TUDelft

A review of Reverse Innovation:

From bibliometric analysis to a conceptual framework and future research directions

A thesis submitted in fullfillment of the requirements
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in
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Master Thesis

A review of Reverse Innovation: From bibliometric analysis to a conceptual framework and future research directions

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Declaration of Authorship

I, B.R. (Bas) Tijhof, declare that this thesis titled, "A review of Reverse Innovation: From bibliometric analysis to a conceptual framework and future research directions" and the work presented in it are my own. I confirm that:

- This work was done wholly or mainly while in candidature for a research degree at this University.
- Where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated.
- Where I have consulted the published work of others, this is always clearly attributed.
- Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work.
- I have acknowledged all main sources of help.
- Where the thesis is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself.

Signed: 

Date: ***August 20, 2020***

"As the world's economic centre of gravity continues to shift—and as new consumers continue to emerge—it's clear that the logic and business practices that drove yesterday's success won't drive tomorrow's"

— Ajay Banga

President and CEO, Mastercard

DELFT UNIVERSITY OF TECHNOLOGY

Executive Summary

A review of Reverse Innovation: From bibliometric analysis to a conceptual framework and future research directions

by B.R. (Bas) Tijhof

Abstract

This study reviews Reverse Innovation (RI) literature by analysing the conceptual, intellectual and social structure of the field. Furthermore, it proposes a comprehensive view of the structural associations amongst RI influencing factors, drivers, antecedents and practices. Bibliometrix R-package and VOSViewer software were used to conduct a bibliometric meta-analysis on 208 articles, obtained from ISI Web of Science and Scopus databases. Influential journals, institutions, scholars and trending articles in RI research were revealed. Concept co-occurrence identified three main sub-fields (a) Conceptual development of RI, (b) Sustainable Dimension of RI, (c) RI for healthcare. Through content analysis of these sub-fields, conceptual conflicts were identified and solved. Based on this content analysis a conceptual framework was proposed which has structured influencing factors and relations to the RI process.

Keywords: *Reverse Innovation, Bibliometric Analysis, Drivers, Antecedents, Conceptual development, Conceptual Framework*

Overview

The expression 'Reverse Innovation' was first created by Immelt, Vijay Govindarajan, and Chris Trimble, 2009 and later popularised by Vijay Govindarajan, Kopalle, and Danneels, 2011. It stemmed from a concern that established multinational corporations (MNCs) will lose market share due to increased global competitiveness and an inability to innovate for customers with diverse and resource constraint needs. 'Reverse Innovation' (RI) is the idea that innovations are best developed through creating and scaling them in emerging markets with lower entry barriers, lower risks and a greater market base (BoP) to then seek market adoption back in the developed market (Corsi and Di Minin, 2014).

This type of innovation approach provides solutions to various societal and business issues. First, it entails an approach directed at currently excluded customers with low incomes in emerging markets. Secondly, it provides an approach towards sustained competitive advantage for MNCs as they are able to access markets with new and large amounts of potential customers. Thirdly, it develops knowledge on how to innovate in resource-constrained environments which can subsequently be used in developed markets.

Interest in RI has steadily risen since 2009. As a consequence, a vast body of literature has addressed a broad array of attributes related to the topic. Yet, no studies have reviewed and analysed from a visual and objective perspective the structure of the field. This makes it difficult for researchers to have a proper overview of the literature and see relations between various developments or identify future research possibilities.

Strengths and limitations of this study

- This study provides insight into the structure of reverse innovation literature by analysing a large amount of literature using bibliometric data
- This research may help scholars in identifying new research directions or research topics. For reverse innovation, this research suggests that research towards specific strategies, conceptual clarification and reverse innovation in other contexts could provide valuable contributions.
- This study contains a conceptual framework which has collated drivers, antecedents and consequences of reverse innovations which can be used as a best-practice approach for managers.
- However, the framework has not been validated with empirical research.

Although the value of RI is apparent, MNCs have experienced difficulty when trying to develop a RI initiative. They can be aided by an overview that indicates what factors and practices lead to successful RI.

Therefore this study aimed to examine and interpret from bibliometric and visualisation analysis the intellectual, social and conceptual structure of the field. Subsequently, through content analysis of relevant publications, it provides a conceptual framework which integrates the steps that lead to RI and it's antecedents, drivers and potential consequences. The main research question under investigation was: *Based on bibliometric analysis, how has the research landscape of RI structurally evolved and based on key publications on RI performance, how can RI drivers,*

antecedents and practices be integrated into a conceptual framework?

Data, Methodology and Analysis

Visualisation techniques based on bibliometric data are helpful in obtaining an overview of the literature on complexly interrelated topics like RI. The first step in the study was obtaining relevant publications on RI. This study has used the ISI Web of Science and Scopus as bibliometric databases. They were found to be most comprehensive and provided a wide array of publications related to the topic. As these databases use different data structures and files, a merging procedure was developed in Rstudio, which also removed duplicate publications. This resulted in a data set of 208 publications related to RI.

After reviewing the various available bibliometric software, the choice was made to use Bibliometrix R-package for the extensive suite of bibliometric tools it contains and VOSviewer for its visualisation possibilities.

Citation analysis is one of the main fundamental technique used in bibliometrics. It shows the structure of a research field through the connections between nodes (e.g. authors, papers, journal), while the edges—the linkages between them— can be separately represented depending on the type of analysis.

This study has performed bibliographic coupling analysis, keyword co-occurrence analysis, direct citation analysis, co-authorship analysis, and co-citation analysis through Bibliometrix R-package. These provide information on the intellectual and social structure of the field. This means they provide information on key journals, research communities, research streams, most influential publications and most influential scholars. Through visualisation techniques, this data can be represented on maps and show on the basis of similarity between the publications how they relate to each other.

Concepts were extracted from titles, keywords and abstracts of the publications, and a visualisation of the most important concepts was created. This provided information on the conceptual structure of the field. A conceptual structure map (concept co-occurrence map) is used to understand the topics covered by authors (the so-called research front) and to identify important and recent scientific issues. This concept co-occurrence analysis was performed and visualised with VOSviewer.

As bibliometric tools only provide quantitative data, content analysis has been used to give insight into the identified relations and structures. This content analysis was also used to develop a conceptual framework. For the framework, the content of articles with a citation count greater than 10 was reviewed. The identified factors that influence the RI process were structured into drivers, antecedents and consequences. Antecedents were defined as factors that cause RI while drivers enhance the progression of RI.

