregory, 2003; Johansen and Vahlne, 1977; Penrose, 1959), where the corporation gradually increases its international involvement (Cheng and Johansen, 2013). 'As a result of globalisation, many organisations have become part of at least one supply network' (Samaranyake et al., 2011, pg. 3128). Selim et al. (2008) pinpointed the importance of an integrated production and distribution planning network in a supply chain as the key deterrent of the ultimate success of a firm. The rationale for this can be shown by the large costs involved for establishing new plants and warehouses, the increasing global sourcing of parts, global production, global marketing, and global logistics alliances -that replaced the traditional methods of local sourcing of parts, local production, local marketing, and independent distribution and services- and the adoption of the 'just-in-time' philosophy.

But it does not end there, the network keeps on growing. Following the trend towards globalisation, manufacturing firms sought further cost reductions by means of multiple sourcing of inputs and location of production plants according to the Ricardo's law of comparative advantage. Yuan et al. (2012, pg. 1097) explain their rationale for globalisation by mentioning Ricardo's law. 'This is the classical theory of comparative advantage which explains why countries engage in international trade. Even when the workers of one country are more efficient at producing goods than workers in other countries'. He demonstrated in his book, published in 1817, 'On the principles of political economy and taxation', that if two countries capable of producing two goods, engage in the free market, then each country will increase its overall consumption by exporting the good for which it has a comparative advantage while importing the other good. Provided by the fact that there exist differences in the labour productivity between both countries (Baumol and Binder, 2016; O'Sullivan and Sheffrin, 2003). Ricardo uses the example of England and Portugal producing and exporting cloth and wine.

This can also be said about corporations and their growing network. With manufacturing, raw material is used as a base, the machines, maintenance, distribution of the goods. With the growth of

a corporation and the focus on the comparative advantage of a specific corporation, other corporations will be involved to assist with the activities which are not the core activity anymore. And with this, the network keeps on growing with inter- and intra-firm relations, making the network more complicated.

The business climate, however, keeps changing. 'The geographical and political boundaries change rapidly, due to the formation and strengthening of trade alliances, but also due to the global corporations who merge, acquire, and deprive themselves of suppliers, product groups, and customer markets' (Goetschalckx, et al., 2002, pg. 2). The rationale behind this is the context of today's business climate. There are 'improved logistics, better computer systems and telecommunications infrastructure, less vertical integration, streamlined supply chains, the emergence of low-cost, high productivity nations as qualified manufacturing nations and competition is stronger than ever' (Cheng and Johansen, 2013, pg. 1351). Meijboom and Vos (1997, pg. 791) acknowledge this also in their review: 'Different variants of global manufacturing strategies to aim towards with models. For instance, cost optimisation when taking advantage of low-cost local resources'. Netland and Aspelund (2013, pg. 390) state that 'multinational corporations develop and deploy multi-plant improvement programmes to advance the productivity in their network'.

Contreras et al. (2012, pg. 847) categorised different optimisation models according to the type of objective to gain competitive advantage:

- The min-sum models, such as the classical p-median problem and the incapacitated facility location problem, focus on minimizing the overall set-up or operational cost.
- The min-max models, such as the p-centre problem, focus on minimising the largest customer-facility distance.
- The covering models, such as the set covering location problem and the maximum covering location problem, focus on finding the least number of facilities to cover all customers or the maximum number of customers to cover within a prespecified distance.

First also the cost minimisation of operations is named, after this follows minimising the distance between customer and facility, thirdly, the different locations with the number of covered customers is optimised. Looking closely at all these options though, they all link back to costs. Less distance to cover is less costs and less locations also means less costs.

Yuan et al. (2012, pg. 1097, 1098) confirm this in their research. They state that 'identifying supply chain management as a promising area for reduction of expenses via operations management' is the rationale for this competition in the business climate and also thin margins on production.

Zhang et al. (2013, pg. 48) have some criticism on the cost characteristic used in the models. 'Dispersed manufacturing exploits comparative advantages of multiple locations, however, dramatically increases the complexity in supply chain design. Locating labour-intensive manufacturing steps in proximity to cheap labour is able to lower production costs but lengthens the supply chain and increases logistic costs. This would mean a trade-off is necessary between efficiency and responsiveness, measured by cost and lead time.' By only focusing on the production costs, especially the labour costs will, with a high probability, lengthen supply chains which will entice extra costs as well.

Das and Sengupta (2008) present a model which selects the different plants and maximises the profit by taking various types of costs into account (border crossing, exchange rates, transportation channelling, distribution to warehouses and safety stock). It also mainly optimises towards the most cost-effective location, while taking the political risk into account. The importance of cost minimisation is also confirmed by Fisch and Zschoche (2008, pg. 1540) 'cost development drives manufacturing corporations to increase their production efficiency by building up facilities in multiple countries'.

These articles describe that having cost as a main characteristic in the MFO model is to ensure competitiveness in the business climate. Keeping an advantage compared to other corporations is what drives these corporations to use the MFO models and frameworks. A downside is that the objective models only focus on cost minimisation and these formulations might result in solutions that are illogical from another economic point of view (Ivanov et al., 2013). Therefore, other characteristics should be considered.

#### 4.2.2 Risk reduction

Many reasons can be given for the establishment of MFO- models, or as stated by Cheng and Johansen (2013, pg. 1351), 'the reason to find new ways to answer core strategic questions'. Other than cost, the reduction or avoidance of risks is an important characteristic. With the rationale of competitiveness, low risk also contributes to the stability in a corporation. Manufacturers in all industries 'are challenged to make big bets on long-term trends while also becoming responsive to near-term opportunities and shocks' (Cheng and Johansen, 2013, pg. 1351). This could mean choosing for the manufacturing of a certain product, or for example remaining with- or opening a location in a certain region or country, which is accompanied by a large investment. This responsiveness in a network, to react to sudden changes, establishes the need to design a flexible network.

Operational flexibility is used as a characteristic when designing a network, however, it is also a motive for expansion of the network, and internationalisation of the production, instead of the market- driven motives of investment. Many studies have showed the use of operational flexibility in network design with uncertainty of exchange rates (Kogut and Kulatilaka, 1994) and international production configuration (de Meza and van der Ploeg, 1987; Hucherzeimer and Cohen, 1996; Dasu and Li, 1997). In other words, to reduce those risks. This is also stated by the following scholars; with altering their production configuration according to exchange rates (Rangan, 1998), labour costs changes (Belderbos and Zou, 2007), economic crisis (Chung, et al., 2010) or the creation of corporation value (Allen and Pantzalis, 1996; Tang and Tikkoo, 1999; Lee and Mikhija, 2009), fast changes can be made to reduce risks and optimise the costs.

Another example of this is the model by Kristianto et al., (2017). They discuss the approach of the Triple R: responsiveness, robustness and resilience. The goal is to hedge against business uncertainties and maximise the responsiveness and robustness by generating operational flexibility at the minimum cost, use of inventories and environmental impact, and to build resilience in global manufacturing in order to achieve strategic flexibility. This is achieved by integrating major operational items, including planning, scheduling, real-time optimisation and control.

#### 4.2.3 Other characteristics

From this analysis, it seems as costs and risks are the main characteristics to be considered in the MFO- models. Mourtzis et al., (2012) stress that schemes must be evaluated against multiple user-defined criteria such as cost, time, environmental impact and quality. The derived alternatives can be used for configuration and coordination of the locations.

Wagner and Nyhuis (2009, pg. 296), also include more relevant competitiveness criteria into their MFO- tool:

- Sustainable fulfilment of customer requirement
- Strengthening of core qualities
- Exploitation of global advantages
- Managing a large variety of products
- Compliance with logistics targets
- Minimising overall costs

Costs are mentioned of course, since this is still a driving characteristic in the current models. Yet, it is one of the six characteristics and mentioned last. 'In order to be able to operate successfully worldwide and at the same time produce at the home location, corporations must define their position within global production network according to their core competences. Furthermore, corporations must comply with customer requirements such as shorter delivery times and better delivery reliability of highly diversified products' (Wagner and Nyhuis, 2009, pg. 302). Interesting to notice is the lack of an environmental factor in this list.

These other characteristics have the ability to change the network design more and more. Strategy changes and the network of the corporation changes with this due to customer needs. 'Firms increasingly drift away from the strategy of mass production to that of differentiated production based on regional needs and tastes. The demands and the localised versions of the products may not be high enough to offset the higher costs of establishing multi-functional plants' Yuan et al. (2012, pg. 1098). It would be more economical to analyse and adjust the network to a more localised strategy. This has, of course also more than only economical benefits.

#### 4.2.4 Conclusion on competitiveness

The current discourse is that corporations need to stay competitive in the current business climate to be able to survive and perhaps more importantly, it is urgent to do so. 'Long-range survival for international corporations will be very difficult to attain without highly optimised strategic and tactical global logistics plans' (Cheng and Johansen, 2013, pg. 1351). With this, they underline the need for an effective and efficient tool to analyse and optimise the manufacturing network of a corporation. The main characteristic in this is costs. All the articles in this analysis focus on one or more types of costs in their model. The reduction of risks, or optimisation of flexibility is the second important characteristic. This, in the end, also leads back to costs and is often expressed in costs as well. The vulnerability of the corporation could be at stake and this is not a safe base for the corporation.