The drivers, antecedents and consequences were related to the following RI steps to visualise at what step they influenced the RI process. The steps also collate recent conceptual contributions made by previous scholars. The following steps provide a complete RI process and some key factors:

① The actor (any MNC) is attracted by a secondary market stimulus (i.e. untapped market), and strategically decides to offshore full or part of its Research and Development practices to that market to enter the market.

② The actor innovates specifically for that market through local growth teams with a high degree of autonomy and strong collaborations with domestic firms to meet specific secondary market needs. Consequently, the initial secondary market becomes the new primary market for innovation and initial diffusion.

③ The innovation is introduced in the new primary market and subsequently a market in the old primary market is identified for which the innovation characteristics appeal or would appeal through slight adaptations.

④ The introduction of the innovation in the new secondary market creates the 'Reverse Innovation' as the primary and secondary market have exchanged.

Results and Discussion

The bibliometric analysis has highlighted that RI literature is produced by a mixture of researchers from different backgrounds. Three major sub-fields were identified and will be briefly described.

1. Sub-field 1: Conceptual development of RI This sub-field researches the RI concept and has provided the most influential publications in the field related to the theoretical underpinnings and development of the field. The major author in this field is V. Govindarajan.
2. Sub-field 2: Sustainable dimension of RI This sub-field researches how RI can provide increased sustainability performance and how the term can be associated with other low-cost innovations. The major author in this field is Y. Bhatti.
3. Sub-field 3: RI for healthcare This field researchers how policies and management in EMs can be used for healthcare practices. The major author in this field is M.Harris.

Vijay Govindarajan and Ramamurti, 2011, M. Zeschky, Widenmayer, and Gassmann, 2014 and Agnihotri, 2015a are the articles that have shown the most consistency in citations and have received the most amount of citations within the field. These articles can thus be used to gain the most important knowledge of RI literature.

M. Zeschky, Widenmayer, and Gassmann, 2014 is the most influential and highly cited publication describing how MNCs should organise for RI. This article is thus important for managers.

The bibliometric analysis also indicated that although some collaboration exists, a lack of communication and accord among and within the sub-field has created misunderstandings regarding the explanation and usage of the RI concept.

Researchers who study RI related to *healthcare* adopt a different meaning for the term. Healthcare researchers use RI to describe a reverse flow of knowledge and ideas. Meaning that RI for healthcare research studies the value of using EMs organisational practices and human management in DMs. Therefore these studies are focused on reversing *ideas and policies* while the industrial domain (conceptual development field) was found to focus on the reversal of *innovations*. This study has concluded that how RI is used in healthcare research is not in line with the conceptual elements that determine the RI process. This is primarily because during RI the intellectual property of the innovation should remain constant. Meaning that and innovation is not transferred between different companies. Therefore, the RI process occurs within the organisational boundaries of an MNC. Furthermore, RI should lead to value creation for both emerging and developed markets.

This research also identified a conceptual conflict within the managerial/industrial domain describing RI as either a phenomenon or a strategy. Through content analysis and identification of the antecedents, drivers and consequences of RI, this study has found that distinctive patterns in the decisions leading to RI can be identified and thus proposes to refer to RI as a strategy in future research.

The antecedents, drivers and consequences of RI were integrated into one conceptual framework (see fig. 6.2).

Recommendations and Advice

The advice for scholars is to use the concept of RI correctly in future research. The study proposes that RI in healthcare should use the term "reverse knowledge transfer" instead of "reverse innovation". This will aid in clarifying the concept and prevent future conceptual entanglement. Furthermore, this research has identified that RI is an umbrella strategy (Mintzberg and Waters, 1985), as it originates in constraints and leadership creates a certain vision for the company by defining strategic boundaries and targets which enables others to respond accordingly with their own strategies and practices. Future studies should, therefore, refer to RI as an umbrella strategy and not as a phenomenon.

Future research efforts should focus on empirical/practical research aiming to develop strategies that lead to RI. Other topics are researching RI in other contexts, for example from a secondary EM to a primary EM. For instance from Vietnam to China. No research has been found that studies this type of reversal and it would provide a valuable contribution.

If managers want to develop a RI initiative I advise them to analyse the framework proposed in this report. It provides a comprehensive integration of current knowledge regarding RI and the factors that influence successful development. It is a good starting point for analysing the necessary measures which need to be in place for RI. The framework provides a best-practice approach to RI and can be used accordingly.

Preface

Dear Reader,

The paper before you indicates the conclusion of my educational time at Delft University of Technology. I can honestly say that this final chapter of my academic education has not quite been what I had expected it to be.

When the COVID-19 pandemic struck the world at the start of this year, our society was disrupted and challenged immensely. . Affecting business practices, our educational system, our working environment and even the way we do our groceries. To graduate in such a time has been both challenging and very educational in a personal and professional manner.

The basis for this research originally stemmed from my interest in achieving sustainability with the aid of technology. As the world moves further into the digital age, supporting emerging markets to catch up is of vital importance for global progression. But the influence of multinational corporations in achieving this goal is often underestimated. When I came across the concept of reverse innovation, I realised that this concept has the potential to be beneficial for both developed and emerging markets but more importantly to close the gap between them. But how could I aid in the development of this concept and especially in a way that would aid firms to develop a reverse innovation initiative? It was my goal for this thesis to not only find out but to develop tools to break down barriers and enhance our knowledge of the concept.

I initially set out for a more strategic approach to reverse innovation. But as the COVID-19 restrictions did not allow for a thorough strategic study, I had to alter my plans towards a more bibliometric and scientific approach.

In truth, I could not have achieved this thesis without a strong support group.

To start, I want to thank my first supervisor *Zenlin Roosenboom-Kwee* who has been a very solid and inspiring guide for me during this time. She has put up with my ups and downs and listened to many of my topic related ramblings. With her experience and knowledge, she has been able to keep me focused on the 'red thread' of this research, a task that must have been quite challenging. She has guided me in towards the right directions and I have been encouraged by the level of attention she has given me and my work in these unprecedented times. Second, I want to thank my chair of the commission *Cees van Beers* who introduced me to concepts of frugal and reverse innovation. He has always been supportive and positive, which has been motivating and helpful. When things were unclear you had a way of explaining things with the greatest ease. I would also like to thank *Martin Sand*, for his efforts towards my reporting and his reflections upon the important points of discussion of this thesis. Thank you for the the support you have given me and your sense of detail. Also, I would like to acknowledge CWTS Leiden and especially *Nees Jan van Eck* for assisting me through some of the bibliometric analysis obstacles. I would also like to thank *Suzanne Kamp* who has been kind enough to help me with the organisational issues that have come up during this pandemic.

To my fellow students at Management of Technology, *Tijs Ziere* and *David van der Meer*, I would like to thank you for your support and inspiration. I cannot express how much you have helped and challenged me during my master's degree and I will not forget our level of commitment and fun in and to "Project Ruimte1". Being able to graduate together in the same week makes me proud and is the figurative "cherry on the cake" after two long years of studying.

Lastly, I am touched by the love and support I have had from my friends and family, especially my parents and sister. Finally, my thanks to my talented and understanding girlfriend Laura, who has been my "rock" during this period.

Thank you all for the unwavering support.

— Bas Tijhof

August 20, 2020

Document Format

This document has been coded with LaTeX, to aid readability I have coded some reading features into this document which will be visible when reading in PDF format.

Therefore, selecting text highlighted in Teal, will redirect the reader to the document elements (sections, figures, etc.) which are being discussed. Text highlighted in Grey are links to the citations used in this thesis and will redirect the reader to the bibliography where the corresponding citation can be found. Finally, text highlighted in Light Blue are hyperlinks (URLs) which will open the personal internet browser where information on that person or institution can be accessed.

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List of Operational definitions

Several concepts are used widely throughout this thesis. To avoid ambiguities the following operational definitions are used for the concepts highlighted.

Developed country/market/economy (used interchangeably)

Developed refers to those declared as *high-income* by the World Bank Country Classification. For the current 2020 fiscal year, high-income countries are those with a GNI per capita of US$12,376 or more (Bank, 2020).

Developing country/market/economy (used interchangeably)

Developing refers to those declared as *low-income* and *lower-middle income* by the World Bank Country Classification. For the current 2020 fiscal year, low-income is defined as those with a GNI per capita — measured adopting the World Bank Atlas methodology — of US$1,025 or less in 2018; lower middle-income are those with a GNI per capita between US$1,026 and US$3,995 (Bank, 2020).

Currently the World Bank no longer distinguishes between 'developed' and 'developing' countries in the presentation of its data, finding the two-category distinction outdated (Bank, 2016). However, for the ease of writing and due to the terms being adopted throughout reviewed literature it has been adopted in this thesis.

Emerging country/market/economy (used interchangeably)

Emerging refers to a subset of developing, however it highlights those with elevated levels of economic development, combined with rapid industrialisation. Emerging often highlights those with unprecedented growth in the industries of energy, technology and communications. They deviate from developing countries as they no longer predominantly rely on agriculture and have achieved impressive growth in infrastructure and their GDP. (Bank, 2019). They are characterised by institutional voids, the relative importance of informal compared to formal institutions, institutional pressures by local governments, as well as institutional change and transitions (Rottig, 2016).

Technological Innovation

"An iterative process initiated by the perception of a new market or new service opportunity for a technology-based invention which leads to development, production, and marketing tasks striving for the commercial success of the invention." (Christopher Freeman, 1989, p. 307).

Innovation flow

The concept of innovation flow indicates that the principal locus of the innovation changes during the innovation process, while the core concept of the innovation stays virtually unchanged (Von Zedtwitz et al., 2015).

Process

Refers to a chain of routines, skills, and integration mechanisms defining resource allocation and decision- making procedures that have to be managed (Bitar and Hafsi, 2007)

New Product Development

New product development is the task of collecting knowledge, combining the knowledge collected, and making it work with the objective of creating new things in a similar way to the approach followed by a scientific research team and is a source of innovation in an organisation (Vila and Albiñana, 2016).

Market saturation

Saturation of the market is a condition that occurs when the volume of a good or service has been maximised in a market place. A business can only achieve more growth at the point of saturation through new product innovations, through taking established market share from rivals, or through growing customer demand.

To

Henk and Anita Tijhof

For providing me with this opportunity

Chapter 1

Introduction to the study

"Innovation knows no geographic boundaries"

— William D. Green
Executive Chairman Accenture

Chapter overview

This report is intended to provide an overview of the process and findings of this MSc. thesis project: a bibliometric analysis of the scientific field of reverse innovation and a conceptual framework. This introductory chapter describes the motivation of this study and the approach to answer the identified research problem. Objectives are described and the value of possible outcomes are highlighted.

› The first section, Section 1.1, is a general introduction to RI and this research. Section 1.2 discusses the current issues with RI literature for which this research aims to find solutions. Subsequently, Section 1.3 explains the research objective, questions and deliverable of this research. Lastly, the general structure of this thesis is described and visualised in Section 1.4.

1.1 Introduction

Multinational corporations (MNCs) are increasingly challenged by market stagnation, market saturation, economic instability, innovation inefficiency and recessions in developed economies. Simultaneously, the economic rise and growing untapped customer base of emerging economies like India, Africa, Indonesia, Brazil, China, and Mexico are becoming increasingly attractive for business practices. This has resulted in MNCs to perceive these emerging economies as principal locations for future expansion and new possibilities (London and Stuart L. Hart, 2004).

The traditional approach to entering these 'markets of the future' is to develop cheaper, slightly altered solutions for customers participating in the formal economy. However, with products and business models comparable to those of developed economies, this approach targets exclusively the most wealthy consumers in emerging economies (Prahalad and Lieberthal, 1998). This approach apart from not generating the desired innovations also ignores the largest portion of the population in these economies, described as resource-constrained customers found at the bottom-of-(*economic*) pyramid (BoP). With 2.7 billion people living on no more than two dollars a day the growth opportunity for MNCs lies in turning the poor into consumers (Giles, 2019).

However, BoP consumers have entirely different needs and demands, as they value mostly simple, reliable, cost-effective products suited to cultural and local specifications. Trying to capture the value in these markets, MNCs have started to develop innovations which are suited to emerging market demands and needs. This has resulted in the development of various new innovation types, for instance, *frugal* (M. Zeschky, Widenmayer, and Gassmann, 2011) and *good-enough* innovations (Gadiesh, Leung, and Vestring, 2007). But as some of these innovations offer great performance for their cost, these innovations are seen to gain traction and find customer segments in developed economies. This process, where products which are developed and adapted solely to emerging markets demands and needs, to gain attraction from and subsequently enter developed markets is called *Reverse Innovation (RI)* (Vijay Govindarajan and Chris Trimble, 2012; Immelt, Vijay Govindarajan, and Chris Trimble, 2009; Vijay Govindarajan and Ramamurti, 2011). Visualised in Figure 1.1, RIs are innovations specifically designed for emerging markets (EMs) which subsequently trickle back to developed markets (DMs).