### 4.3 Actors

Actors influencing the establishment of MFO models can be anything, i.e. specific persons, groups of people or a certain environment. Who actually has influence? What is the background of people, institutions, organisations? Since this is the discourse analysis of scientific articles, the first group of actors is fairly obvious.

#### 4.3.1 Researchers

All the articles are written by (multiple) scholars. Due to their research, their interest in the subject and their knowledge in the field, these articles exist in the first place. The 20 articles included in this analysis have in total 57 authors and co- authors, all interested in this specific field of research.

‘Despite the evident popularity of such programmes among practitioners, the corresponding literature remains scarce and no coherent stream of literature has emerged to this date on this widespread phenomenon’. (Netland and Aspelund, 2013, pg. 407). This is a rather small group of constantly reappearing researchers who focus their interest on many different subjects in the field of the manufacturing network: the analysis of the business climate in general, the workings of individual plants, and the improvement of the network as a whole. This last scope was chosen for this specific research. They analyse the current business climate and discuss past developments, but for future improvements they are waiting for the demand from the field. All the articles describing a new model use empirical evidence as a motive for the development of the model, this emphasises the importance of practice with these models. They serve a specific goal and are, in most cases, developed in cooperation with a corporation.

Some of the researchers even have multiple roles. Next to their involvement as a researcher, they are also employed by corporations, to conduct this type of research. Gunther Schuh, who is one of the researchers working on the OptiWoo tool, is also employed at WZL, a large heavy machinery corporation in Germany. Another example of this is professor Abele. While writing the book on global production, he was also employed as a consultant at McKinsey, where he was able to gather data and test his theories and models in practice. This shows that the connection between research and practice with this subject is a thin line.

#### 4.3.2 Corporation managers

With researchers sometimes employed as corporation managers or consultants, influencing the course of research from an academic stand of view, independent corporations also influence the establishment of MFO frameworks and models. Their experience in practice and effort in managing the daily performance of the network is leading in the establishment and development of MFO frameworks. This is because they encounter the first difficulties and where they are impossible to solve with the knowledge and expertise at hand, they ask for outside expertise. For example, the BMW strategic planning model by Fleischmann et al. (2006) in Chen, et al. (2013). This can be a consultancy corporation, or in this case the university, or a combination of the two. As mentioned before, this is where all the models in this discourse analysis originated.

Corporations even offer important information as input for academic research. Some of the sources are corporations such as Boston Consultancy Group (Kristianto et al., 2015), GPRD Business Council (Zhang et al., 2013) or Roland Berger Strategy (Chen and Johansen, 2014). This is because they experience first-hand how the business environment changes and how competitors react to this.

### 4.3.3 Business climate

The most mentioned actors influencing and establishing the MFO frameworks and models is the business climate. But what makes the business climate change? And what is this so-called change that needs to be taken into an account?

#### *Technical development*

Geoffrion and Powers (1995) in Goetschalckx et al., (2002, pg. 4&5) provide a historical perspective on the establishment of strategic distribution system design, which is another name for MFO frameworks. They identify six major changes in the last 20 years (1975-1995). 'These changes could provide for a better understanding of the rationales of today's discourse of the global business climate:

1. Logistics has changed from a neglected activity to an essential corporate business function.
2. The introduction of computers and communication devices.
3. The migration from non-optimising evaluation to heuristics, to commercially available MIP (Mixed Integer Programming) models.
4. The growth and use of database tools.
5. Systematic growth of logistics design models to encompass more features and a larger segment of the supply chain.
6. The use of this tool is applied not only in warehouse locations, but for the entire chain.'

These steps describe the technical changes in the specific field of research and suggests that the models have been developed accordingly. Other technical improvements have been beneficial to the establishment of the MFO frameworks as well.

Yuan et al. (2012, pg. 1097) describe how the management practices in the models are 'greatly facilitated by the advances in transportation and communication infrastructures that bring together raw materials and intermediate parts from diverse locations for assembly of the final product to be distributed to retailers and end users in a more affordable and timely manner'.

Zhang, et al. (2013, pg. 48) also emphasise that manufacturers nowadays do not manufacture the complete product on one location. They often ship semi-finished products to a different location for further processing or sales (Fawcett, 1992; Ferdows, 1997a; Feng and Wu, 2009). The enabler behind this is the rapid advancement of information technologies, especially the wide adoption of e-business platforms and enterprise information systems (Li, 2011).

#### *Change within the network*

Economic conditions change constantly, and competition gets tougher. Global corporations find themselves struggling with a dispersed, heterogeneous and low-performing network. Netland and Aspelund (2013, pg. 390, 391) state that the corporations experience a 'need for continuous process improvement in all plants in the network, improvement in operational capabilities and increase in the competitiveness of the corporation as a whole'. Shi and Gregory (1998) add to this that 'the knowledge that the ability to learn within international networks offers a potent source of competitive advantage', sees that these factors together lead corporations to multi-plant improvement programmes (Netland, 2012). So, even when economic changes occur, and the network is not performing as preferred, continuous improvements in the network happen and are needed to improve the competitiveness as a whole. Rudimental research in the field of international business even suggests that 'the ability to share knowledge in the intra-firm network efficiently is the

prime reason for the existence of MNCs in the first place' (Kogut and Zander, 1993; Buckley and Casson, 1998 in Netland and Aspelund, 2013, pg. 391).

Netland and Aspelund (2013, pg. 390) also state that 'multinational corporations develop and deploy multi-plant improvement programmes to advance the productivity in their network'. However, they only found 30 articles that specifically deal with this matter, which they interpret as a low number, since it contrasts sharply with the importance of these programmes in practice.

### *Economical change*

The MFO models go even further back than the changes in the business climate described by Geoffrion and Powers (1995) by Goetschalckx et al., (2002, pg. 4&5). According to Cheng and Johansen (2013, pg. 1353), they have established themselves through the changing business climate over the last 30- 40 years. Ferdows (1997) states that manufacturing, as the largest form of foreign direct investment (FDI) has become more international. Kristianto et al. (2017, pg. 607) uses Asia as an example of this: 'its status in the last five years is of an emerging market with a regional growth accounting for about two thirds of total global growth. This is due to the 'explosion of developing countries' populations and the power shift from the Atlantic to the Pacific'. This power shift is a result of FDI and internationalisation of networks. This rapid economic growth is changing the standards of living, along with the desire of consumers for certain experiences when buying products. This in return, changes the business climate again, with entire new markets asking for products.

Managers have benefitted from choosing global manufacturing for multiple reasons: trade barriers fell, so entry in new markets became possible; transportation became easier and communication technologies improved (Goshal and Bartlett, 1990). Over those years, 'the manufacturing corporations have attempted to globalise their geographically dispersed plants by coordinating them in a synergetic network' (Ferdows 1997a, 1997b; Shi and Gregory, 1998 in Cheng and Johansen, 2013, pg. 1353). This change provided for the need to analyse and evaluate the manufacturing process, possibly even improve this process, and this is where the first research started, and models were developed. With these networks, the role of manufacturing corporations changed from supplying domestic markets with products, via supplying international markets through export, to supplying international markets through local manufacturing. This development resulted in an even faster change in manufacturing systems and their focus on networks and network analysis and improvement (Ferdows, 1989; Rudberg and Olhager, 2003). With networks expanding in size, they have become more complex and detailed, because these new relationships are 'beyond the conventional concepts of the corporation that owns and operates its own factories (Cheng, Johansen, 2013, pg. 1351). This is also why MFO- models are necessary, to help analyse the increasingly complex frameworks. Schuh et al. (2012, pg. 382) clarify this is their research: 'The continuous growth of production networks has led to an increasing number of planning objects'. All these variables need to be integrated in the network, which leads to increased complexity.

'Another effect is the outsourcing of non- core manufacturing tasks and organising collaborations between different firms' (Lambert, Cooper and Pagh, 1998; Lamming et al., 2000 in Cheng, Johansen, 2013, pg. 1351). For example, they will only focus on the manufacturing of a specific part of a product, a half fabricate and will leave the assemblage and distribution to other corporations. Even though corporations own only a small part of the supply chain, they will be able to influence the whole network when it would need improvement (Shi, 2004). This is an interesting notion, since it

suggests that not only the business climate influences the corporations, but that this has a reciprocal effect. Multinational corporations also influence the business climate when they change their network.

Focusing again on the changing business climate, with increased significance of both internationalisation and externalisation, corporations need a tool to answer their key strategic questions, while also analysing the current network. MFO tools are also presented as a method to answer these questions, adaptable to whatever this question might be. Chen and Johansen (2013, pg. 1351) state that becoming responsive to the changing business climate is 'more urgent to manufacturers of all types in the context of today's business conditions'. These conditions are improved logistics, better computer systems and telecommunications infrastructure, less vertical integration, streamlined supply chains, the emergence of low- cost, high productivity nations as qualified manufacturing locations and competition that is stronger than ever before.