Examples of RI have only been visible in the global marketplace recently but can be found across numerous industries and geographies. The most well known is General Electric's (GE)– MAC 400. The company used to sell electrocardiogram machines (ECGs) — used for detecting heart problems — for 10,000 dollars in the United States. The eight kilogram weighing machine

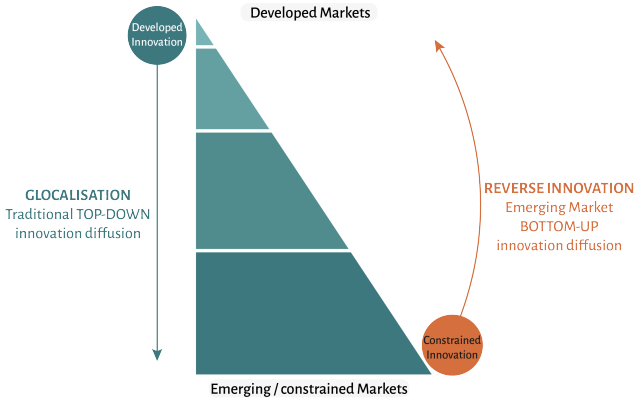


FIGURE 1.1: Schematic of Reverse Innovation

Source. http://www.ge.com/innovation/2008/index.html

FIGURE 1.2: General Electrics MAC-400 ECG

took 5.4 million dollars and three and a half years to develop. The machine was difficult to operate, bulky and 90% of Indian hospitals could not afford it, leaving a large number of potential customers unserved in markets where GE was not yet present.

So GE initially set out to develop a compact, portable and cheaper ECG machine to provide health services for rural areas and for those who could not afford expensive health care. To achieve this they had to go from the old ECG machine to a one and a half kilogram weighing device that could be carried with one hand and purchased for only $1500 and at a fraction of the development costs. They achieved what was perceived as impossible and the MAC 400 was GE's first portable ECG developed in India and fit for local market demands (see Figure 1.2). The device was a major success and created a tremendous growth opportunity for GE in India. The product gained such attention that also DMs were interested in the device and perceived applications in ambulatory healthcare. GE subsequently launched an improved and slightly altered version for the DMs later that year and currently sells the MAC-800 in 120 countries worldwide (Trimble and Govindarajan, 2012).

Acknowledging EM opportunities and potential, RI has in recent years received notable attention from scholars and practitioners in a wide array of disciplines as it provides solutions to various global business and societal issues.

Apart from market saturation, MNCs are also experiencing a reduction in innovation efficiency (Scannell et al., 2012; Hall et al., 2018). Meaning that to maintain a certain degree of innovation output, MNCs have to use increasingly more resources despite technological advances which were expected to lower innovations costs. This notion is commonly described as *Eroom's law* (Moore's Law backwards) — where improved price performance due to technological advances are outweighed by increasing costs of regulatory approval and other commercialisation costs (Scannell et al., 2012).

As innovation processes in DMs have become increasingly inefficient due to increased safety, regulatory and marketing costs, MNCs experience an amplified difficulty to innovate. This leads to higher innovation costs and more expensive products increasingly excluding customers with less incomes.

On that account, the value of EMs for innovation processes is twofold. First, they do not have strict rules and regulations and thus provide opportunities to have better innovation outputs for local and constrained demands at lower costs and lesser risk. Second, MNCs can learn how to innovate in resource-constrained environments after which they can transfer these practices to the developing world to meet the increasing constraints they are subjected to there and to meet the demands of a wider customer base.

Furthermore, income inequality is increasingly becoming apparent in EMs and DMs (OECD, 2019, p. 99). This means that a large proportion of our global society's needs are not met in our current innovation system. Innovations are targeted only towards the top of the economic pyramid, excluding individuals and large customer segments around the world. This not only raises inequality issues but also prevents the closure of the wealth gap and the participation in our global economy. However, these excluded market segments also provide tremendous growth opportunities due to the vast amount of people they posses.

MNCs are also becoming increasingly threatened by EM firms (Suresh Malodia, Shaphali Gupta, and Anand Kumar Jaiswal, 2019). As EM firms are capable of developing innovations suited to constrained needs these firms have been shown to grow rapidly. These capital enriched EM firms subsequently acquire DM firms as they want the capacities to enter DMs. This leads to DM firms being challenged by EM firms who have better global reach and are better equipped to satisfy needs at all levels of the consumer pyramid.

These challenges, summarised in Figure 1.3, can be faced through the adoption of RI initiatives and practices. But while the possible advantages of RI are appealing, MNCs attempting to induce RI encounter several obstacles. RI requires alteration of organisational structure and culture, risk-taking and has the potential of cannibalising own products (Vijay Govindarajan and Ramamurti, 2011; Trimble and Govindarajan, 2012; Hadengue, Marcellis-Warin, Zedtwitz, et al., 2017).

While these issues may currently prevent global adoption of RI, the opportunity to harness RI capacity increases the probability that MNCs will succeed (Vijay Govindarajan and Chris Trimble, 2012; Immelt, Vijay Govindarajan, and Chris Trimble, 2009; Vijay Govindarajan and Ramamurti, 2011; Von Zedtwitz et al., 2015). As innovative ideas for satisfying these basic demands are turned into compelling innovations, EMs are growing into innovation hubs. MNCs therefore increasingly acknowledge that to sustain their competitive advantage, a truly global strategy must encompass intelligent pathways to EMs, as they promise the richest future growth and will bring competitors of the future (Suresh Malodia, Shaphali Gupta, and Anand Kumar Jaiswal, 2019).

Reverse innovation is an approach to innovation which may provide ways of accessing EM customers by adequately addressing their needs through utilising human capabilities present in these markets. But before MNCs will adopt this type of innovation approach, a thorough understanding of the concept and process is necessary. While RI holds a lot of promise, there are barriers and challenges that need to be faced and tackled in order for RI to develop further.

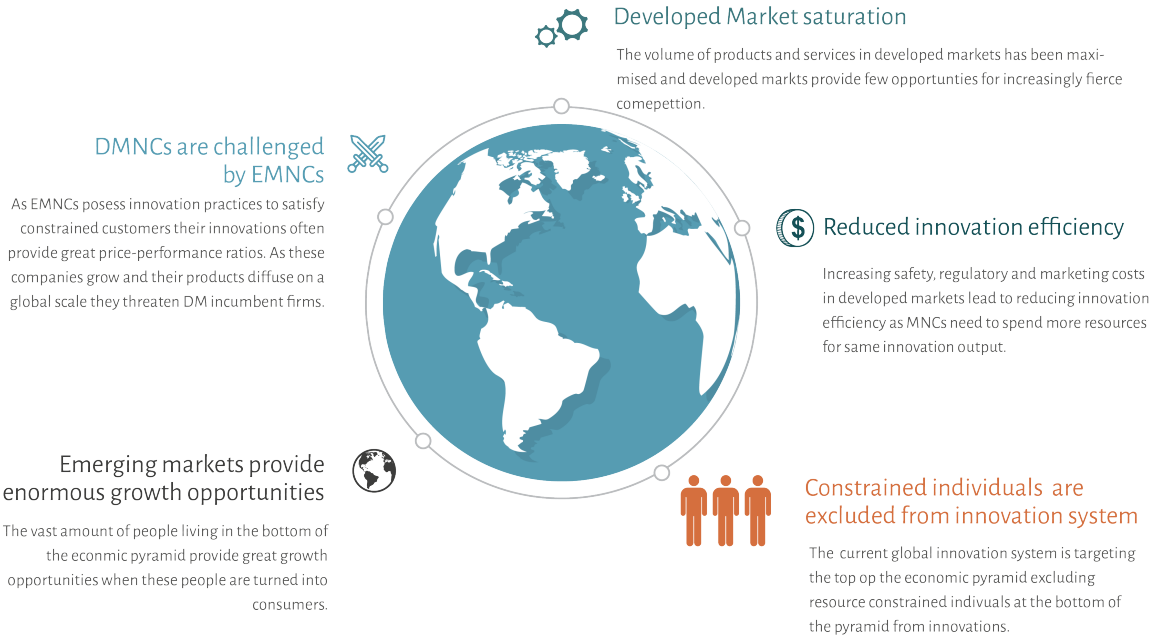
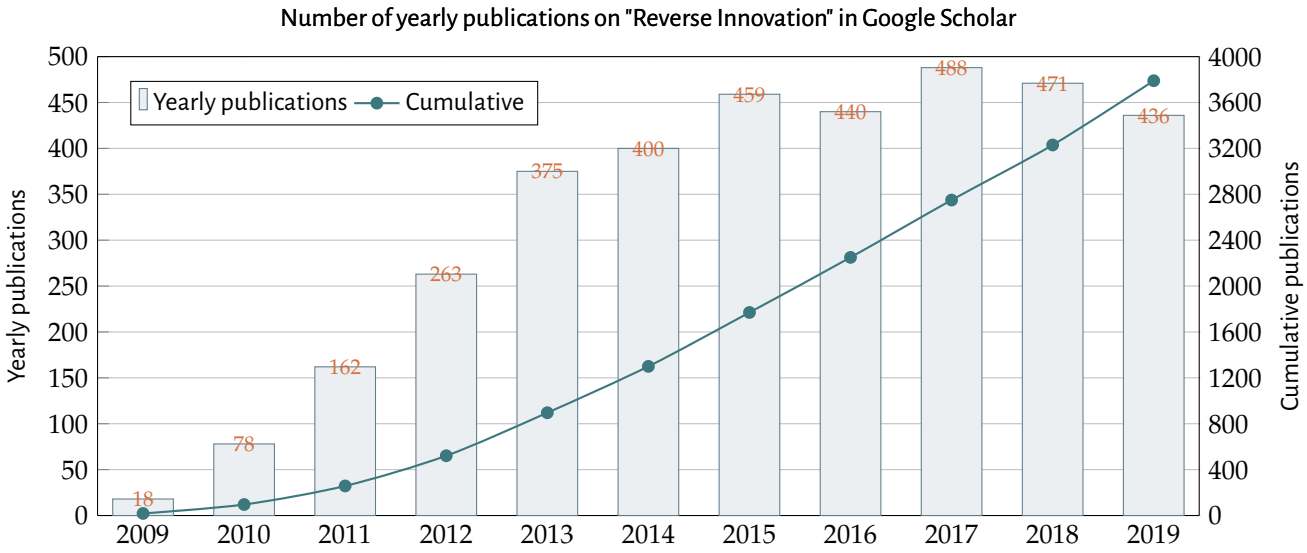


FIGURE 1.3: Challenges for which RI could provide solutions

1.2 Research Problem

The concept of RI has secured itself in scholarly discourse at a fairly fast pace. Immelt, Vijay Govindarajan, and Chris Trimble first described the term in 2009 and it remained virtually unknown with only 18 entries on Google Scholar that year. But not surprisingly, the new possibilities, demands and obstacles connected to RI have spurred great research interest in the topic. Scholars and practitioners have been sharing findings, practices and opinions in the literature across multiple disciplines. Increasing the number of relevant publications on the topic to 3,790 at the end of March 2020. But as Figure 1.4 displays, the scholarly interest for RI has fluctuated and less publications have been produced in recent years. This can be due to various reasons of which the following are most prominent.

First, a RI is a rather new concept, a consensus of what it precisely encompasses has to date not been reached. Hitherto, most scholars have centred on understanding and describing the concept while pointing to its relevance for firms and the potential in EMs as well as for DMs (e.g. Janda, Schuhmacher, and Kuester, 2018; Borini, Costa, and Oliveira Junior, 2016; N. Xu and Y. Xu, 2016; Corsi and Di Minin, 2014; Reinhardt, Gurtner, and Griffin, 2018). Throughout this thesis RI is described as a theory, phenomenon, scientific field and innovation approach, displaying the different ways the literature refers to RI and how dispersed the concept currently is. The literature on RI is evolving but still remains fragmented with various scientific disciplines trying to specify the necessary conditions of RI and developing an operationalisable definition (Malodia, Gupta, and A K Jaiswal, 2019).