#### *Political change*

'Socio-economic issues like political pressure and the influence of the global economy tend to influence the governments of countries where strategic business units (SBU's) are often located particularly in less developed countries', to implement incentives, such as tax benefits, that encourage new investment (Schmidt and Wilhelm, 2000 in Das and Sengupta, 2008, pg. 402). These government regulations, together with other international uncertainties, often affect the costs of raw materials, which in turn impact the production costs and force the decisions makers in corporations, to re-evaluate and analyse the current production- distribution plan. Therefore, also politics and especially the risks that come with the unpredictability of choices of made by governments, can influence the changes in the business climate, which then influences the variables in the MFO models and the use of these models.

### **4.4 MFO frameworks in practice**

As mentioned in the previous sections 4.3.1 and 4.3.2, the field of manufacturing has substantially influenced the establishment, development and optimisation of MFO frameworks. Describing the practice in this analysis will elaborate on that, together with briefly explaining the operationality of the models and ending this section with the shortcomings of the literature compared to practice.

#### 4.4.1 Models from the field

All the articles written to present or describe a certain model, originated from or were applied directly in the field of manufacturing. The following model did also derive directly from the practical need for it: the MILP model. The TFT-LCD market, with specific needs and characteristics asked for it, so the authors developed this method further than the previously designed model. It is established from societal need and therefore most relevant. The model is influenced by some existing literature; however, it also acknowledges certain important gaps in this literature, 'such as a multi-site, multi-stage, and multi-generation production network'. This provided the need to develop a new model of their own for this specific industry (Chen et al., 2013)

This is only one example of the 13 articles in this discourse analysis who are categorised as model research/ presentation (see Appendix I). And while the aim of the model can be similar in some of the cases, for example minimise costs (9 models) or maximise profit (2 models), all these models were developed from a specific need regarding to a specific case in a corporation or field. This emphasises that without practice, these models would not have been developed.

#### 4.4.2 Operationality of frameworks

With the models originating from practice, this brings along difficulties. Being designed to a specific case, corporation of industry, makes it difficult to generalise and apply in other industries. Also, developed for and by a corporation, most managers do not prefer to share this kind of information with competitors.

Most importantly, the number of variables in practice makes it difficult to compute a viable outcome. This can be translated to the idea that grasping the complexity of a multinational corporation is analysing the whole network. This complication is mentioned most by researchers developing the models. Chen et al. (2013, pg. 153) describe that 'due to the computational complexity of the model it is impossible to solve a practical problem using a commercial optimisation package'. Ivanov et al. (2013, pg. 5386, 5387) use the real logic of decision making to exclude the demand constraint from the linear programming (LP) model. Different models and why they are used are discussed in the introduction, however, they state, 'for real data complexity, it is frequently very difficult to implement the models where data and decision variables of different time horizons and detailing level are considered within only one large scale model'. Too many variables are impossible to solve without a computational model, but models with this much variables can take up to weeks to solve a single location constraint.

Schuh et al. (2012, pg. 382) describes the difficulties of working with variables in the following text: 'It causes problems with identifying the planning objects and defining clear optimisation criteria. A number of applications with different objectives have established an unfocused character of the planning process. This causes the demand for an interactive computing application taking into account the main planning objects, production volume and production resources'. So, the different objectives of too many variables cause chaos in the planning process and establish the need for an interactive computing application. Where many variables could create difficulties in using optimisation models, Schuh et al. (2012) use this to develop an interactive model.

#### 4.4.3 Shortcomings of the models

With the models' ability to only work with a select number of variables, comes more difficulties. How representative are the outcomes with only a selective input? Yuan et al. (2012, pg. 1098) elaborate on the fact that 'the prototype requires some key decisions up front, namely the site selection for plants and warehouses, as well as the assignments for production and demand. This includes setup costs (fixed overhead for establishment of the plant and additional costs for making it ready for manufacturing, like machine purchase, labour training, maintenance and other variable costs)'. This would mean that changes in the business climate, where these models need to act on, cannot be fully taken into an account and therefore not useful towards their purpose, which is designing and optimising manufacturing networks. This is not only the case for the computation of the models: 'From this perspective, the current scholarly literature fails to fulfil its role to synthesise and guide practitioners who implement and manage such programmes'. This calls for more research on multi-plant improvement programmes, but also international aspects of operations strategies in general (Barnes, 2008; Ferdows, 2008 in Netland and Aspelund, 2013, pg. 404).

For future research, this expected failure of research is also noticeable. Goetschalckx et al. (2002) describes the sentiment in 1995, however this is still accurate today. 'They conclude that the future is likely to see a growth in the capabilities of design models and algorithms but that the size of feature requirements in industrial organisations will continue to outstrip the available methodology'

(Geoffrion and Powers, 1995 in Goetschalckx et al., 2002, pg. 5). Changes in the business climate are too fast for literature to catch up on and come up with accurate computational models to analyse the existing network.

#### **4.5 Conclusion**

With the start of this chapter, the scope was determined by analysing the specific articles used in the analysis. This, because in a discourse analysis, the background of the authors, the time when they were written and influenced by whom, are just as important as the article itself. The main point made by Foucault about how knowledge is established, is that all texts are the outcome of a process of power within a social context. For this reason, background information on how the text was established is this important. So, who has power over these models, what is said about them and also, what is not written about?

The important characteristics in the models are costs and risk. Also, some other characteristics were mentioned, however, many of them lead back to costs and risks as well. Only Wagner and Nyhuis (2009) mention sustainability (fulfilment of customer requirement), in their competitiveness criteria. And however, this is worrisome, this is new discussion and research topic. The different characteristics lead to the rationale of competitiveness, which has partially established the MFO-models as we currently know them.

Actors involved with the models are of course the people who develop and use them: researchers and managers. Yet, both actors look towards the changes in the business climate as an important actor in the establishment of the MFO tools (Cheng and Johansen, 2013, pg. 1353). 'These changes are technological, economical, social and environmental', and all founded in the discourse that growth is progress. Bigger is better and more is more. Improvement, expansion, advancement, increase are all believed and accepted synonyms for words as gain, rise, prosperity or success (Thesaurus, 2019). This also emphasizes the assumption that this is the current discourse. However, it is debatable whether this is true.

While only touched upon lightly, possibly silenced by those with power, it is critical to repeat the notion of who influences who in the business climate. By being part of the network, large corporations have power over the network and can therefore steer the business climate in the direction they please. Controlling the manufacturing network and the power (and money) which comes with that, is also an important rationale.

Lastly the models in practice were discussed. Established and developed to be more effective and efficient, originating from the need directly out of the field, proves this to be also the greatest difficulty. Their operability is due to the many variables not proven to be effective because of the restraints. Moreover, due to the rapid changes in the business climate, development of the models cannot keep up with the demand, flexibility and complexity. Also, implementation by managers shows to be a challenge. For future research, this is interesting to take into an account.

With the results of the discourse analysis of the articles explained the sections above, divided over the 3 subjects of the characteristics, actors and practice, the observations will be discussed in the following chapter.

## CHAPTER 5 OBSERVATION ANALYSIS

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In the previous chapter, a discourse analysis was executed on the existing literature on the topic of MFO frameworks. The characteristics, actors and how they function in practice were discussed, following in a conclusion. In this chapter, the process of a footprint advice given by BCI Global is reviewed. The different steps the BCI Global framework follows, the methods they use and how this is presented to their clients. Sourcing will indicate if the analysis was made on observations (Ox.date) or memo's (Mx.date) during the internship.

### 5.1 Corporation S.

During the time of the internship, March until September 2018, BCI Global worked on a footprint analysis project, where the observations were made for this research. The corporation for which the advice was written, will be known as corporation S. in this research, due to privacy reasons. The real name and more precise data are known by the author.

Corporation S. is a United States-origin multinational corporation, founded in the sixties, with its headquarters located in the centre of the USA. They have a strong legacy in that area and would not consider leaving that area. They design, manufacture and distribute small electrical medical devices, both standard and custom made for their customers, with other optional pieces and also handle the repairs. The corporation has multiple plants and distribution sites in the Americas, Europe and APAC (Asia and the Pacific) and approximately 5000 employees. They have a large research and development team in Asia, most of their offices and corporate employees are located in the US and the manufacturing is mostly located in Central America and Asia, but also in smaller quantities in the US. They are a world leading corporation in their field with a large global client base. According to their own policies, their strategic aspiration is 'to ensure a lasting organisation through sustainable, profitable growth'. In order to do so, they state 4 priorities in business: 'operational effectiveness, the focus on being more disciplined and eliminate waste; product diversification, explore and develop products outside of traditional products; channel diversification, explore and develop new ways to deliver better products; global expansion, facilitate growth in targeted developed and emerging markets' (BCI Global, PP1, slide 67, 2018).

With these priorities and existing strategy, Corporation S. asked BCI Global to come up with the best possible footprint for all their locations.

### 5.2 BCI Global framework characteristics

BCI Global presents a general framework for their advice on footprint optimisation in Figure 7.

The model consists of 6 parts: A, B, C, D, E and F. The A stand for the As-is analysis, consisting of the analysis of the current footprint or supply chain, the analysis of products and markets portfolio and a SWOT- analysis (strengths, weaknesses, opportunities and threats) of the current business strategy.

In this part of the process, it relies heavily on the data made available by the corporation.

Corporation S. send the data requested by BCI Global, after the first visits to the corporations' headquarters in the US, which were used to form a 'baseline', as BCI calls it. Together with B; the strategic inputs, such as the expected changes in products, technologies and markets, the future business strategy drivers and the external business disruption risks, and C; the long term business planning, which entails the forecasting of sales, forecasting of financial results and the current investment programs, this is the most important data set, on which also future scenarios are based

(O11.2905). The existing and available data is gathered in an Excel sheet, to ‘clean’ the numbers and ensure no mistakes are made, which could lead to incorrect output. BCI works the data they receive and try to gather as much as possible. Otherwise, they need to complement the data with assumptions, or leave gaps. For example, with corporation S., they did not have the exact number of products made, but they did know the revenue and profits made.

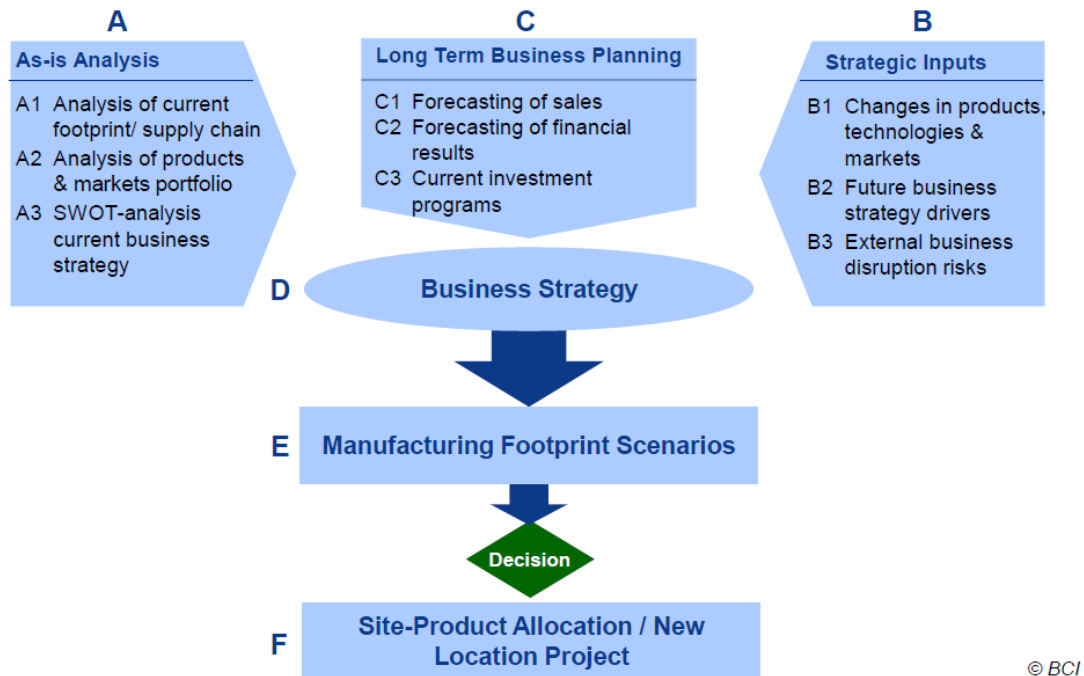


Figure 7 Manufacturing Strategy Design & Implementation Framework (BCI Global, 2018).

Then, in part D, the business strategy of the corporation is taken into an account. After this, by talking to different managers within the corporation to discover the inner workings, the different manufacturing footprint scenario’s arise in part E. With corporation S., multiple scenarios were designed and calculated on credibility, using some standardised and some extreme footprint designs. These scenarios are not derived from a certain source or example but devised by the consultants themselves and the experience they possess (M1.0307).

The corporation makes the ultimate decision which scenario is the best fit for their vision. This finishes the framework in part F, the site- product allocation or new location project. This is where the MFO analysis has stopped already and BCI can help with implementation of the new scenario, or search for a new, more precise location for a plant or distribution centre.

### 5.3 Actors influencing the framework

In the general presentation available by BCI Global (PP1, slide 11, 2018), they explain that their ‘Global Footprint Strategy’ is based on the four questions that must be addressed by the University of Cambridge. In figure 8, the why, what, where and how are explained together with the underlying reasons which factors a global footprint must encompass.

Cambridge University (2018) states in their vision that it must (1) ‘Align with business strategy and embrace change at the same time’. (2) It should help with the ‘make or buy dilemma’, which is the dilemma if a corporation should make every aspect of a certain product or buy different parts and assemble these; balance the outsourcing risks and establish corporate guidelines. (3) Provide

information on the most suitable location(s) for the corporation and lastly, (4) ‘Mobilise it for change; transition and embed this whole process in the current footprint’. This means that the network should be flexible, ready to change when necessary and that managers have fully embedded this new method into the core strategies and culture of the corporation. When asked why BCI Global chose the insights of Cambridge University as an inspiration for their own framework, they answered that it was easy to access and made available to them through a two-day course (O5.2805). It also seems a credible source because of the reputation of the University (M3.2905), since besides the slide in the presentation, BCI does not use any more input, data or models from Cambridge or any other university.

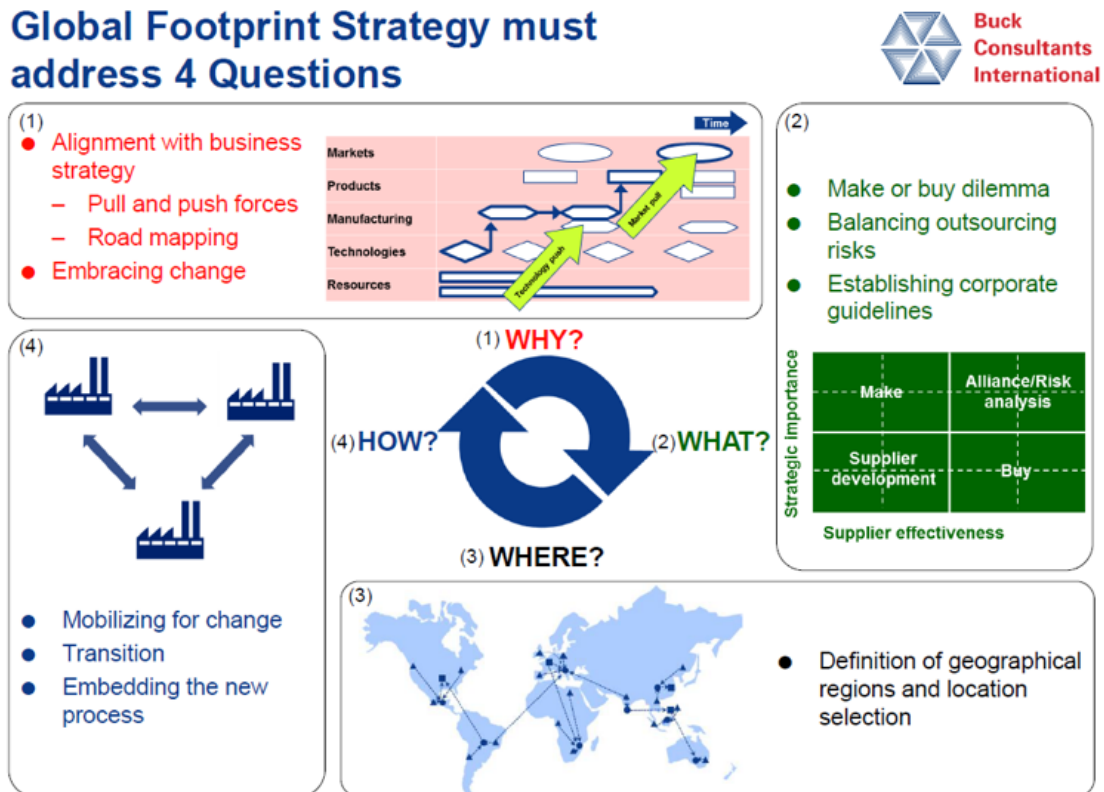


Figure 8 Global Footprint Strategy (BCI Global, PP1, pg. 11, 2018)

As mentioned in section 5.2, BCI developed their strategy themselves, influenced by the Cambridge University method and their own experiences in the field of location selection and data analysis. Therefore, another influencing actor to note is the corporation itself, and especially Mr. Buck himself. As the founder, CEO and department head of the location selection and strategy department, he is the most influential actor in the corporation. Since starting the corporation, he has always been in lead and manages the business and processes with clear hierarchal views. His motives for change and the establishment of the model are founded in the research he reads and his own experiences. He is open to new input from other colleagues, however, it is him who makes the decision to develop or adapt the model. This causes silencing of other opinions in the corporation, for example about the use of algorithms, computational methods, cooperation with other universities and other corporations already using these models and/ or strategies.