Graph depicting the number of yearly publications with the keyword "Reverse Innovation" and the cumulative amount of publications.
Note. Constructed with data obtained from Google Scholar on (01/04/2020)

FIGURE 1.4: Graph of yearly publications on RI

However, the studies debating and theorising the concept of RI have been limited (Vijay Govindarajan, Kopalle, and Danneels, 2011; Von Zedtwitz et al., 2015; M. Zeschky, Widenmayer, and Gassmann, 2014; Hadengue, Marcellis-Warin, and Warin, 2017). First, due to the newness of the concept, both conceptual and empirical research on the subject is mostly descriptive, trying to understand and develop a theoretical foundation. Also, the limited availability of RI evidence results in the literature being anecdotal and unsatisfactory in describing the underlying dimensions of RI to define it as a construct[1] (Malodia, Gupta, and A K Jaiswal, 2019; Nanami Furue and Yuichi Washida, 2014). Making it difficult to develop a sound and reliable theory for practice.

To develop such a theory for practice scholars must first understand the various contributions that have been made and how the main concepts in the field are related and structured. Creating an overview of these relations and structure will aid to deepen our knowledge of the root causes and processes of RI. Furthermore, there are clear relations to other terminologies and phenomena mentioned in the literature, but how these relations are structured and which are most prominent remains simply unclear. This induces the following problem.

Problem Statement 1: RI research has seen less publications in recent years creating a need to analyse and review RI literature to identify the structural associations between the main concepts in the field and to identify research streams guiding future studies for knowledge development.

One could question the motivation behind this study, as these structural overviews can be made at any time. So why now? The main reason is that studies reviewing the structural associations of RI literature are simply nonexistent. When linkages between research are not identified research can be cyclical (J. D. Daniels, 1991). Taking a step back to reflect and analyse the evolution of scholarly research can, hence, be beneficial and necessary for the progression of the field.

Furthermore, most studies on RI have been qualitative. Quantitative techniques are sometimes crucial to present the facts in a more specific and definite way. The outcomes drawn numerically through quantitative literature analysis techniques are often more objective and allow for more generalisations than those obtained qualitatively. Structuring this quantitative data in an intuitive way and identifying most influential scholars, publications and journals should aid managers and practitioners alike (J. Daniels and Thistlethwaite, 2017). Identifying and analysing the field and its relations will also aid in keeping future research relevant (J. D. Daniels, 1991). Therefore, a study investigating the theoretical base, shape, relations and concepts of RI in the mirror of scholarly discourse and publications is needed for further development of the field and to address current research development.

When further assessing current literature, studies fail to present RI from the perspective of business. Meaning that MNC willing to endeavour in RI, have no clear framework based on literary findings which they can follow. Currently it remains unclear how

[1] An idea or hypothesis that incorporates various philosophical elements, usually one that is considered theoretical and not based on empirical proof.

MNCs should organise for RI, what factors lead to inducing RI and if these are market or industry specific. Developing a framework describing current knowledge on conditions and circumstances for RI is important as it provides value in two ways. First, firms can understand how to intentionally harness RI and can follow the framework to develop a RI initiative. Second, When such a framework would be present, empirical studies could further develop and enhance the framework and thus the concept. Therefore, the following research problem emerges.

Problem Statement 2: There is a lack of knowledge concerning the conditions and circumstances at which RI occurs or is induced and how these differ among EMs.

Prior studies on RI have neglected to distinguish whether RI occurs "as a consequence" or as "an aim to be pursued." (Nanami Furue and Yuichi Washida, 2014, p. 1). Present literature mostly describes RI as a phenomenon or as a consequence of circumstances. But for global adoption of RI and for MNCs to benefit from RI it is important that they are able to 'induce' RI. In order to tap into the potential of RI, scholars should aid practitioners in how to organise for the development of RI.

Furthermore, publications that have studied factors influencing RI have disregarded geographical effects. Instead of considering RI as a phenomenon affected by different EM characteristics publications have merged all factors. Assuming that all RIs from different EMs and industries share the same characteristics and thus RI factors and antecedents are the same across the globe and industries. However, no evidence or argumentation for this assumption is present in current scientific literature. Moreover, various publications identifying these factors use only a small number of case studies in similar empirical contexts (e.g. Corsi and Di Minin, 2014; Tournois, 2016) which reduces their construct validity and external validity.

Therefore there exists a gap in present RI literature that classifies and structures factors influencing RI based on EMs. Meaning scholars should aid business decision-makers developing a business strategy for RI by reviewing what factors are influential across all markets and what factors are market-specific and present them in an intuitive manner.

1.3 Research Objectives and Questions

Based upon the above, it becomes clear for research to be carried out which addresses the problems identified in Section 1.2. To summarise: an issue hampering further RI development is the lack of overview of the RI research landscape. Furthermore, to aid inductive RI and for the future development of RI practices, the antecedents and factors of RI and their relation to EMs need to be identified. Therefore, the overarching objective of this study is twofold:

The objectives of this study are to [1] **examine and interpret from bibliometric and visual analysis the intellectual network structures, evolution, significant studies, influential scholars, notable topics and the recent trends in the literature on RI** and [2] **to develop a conceptual framework for RI drivers, antecedents and practices that regards the emerging market of origin.**

Thus, in addition to disentangling the structural associations and the development of RI over time, a meta-goal of this thesis is to position RI in a more firm-integrated perspective. Put in another way, to identify the factors and antecedents connected to the practice of RI in a conceptual framework. Such a conceptual framework could further explain the concept and its practice and more importantly, open a pathway for empirical studies.

Currently, there is no research on the intellectual structure and gradual development of literature on reverse innovation. Therefore, an exploratory research methodology is best suited to fulfil the objective of this study as it aims at forming a foundation for future theory and hypothesis building (Sekaran and Bougie, 2016). By conducting this type of study, future research efforts can be directed to areas worth pursuing, thereby saving time and other resources (Pillai and Kaushal, 2019).

There are various types of literary analysis and methodological approaches to achieve this. These have been visualised in Figure 1.5.

Two methods can be used for the literary review. *Subjective* or (bottom-up), dependent on a qualitative analysis. This is achieved by analysing and assembling large quantities of literature and offering a scholars interpretation (Jesson, L. Matheson, and Lacey, 2011).

The *objective* or (top-down) approach uses bibliometric analysis, which is characterised as a quantitative research method. The focus is on the collection of numerical data, the description of such data and the interpretation of the results (Pillai and Kaushal, 2019). This type of analysis has not yet been done for RI literature. Both approaches hold advantages and disadvantages and often a combination of the two provide the best results (J. Daniels and Thistlethwaite, 2017; Acedo and Casillas, 2005).

Bibliometric and visualisation analysis is an appropriate methodology for the first objective of this study since these approaches present often useful and objective insights into "influence and specialisations" of scholars and into "processes of knowledge dissemination" (Raan, 1988). Therefore, surpassing subjective scholarly notions. For the second objective of this study, a content analysis will be used as the objective is to comprehend the dynamics of RI performance.

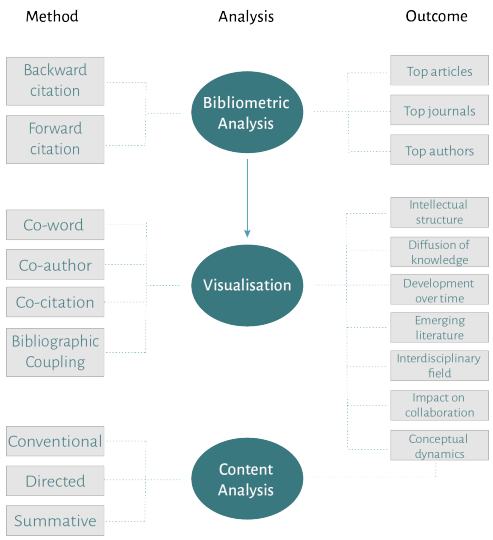


FIGURE 1.5: Literary Analysis Types

In acknowledgement of the above, the main research question guiding this research is:

Main Research Question

Based on bibliometric analysis, how has the research landscape of RI structurally evolved and based on key publications on RI performance, how can RI drivers, antecedent and practices be integrated into a conceptual framework?

Therefore, this research is grounded in content, bibliometric and bibliometric visualisation analysis. To analyse the structural associations and evolution of main concepts in RI literature and for identification of research streams, trends and influential scholars and institutions bibliometric analysis and bibliometric visualisation analysis will be used. As such this can be broken down into two corresponding sub-questions:

Sub-question 1: What are the key journals, influential institutions, most productive scholars, impactful and trending articles in Reverse Innovation research based on bibliometric analysis?

Sub-question 2: What are the structural associations among RI literature, and how do they relate based on bibliometric visualisation analysis?

Bibliometric analysis is an appropriate methodology for the first sub-question and visualisation techniques based on bibliometric data are useful for obtaining an overview of the literature and provides a more intuitive way of viewing current literature, making it more accessible for firms wanting to develop a RI initiative.

Answering these sub-questions will provide the knowledge to answer the first objective of this study. To answer the second objective of this study the following question needs to be answered:

Sub-question 3: What are the key drivers and antecedents for RI and if applicable, how do these differ based on their emerging market based on content analysis of key publications on RI performance?

Using the knowledge derived from the bibliometric analysis and bibliometric visualisation analysis, key papers on RI performance should be identified. Through a content analysis of these papers a conceptual framework can be developed which identifies and structures interrelating drivers and antecedents for RI, regarding potential differences between EMs. This is done for two reasons. First to show the usefulness of the bibliometric and visualisation analysis and how their outcomes can be used for subsequent research endeavours. Second, to evaluate the assumption that drivers and antecedents are the same regarding different EMs.

1.4 Thesis Structure

To achieve the objectives of this study and to answer the research questions this thesis follows the common structure for scientific research. The complete structure of this thesis and where specific information is found is presented in Figure 1.6.

This chapter, **Chapter 1**, has defined the research problem, objectives and questions to be answered through this study. The following chapter, **Chapter 2**, reviews relevant literature and provides the conceptual evolution of RI, related innovation types and the rationale for the research interest in RI highlighting the sustainable dimensions. **Chapter 3** discusses theory on quantitative and qualitative reviews substantiating the methods used in this study en relevant theory. It introduces concepts in bibliometric analysis and discusses the databases and software (Bibliometrix and VosViewer) used in this study. **Chapter 4** describes the orderly procedure used to collect and analyse the data obtained from the ISI web of science and Scopus. First, data was collected and files were merged through coding to create data files which would provide all relevant publications and which could be used for the adopted software. This chapter also provides an initial descriptive analysis of the collected data.

This literary data was then used for for the primary bibliometric analysis, found in **Chapter 5**. This chapter provides the most relevant publications, journals, scholars, countries, years, keywords and institutions. This chapter thus presents who have shaped the field of RI and provides the answer to sub-question 1. Concept co-occurrence analysis is provided to identify conceptual overlays and conflicts. To obtain an overview of reverse innovation literature at the publication level, a first assessment of the relatedness of publications is provided. This is done by using bibliographic coupling and co-citation analysis. A clustering technique has been used to classify research clusters of closely associated publications. This clustering technique will present an overview of the literature into several research topics associated with reverse innovation. Collectively these types of analysis provide the answer to sub-question 2.

Chapter 6 provides the conceptual framework which relates the drivers and antecedents of RI into one figure. How this was achieved is discussed and what the benefits of this framework are for the development of RI initiatives. This chapter is based on content analysis and is thus qualitative in nature. It provides the answer to sub-question 3.

In the discussion of this research, found in **Chapter 7**, the findings are further interpreted, analysing and reflecting on what they represent. New understandings and insights concerning the problems described in this introductory chapter are discussed and evaluated.

Chapter 8 is the final chapter on this thesis and presents the answers to the research questions and how these answers have contributed to science. The implications and managerial relevance of this study are outlined and a conclusion is provided regarding the state-of-the-art on RI. Finally, the limitations of this study are described and related to future research directions that could further enhance our understanding of RI.