## 5.4 The framework in practice

Through the experience and knowledge of their employees, BCI is able to build the baseline using an Excel spreadsheet. As mentioned earlier, data is gathered together with corporation S. and some assumptions are made for numbers of growth, taxes, inflation. The baseline, consisting of parts A, B, C and D in figure 7, leads then to part E, the scenarios. For corporation S. 4 different scenarios were presented in PP3: a regionalised and globalised footprint, a footprint designed with only costs in mind and a footprint with the highest service quality for costumers. The different scenarios have multiple different pros and cons to them and rationales for proposing them in the first place. In the following figures, the different scenarios will be explained:

- Regionalised Footprint
- Globalised Footprint
- Cost optimisation
- Service quality optimisation

### 5.4.1 Regionalised Footprint

The regionalised footprint (figure 9) would mean separate plants and distribution lines per geographical region. In the simplified footprint, the 4 different regions are specified with a separate manufacturing plant (MF). Distribution lines would be shorter than with the current footprint, however the costs of realising several new locations would be considerable.

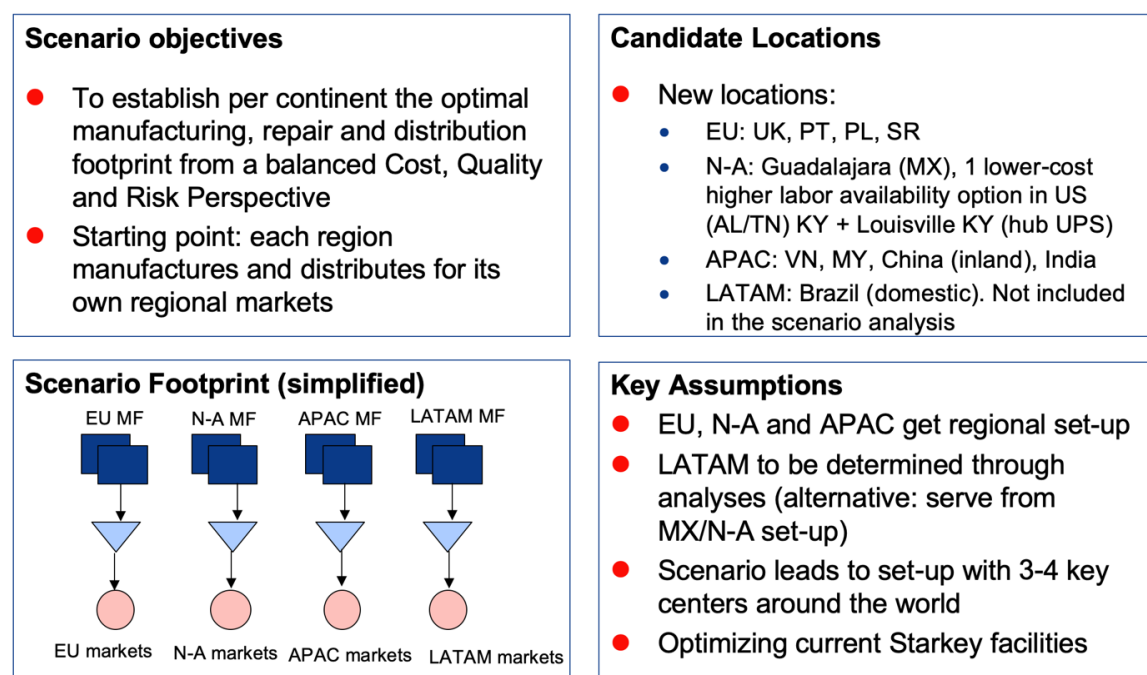


Figure 9 Regionalised Footprint (BCI Global, PP3, page 4, 2018).

Also, choosing the precise number of new locations and the locations themselves, is based on knowledge, input and experiences from the BCI employees, not the outcome of a model. According to BCI, this would not be possible to calculate with the help of an Excel sheet, so they choose the options, based from the current locations and their own choices. Therefore, is this the actual most optimised regional footprint? It could be argued that it is the optimised network, with their own

network kept in mind, for corporation S. this is optimal, however for science, this would not be the exact optimised network model.

#### 5.4.2 Globalised Footprint

The globalised footprint (figure 10) could reduce the current number of manufacturing plants greatly. With 1 super plant, or multiple specific product plants, all smaller manufacturing would not be necessary any longer. Distribution, however, would take much more time and with custom designed products and possible repairs, this could be an issue with customer satisfaction in mind. Also, with the strains on the current environmental climate this would be an even greater impact on the carbon footprint by corporation S.. However, this is not taken into account in any model. Costs could be cut though by locating the manufacturing plants in labour and tax favourable geographies.

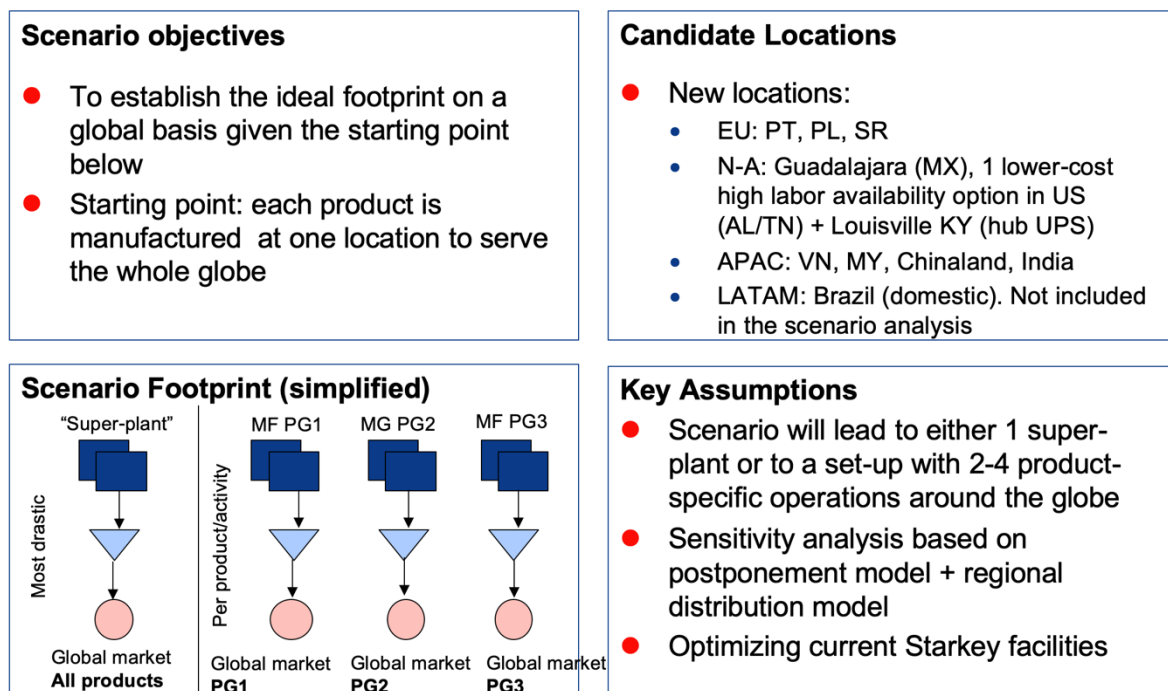


Figure 10 Globalised Footprint (BCI Global, PP3, page 5, 2018).

#### 5.4.3 Cost optimisation

In figure 11, the scenario for cost optimisation is displayed. However, this is not fully elaborated on, since this would propose the 'clean sheet approach'. All current locations would be non-existing and with the knowledge currently available, the most favourable locations could be chosen for manufacturing. Since this is highly unlikely to happen due to the ongoing legacy of the corporation in certain locations.

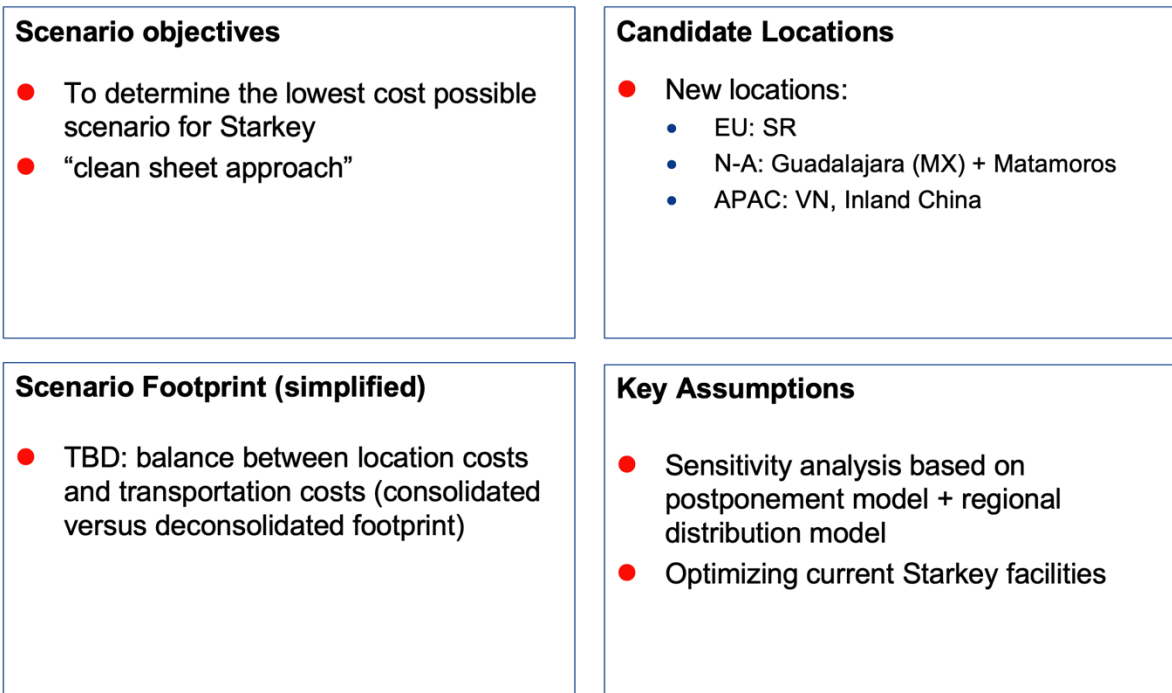


Figure 11 Cost optimised footprint (BCI Global, PP3, page 6, 2018).

#### 5.4.4 Service quality optimisation

Lastly, in the fourth scenario, BCI has optimised the service quality offered to customers in its footprint. They have quantified service as mainly the lead time: the time it takes for corporation S. to repair the product and send it back. They also comment on this scenario that it needs to be proven from analysis how far the current footprint is from this scenario. This strategy is also not elaborated on further, since it does not take costs into account as much as corporation S. would like.

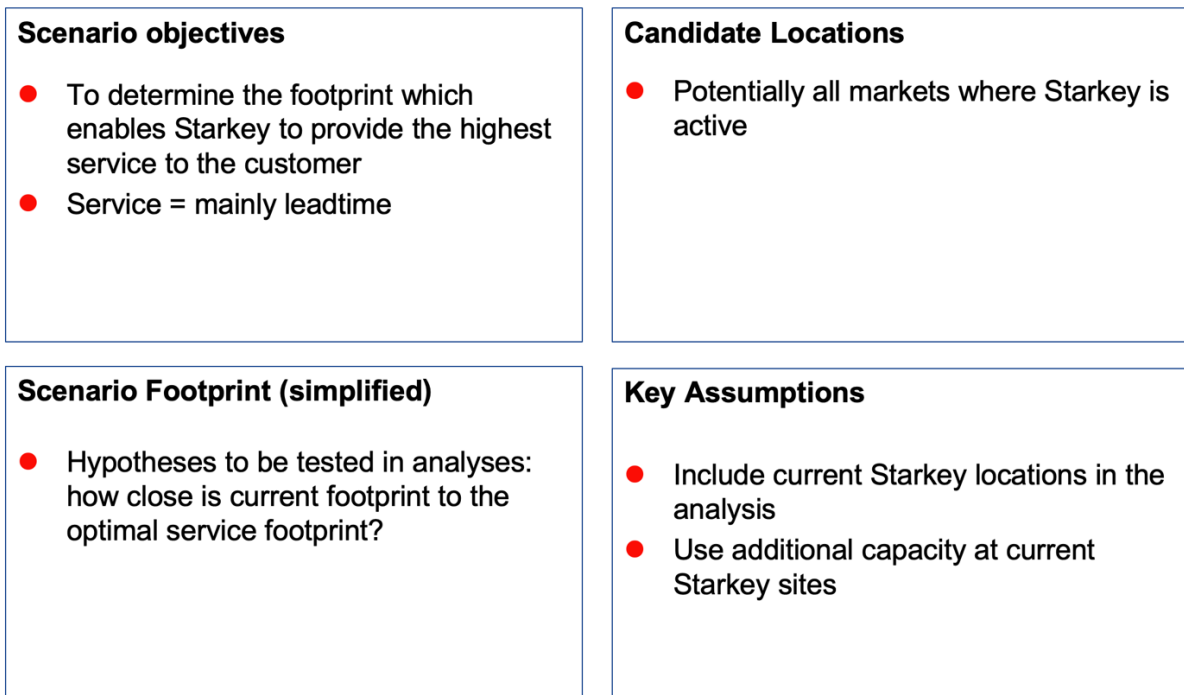


Figure 12 Highest Service Footprint (BCI Global, PP3, page 7, 2018).

In the end are these all extreme scenarios, which show the possibilities of the framework BCI proposes. Together with corporation S. they will try to find a combination of these scenarios, which provides the corporation with some ideas to cut costs and grow towards a future of their vision. BCI, in the end, provided them with an analysis of their current locations, costs and offered them some options for future optimisation of their footprint. By an interactive process together with corporation S. BCI was able to offer advice on the best possible locations for the future with their strategy and vision. If and how corporation S. chooses to go forward with this analysis is unclear since the completion of the internship.

## 5.5 Rationales

As mentioned earlier, corporation S. has the vision to be a lasting organisation through sustainable and profitable growth. To do so, they want to optimise their network of locations. How they exactly arrived at the decision to hire BCI Global as their consultants is not known information. Probably because of the BCI marketing employees located in the US, who actively advertise with the notion that BCI can help 'your corporation to stay competitive' (BCI Global, 2018).

During the internship at BCI, the observation was made that, they offer an analysis of the manufacturing footprint as one of their key competences. According to Mr. Buck, 'BCI is developing the MFO framework for 2 years now'. They noticed that they had more to offer to multinational corporations than only an advice for the question: 'where should we build the next location' (O1.2805). With this realisation, he started doing some research and simple Googling let him to see what possibilities could be (O2.2805). For BCI the development of the MFO framework was born from the idea that more business could be generated by offering a complete footprint analysis, rather than just a site selection. Staying competitive is the most evident rationale for them to establish a MFO framework.

For their customers, coming to them for consulting, they offer a range of different changes, external and internal, that could be motivations for optimisation of the manufacturing footprint (figure 13).

- **External Changes**
  - Markets shift geographically
  - Geopolitical developments (for example: trade agreements)
  - New competitors with new business models
  - Shifts in risks doing business
  - New labor pools
  - Regulatory challenges in specific markets
  
- **Internal Changes**
  - Growth of business
  - New technologies
  - New product lines
  - M&A activities
  - New organisational thinking

*Figure 13 External and internal changes (BCI Global, PP1, page 18, 2018).*

These changes could be divided into different groups of rationales for the establishment of MFO frameworks by BCI Global:

Competitiveness would be the main rationale for the establishment of the MFO model at BCI Global. With most of these changes, the business climate could be different in the future and to maintain a profitable corporation, its footprint should change as well, to remain this way. The shift in new markets, changing of trade agreements, new competitors, overall risks in losing business, new labour pools opening up and other changes in markets all impact this. Moreover, these are only the external changes of the business climate. All the internal changes have impact on the competitiveness of a corporation as well. Growth of the corporation, new technology which can be implemented, new products, mergers and acquisitions and new management styles all change the corporation and affect its conducting business.

Efficiency is also an important rationale. To be cost efficient is an excellent way of remaining profitable as a corporation. Cost efficiency is the variable which is used to determine the direction and strategy of the corporation the most, and this is also why it is used as the first variable in the analysis of BCI Global. The internal changes addressed by BCI have an impact on the efficiency within the corporation.

Quality aspects, or otherwise interpreted as sustainability or corporate responsibility, should also be an important rationale, however, they are not. Even though this is mentioned in the vision and strategy of corporation S., BCI hardly acts upon this vision. In the baseline they analyse all the data according to the additional costs and this is also how the scenarios are formed. The quality or risk factors, however mentioned in their model, are barely present, even though they praise themselves on their QCR- model of decision making. Which stands for Quality, Costs and Risks evaluation.

## **5.6 Conclusion**

From the MFO model, the use of it in practice and the observations made during meetings and the internship as a whole, it has become clear that the rationale for using the MFO models is competitiveness, driven mainly by costs. BCI Global believes that to be costs effective, especially by minimising costs, corporations will be able to design their optimal footprint. They make recommendations based on their own past experiences in the field and not on mathematical models, calculations or with the use of algorithms such as most of the academic articles do.

## CHAPTER 6 CONCLUSION

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Foucault was interested in what discourse does, or more specifically, what the discursive practice does. Not just how it represents the world, but also how it changes the world (Waitt, 2010). Discourse constructs or shapes the very thing that it describes. It is not just words, but it is bound up in change and institutions, which influence the world, social reality and within the topic of this thesis: global society. To understand the discourse, it is thus important to understand it in the sense of power.

For this research it means that understanding the discursive practice of MFO models and frameworks, can uncover the rationales behind this concept and answer the research question:

*How did the framework of manufacturing footprint optimisation establish itself as a key practice in the business sector worldwide?*

With answering the question, more can be said about the society we are a part of, what our current beliefs are and perhaps change this with new insights.

### 6.1 Answering the research question

In order to answer the research questions, three sub questions were formulated. For each question, a short answer will follow incorporating the literature analysis and the observations. After that, the conclusion of this thesis will answer the main research question.

#### *1. Which characteristics does the current MFO framework contain and where do they derive from?*

For the literature analysis, three categories were discovered, all leading back to one rationale for incorporating them in the model. The goal or strategy of the corporation, together with the aim of the model determine the specific characteristics of the model. In most cases it is based on cost minimisation, however, also models exist advocating for a multi-dimension analysis, including risk, time to customer and environmental constraints, which the two latter are categorised as 'others' in this research, since they are used so scarcely.

In the observation analysis, cost characteristics (as-is analysis), risks (change, future strategy and forecasts) and also quality characteristics (business strategy) are considered in the footprint model. BCI Global has adopted these from the Cambridge method and given them more depth with their own insights.

For both parts of the discourse analysis, the rationale of competitiveness comes forward as an important factor contributing to the establishment of MFO models.

#### *2. Who are important actors executing their power over the MFO framework?*

Actors involved with the models are of course the people who develop and use them: researchers and managers. Yet, both actors look towards the changes in the business climate as an important actor in the establishment of the MFO tools. As mentioned earlier, these changes are technological, economical, social and environmental', and all founded in the discourse that growth is progress. So, in the end, who has the power?

For the model presented by BCI Global, this is a bit different. The model is partly influenced by researchers such as Cambridge University, however, the biggest actor influencing the model is Mr.

Buck himself. His drive to stay competitive, his focus on costs and his influence in the corporation makes him the most powerful actor in determining the establishment and development of the model. His experience in the field, combined with his power as CEO in a hierarchical corporation is leading in this case and could be a leading actor in more corporations.

As most large corporations at the moment have a hierarchical structure and are focused on costs, the conclusion would be that, just as Mr. Buck, the executive manager implementing the model, or even the CEO, is most powerful in choosing the model and using it in practice.

For this sub question, the competitiveness, as well as having power over the network or business climate can be seen as important rationales determining the establishment of MFO models.

### *3. How is the framework applied in current corporations and industries?*

In the literature analysis is determined that all the models discussed, originated directly from the field. Established and developed to be more effective and efficient, originating from the need directly out of the field, proves this to be also the greatest difficulty. Their operability is due to the many variables not proven to be effective because of the restraints. Moreover, due to the rapid changes in the business climate, development of the models cannot keep up with the demand, flexibility and complexity. Also, implementation by managers shows to be a challenge.

The observation analysis also detects these difficulties. At BCI however, they work with certain set typologies and use their own experience as a guiding factor to determine the outcome of the specific locations where information and variables are lacking. With this type of method, this is possible, with computational models, this would not be the case. Therefore, they are more flexible and can adapt the outcomes easier than with an algorithm or complex computational model.

Here, the need for efficiency of the models combined with the need to be competitive is the rationale for establishing the MFO models as we currently know them.

## **6.2 Conclusion**

*How did the framework of manufacturing footprint optimisation establish itself as a key practice in the business sector worldwide?*

Three rationales come from this discourse analysis, which together, established the manufacturing footprint optimisation models as a key practice in the business sector worldwide.

Competitiveness is mentioned multiple times by all literature, as well as by BCI Global, staying relevant in the business climate is necessary to 'survive' and be a profitable and viable corporation. This means growing towards new market, optimising production flows and minimising costs. By analysing and optimising the network, using the MFO model, this is possible.

Possession of power over the corporation network and with that, the business climate is only touched upon lightly. This rationale is possibly silenced by those with power, however it is critical to repeat the notion of who influences who in the business climate. By being part of the network, large corporations have power over the network and can therefore steer the business climate in the direction they please. Controlling the manufacturing network and the power (and money) which comes with that. This also has overlap with the rationale of staying competitive.

Lastly, efficiency is a rationale in the establishment of MFO- models due to the need to reduce risks in the network, but also incorporate other characteristics, such as customer delivery time. With the inspiration coming directly from practice, the reason for being more efficient is always present.

### **6.3 Recommendations**

Different sorts of recommendations can be made about this research. This regarding the execution and process of the research itself and after this is discussed, about future research on the subject. Personal experiences during the research and internship will be reviewed in section 6.3.

#### **6.3.1 Execution of research**

With the execution of this research, some aspects can be improved in the future.

With the decision on the scope of the research, it is important to keep this an iterative process, as in the stage of data collection more information comes forward on what exists and what not. With this specific research scope, not much had been written about the combination of configuration and coordination aspects of different locations of multinational corporations. Also, if both aspects were included in a research, it would not mention these definitions, making it difficult to determine the scope. Therefore, the recommendation for future research would be to determine the definitive scope as late as possible and keep options open during the entire research after considering new insights.

Building on the previous argument on the research scope, the collecting the data was a difficult process due to the many definitions used in the different fields of research, but also the many definitions in general. With this in mind, the recommendation is to keep track of all the different possible combinations made while collecting all the data. This to be sure no articles and books are missed.

Coding is a laborious, but crucial part of the research. Recommended steps for future research are to make a distinction between coding in certain distinct parts of the text such as actors, characteristics, practices, etc. and coding in content, the in-depth meaning of the words themselves. To create codes twice, and analyse them separately, perhaps a better understanding can be formed about the explicit content of the models and frameworks and not just the establishment of them.

#### **6.3.2 Scope for new research**

With regard to the literature analysis, as well as the observations made during the internship at BCI Global, other research topics and scopes came to light to continue researching in the future.

MFO models are communicated as 'survival' tools in the field of operations management. Adapt or die, just like in nature. However, no natural inspiration is used in the models or frameworks. Not even is sustainability an important characteristic included in the models available. Only sporadically sustainability is mentioned as a possible constraint or characteristics to be included. Focus on sustainability is lacking with regard to current developments in the economic climate. Chen, Olhager and Tang (2014) focus in more recent research on this topic. However, not much else is written taken this variable taken into an account. A focus on sustainability in future research would be, with the changes in the environment, which also affect the business climate and risk characteristic, be a great opportunity for future research.

Operational flexibility, discussed in the literature analysis as well as the observations during the internship at BCI Global, the business climate (external and internal factors) is constantly changing. The current models and also corporations are not capable of changing with the same flexibility as their environment. Future research could focus on the development of more flexible models, who can take into account all the existing variables, so no assumptions need to be made.

Continuing on the previous recommendation, the current models are capable of calculating and visualising new network typologies, but only to a certain extent. Many variables take too long to calculate and not one correct outcome exists, only approximations. Other tools, perhaps on a smaller scale, can be utilised as well. The large scale of the analysis method and the network of locations taken into an account by these models, makes it almost impossible to render a complete and 'perfect' outcome. Concessions must be made to make an outcome possible and the calculating time with these models is enormous. Especially with the use of mathematical modelling, or algorithms.

Another problem with algorithms is the 'black boxing' of the analysis process. The data is entered and with certain calculations, the optimal network appears as output. However, how this actually works is uncertain, especially with the use of heuristic algorithms, which is the case with most frameworks. The consideration could be made if this is 'good enough' for current corporation networks, who will not consider complete green field network design due to legacy and costs. Or, is it necessary to conduct more research on this topic? With improving technology, such as artificial intelligence and even faster computers with more capacity, it is still unknown if it would be possible to calculate the exact network locations, however, improvement is always possible.

To end the recommendation section, it is important to consider, with the knowledge from this research as a new source of information, if adding new research to this subject is actually necessary. With the points of critique made clear in the analysis and the last two recommendations, it would be wise to consider if MFO- models are the right tool to analyse and optimise the manufacturing networks of multinational corporations. Future research could be directed at discovering a new method, leading the business climate and corporations towards solutions in a new and green network.

#### **6.4 Reflection**

On the different stages during the internship, executing this research and while writing this thesis, reflection will be offered in this section.

Starting this research, coming up with the subject was in cooperation with the internship corporation. BCI Global had multiple questions about their manufacturing footprint optimisation strategy and method. Together with them, I explored this topic further and with the help of my supervisors, we determined the research question, with accompanying sub questions. This, however, was quite a long process. Where the internship corporation was more interested in a benchmarking research against existing methods and models, this was not seen as a viable academic approach by the university. A scientific theoretical approach with appropriate methodology was and is their foremost interest during the execution of the Master thesis research. These differences in interest are understandable of course, however, they made the process of starting the research difficult. Before the research question, with the scope and method was agreed on by university and corporation, already 4 months had passed. Observations were made, but hardly any in-depth interviews were done, or theory was written. Also, no clear output was formulated together with BCI, which made the internship only more difficult.

Communication about the case with corporation S. during this time was not optimal and, in the future, full disclosure about the research case would be necessary to be able to execute a proper discourse analysis. Because I was not fully involved in the case, I personally found it hard to focus on the subject. While interesting, the subject falls partly outside of the field of economic geography and is more involved with operations management and logistics. This costed me a great deal of energy to remain motivated to finish the research.

Choosing discourse analysis for the theoretical approach and methodology was hard. Personally, I had never executed research with this approach, it was recommended by the supervisor as a fitting method for the motive of the research and the requested results and recommendations by BCI Global. In the end, it worked perfectly for this research, however, because of the philosophy of discourse analysis by Foucault, no structure or clear steps are determined in the methodology. Just examples in specific research where it was used. The 7 strategies formulated by Rose (2001) helped by the execution, especially since it was a first. It took much reading and desk research, not my first and foremost specialty or preference, but together with the field work, it resulted in a triangulated dataset.

Whereas I expected to focus my research on globalisation of business, internationalisation and what the characteristics of a successful network where, the manufacturing footprint optimisation models and frameworks are mostly mathematical and computational models, which make use of algorithms, complex formulas and calculations. Comprehending the precise steps made in these models, the characteristics included and how much they weigh in these models was challenging. I do not have a background in operations management, supply chain or logistics, so conducting the discourse analysis on this topic was even harder because of that.

In the end, I learned much about myself. How to motivate myself in moments where I do not feel good about myself, when my confidence was low, and I felt that all I would write would be disapproved by my supervisors. Because, how could I know that without actually handing in my text? Most of the times my pieces were better than I thought myself and with some feedback, I was able to use most of it directly. I know now what I want in my future career and also what I do not like to work with. I learned about new theories and forms of research methodologies, to be open to new insights in unexpected fields, or hidden in texts and subtext. This is something which is still applicable in my career today.

With this as a finished result of this research, I must admit that I am very glad that it has come to an end. The subject I found very interesting, however the used approach, view of the internship corporation and the current discourse of the business environment did not correspond with my personal beliefs. I lost a large part of my motivation because of all this to finish the research, however, Simone, together with my family and friends kept pushing me to keep writing and complete the thesis. For the future, I know now, with certainty, where my qualities lie: in the field, working with people on geographical and planning cases with an important link to sustainability; and also definitely not executing solo research over a long period of time, with having to write an extremely long and detailed document about it.

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# APPENDIX I

Table with reviewed articles.

AUTHOR(S)	TITLE	YEAR	JOURNAL	TYPE OF ARTICLE	SECTOR/ INDUSTRY	NAME OF THE MODEL	AIM OF THE MODEL	TYPE MODEL
Chen, T., Lin, J. T., Wu, C.	<i>Coordinated capacity planning in two-stage thin-film-transistor liquid-crystal-display (TFT-LCD) production networks</i>	2014	Omega	Model research/ presentation	High tech products (TFT-LCD screens)	mixed integer- linear programming (MILP) model	Maximise profit	Computational
Cheng, Y., Johansen, J.	<i>Operations network development: externalisation and internalisation of value chain activities</i>	2013	Production Planning and Control	Literature review	Cases: furniture and nautical equipment	nvt	nvt	nvt
Contreras, I., Fernández, E., Reinelt, G.	<i>Minimizing the maximum travel time in a combined model of facility location and network design</i>	2012	Omega	Model research/ presentation	Health care facilities, emergency services/ units	Center Facility Location/ Network Design Problem with Budget Constraint (CFLNDPB)	Minimise the customer- facility travel time	Computational
Das, K., Sengupta, S.	<i>A hierarchical process industry production-distribution planning model</i>	2008	International Journal of Production Economics	Model research/ presentation	SBU located in a third world country using raw materials (industrial gasses or chemical fertiliser)	MIP (Mixed Integer Programming) mathematical model	Provide an optimal strategic and operational plan for the network, incorporating impact of changes in cost of input on expected product cost	Computational
Feldmann, A., Olhager, J., Fleet, D., Shi, Y.	<i>Linking networks and plant roles: the impact of changing a plant role</i>	2013	International Journal of Production Research	Research relationship networks- plant roles	Chemical- Heat transfer, centrifugal separation and fluid handling.	nvt	Mapping the relations between plants and network responsibilities for competence areas	Framework/ visual presentation
Fisch, J. H., Zschoche, M.	<i>The role of operational flexibility in the expansion of international production networks</i>	2012	Strategic Management Journal	Model research/ presentation	352 different manufacturing firms in Germany	Hazard rate models (Cox, 1972) and Weibull models	Maximise profit	Computational
Goetschalckx, M., Vidal, C. J., Dogan, K.	<i>Modelling and design of global logistics systems: a review of integrated strategic and tactical models and design algorithms</i>	2001	European Journal of Operational research	Review and model presentation	All manufacturing units	LP model	Minimise costs	Computational
Ivanov, D., Sokolov, B., Pavlov, A.	<i>Dual problem formulation and its application to optimal redesign of an integrated production-distribution network with structure dynamics and ripple effect considerations</i>	2013	International Journal of Production Research	Model research/ presentation	Food industry, electronics, long moving customer goods, etc.	LP model	Minimise costs and improve the service level	Computational
Kristianto, Y., Gunasekaran, A., Helo, P.	<i>Building the triple R in global manufacturing</i>	2017	International Journal of Production Economics	Model research/ presentation	nvt	Triple R	Generating operational flexibility at the minimum cost, use of inventories, environmental impact and to build resilience	Conceptual
Lampel, J., Giachetti, C.	<i>International diversification of manufacturing operations: performance implications and moderating forces</i>	2013	Journal of Operations Management	International diversification	38 Car and ligh truck production corporations in 45 countries	nvt	nvt	nvt

AUTHOR(S)	TITLE	YEAR	JOURNAL	TYPE OF ARTICLE	SECTOR/ INDUSTRY	NAME OF THE MODEL	AIM OF THE MODEL	TYPE MODEL
Lanza, G., Moser, R.	<i>Strategic Planning of Global Changeable Production Networks</i>	2012	Procedia CIRP	Model research/ presentation	nvt	nvt	Cost effectiveness	Conceptual
Lorentz, H., Toylli, J., Solakivi, T., Halinen, H., Ojala, L.	<i>Effects of geographic dispersion on intra- firm supply chain performance</i>	2012	Supply Chain Management: An International Journal	International diversification	95 large global manufacturing corporations in Finland	Linear modelling	Effects of geographical dispersion on the supply chain	Computational
Meijboom, B., Vos, B.	<i>International manufacturing and locations decisions: balancing configuration and co-ordination aspects</i>	1997	International Journal of Operations and Production Management	Research relationship networks- plant roles	All manufacturing	nvt	Show that configuration and coordination should be combined in research	nvt
Mourtzis, D., Doukas, M., Psarommatis, F.	<i>Design and planning of decentralised production networks under high variety demand</i>	2012	Procedia CIRP	Model research/ presentation	Automotive industry	nvt	Minimise cost, time, environmental impact and optimise quality	Conceptual
Netland, T. H., Aspelund, A.	<i>Multi-plant improvement programs: a literature review and research agenda</i>	2014	International Journal of Operations and Production Management	Literature review	nvt	nvt	nvt	Conceptual
Samaranayake, P., Laosirihongthong, T., Chan, F. T. S.	<i>Integration of manufacturing and distribution networks in a global car company – network models and numerical simulation</i>	2011	International Journal of Production Research	Model research/ presentation	Automotive industry	nvt	Providing visibility, flexibility and maintainability	Conceptual
Schuh, G., Potente, T., Kupke, D., Varandani, R., Wagner, C., Nyhuis, P.	<i>An evolutionary approach for global production network optimisation</i>	2012	Procedia CIRP	Model research/ presentation	All manufacturing	OptiWo tool	Cost optimisation	Computational
Wagner, C., Nyhuis, P.	<i>A systematic approach to analysis and design of global production networks</i>	2009	Production Engineering Research & Development	Model research/ presentation	All manufacturing	Global variant production system (GVP)	Cost optimisation and production-distribution strategy	Conceptual
Yuan, X., Low, J. M. W., Yeo, W. M.	<i>A network prototype for integrated production-distribution planning with non-multi-functional plants</i>	2012	International Journal of Production Research	Model research/ presentation	All manufacturing	Two-echelon network prototype (MIP model)	Cost optimisation and production-distribution strategy	Computational
Zhang, A., Lao, H., Huang, G. Q.	<i>A bi-objective model for supply chain design of dispersed manufacturing in China</i>	2013	International Journal of Production Economics	Model research/ presentation	Dispersed manufacturing in China	Bi-objective model	Cost and lead time optimisation	Computational