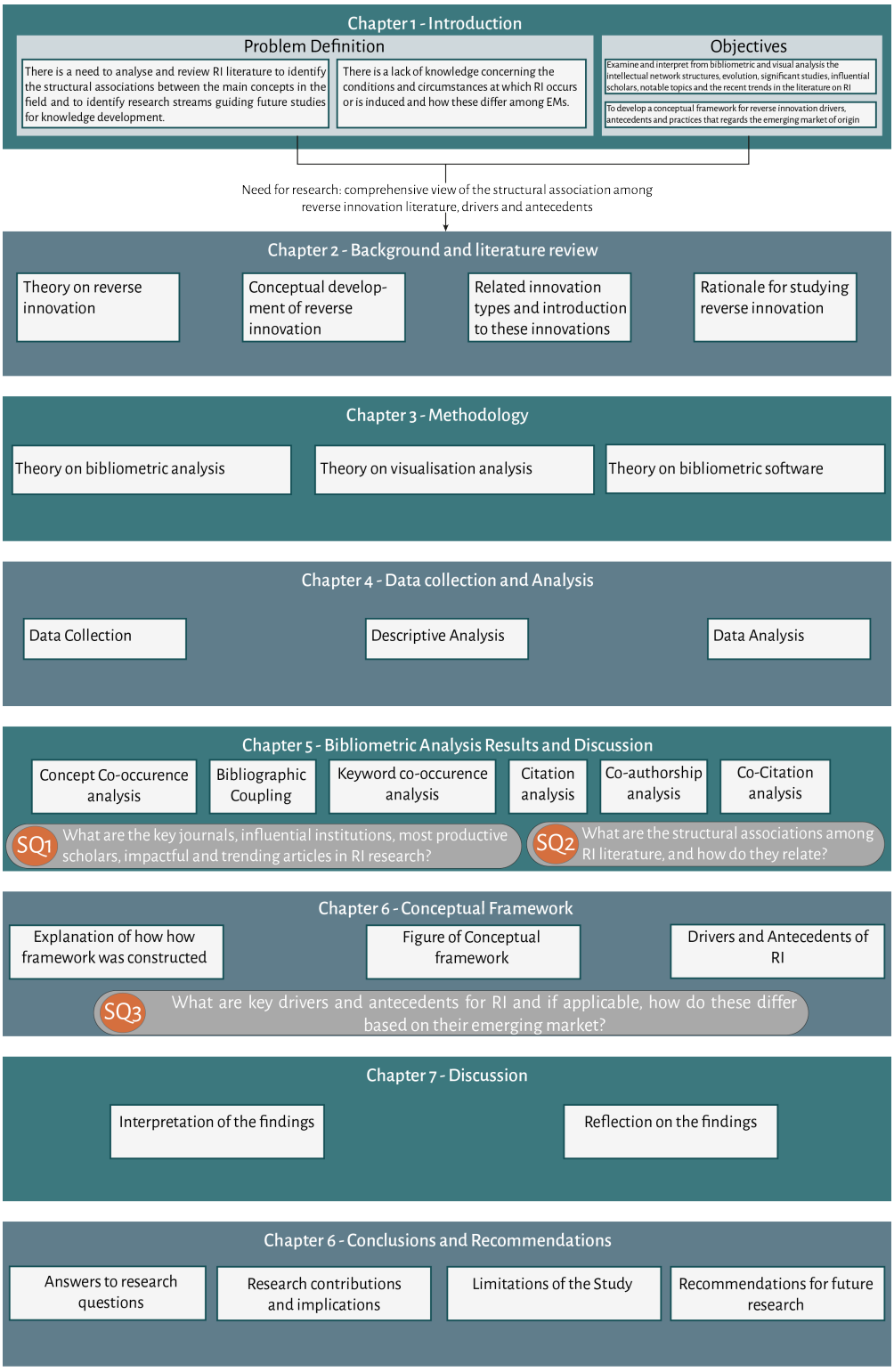


FIGURE 1.6: Thesis Structure

Following this introductory chapter is chapter 2, which provides a theoretical perspective on RI —- in particular its conceptual evolution and its market significance. Also in Chapter 2, the relations to other innovation typologies are highlighted which will be of importance when analysing the structural associations in the literature.

If relevant background knowledge on RI and bibliometric analysis is held please proceed to Chapter 5: Bibliometric Analysis Results: Current state of the scientific field

Chapter 2

Background & Literature Review: Understanding Reverse Innovation

"Innovation is bred from dissatisfaction"

—TK Kurien, CEO Wipro, India

Chapter overview

The findings of a study of current scholarly literature on RI are discussed in this chapter. This chapter aims to provide a background to the theory on RI and how the concept came into existence and relates to other innovation types.

› The chapter's structure is as follows. The first section, Section 2.1, begins by asking what is meant with 'innovation' and 'innovativeness'. Section 2.2 describes the conceptual evolution of reverse innovation. In Section 2.3, innovation typologies are delineated and theory on various innovation types related to RI is outlined. The similarities and differences between these innovation types and RI are discussed. Table 2.4 shows all typologies and their characteristics in one table, which can be used for later referencing. Finally, Section 2.4 describes why RI is of interest to scholars and practitioners and could become more important in the future.

2.1 Introduction: What Is Innovation?

Throughout the years, innovation has evolved to be the equivalent of development, technological advancement and an instrument for business success. Innovation is these days not just the 'creation of novelty' but also a cure for a broad range of issues. Resulting in the term 'innovation' being used in numerous arenas by policymakers, marketers, scientists and managers — not just as a purely scientific thought but also as a metaphor, political promise or catchword. The term innovation thus spans disciplines and research domains.

Scholars indicate they have started to understand the process of innovation development. But, innovation processes have to date been termed *'incremental'*, *'radical'*, *'discontinuous'*, *'imitative'*, *'breakthrough'*, *'disruptive'*, *'frugal'*, *'jugaad'* and, of course, *'reverse'*. In addition to these various given names for innovation, particular approaches based on scientific evidence have been suggested for each of these innovations. But how should scholars and managers differentiate among all these innovation types? Because what is the discrepancy between a jugaad innovation and frugal innovation? Are they reverse innovations or are related? Moreover, why is it important to distinguish and label all these innovations? The following sections highlight these issues. But first underlying theory is discussed.

In new product development (NPD) literature, numerous constructs and scales have been used to describe product innovativeness. This shortage of consistency in operationalising 'innovativeness' has led to the exchangeable usage of the constructs 'innovation' and 'innovativeness' to describe innovation types (R. Agarwal et al., 2015; Garcia and Calantone, 2002). Resulting in the irregular categorisation of innovations and uncertainty on what scientific studies actually observe (Garcia and Calantone, 2002; Klarin, 2019). No consistent delineation in the literature is present as to what is determined radical or discontinuous and even at what degree a product has a 'high' or 'low' degree of innovativeness. In light of this and future research, it is necessary to follow a clear set of working definitions.

2.1.1 'Innovation' explained

Innovation is often described as the development of novelty. Innovation is thus difficult to grasp as it contains all sorts of of 'newness' and the scope is almost all encompassing. Reducing the spectrum of innovation meanings, this thesis refers predominantly to 'technological innovations'. Christopher Freeman was the first to study technological innovations extensively and defined them as "An iterative process initiated by the perception of a new market or new service opportunity for a technology-based invention which leads to development, production, and marketing tasks striving for the commercial success of the invention" (Christopher Freeman, 1989, p. 307).

In this definition, two important traits can be recognised:

1. The 'innovation' process encompasses the **creation of an invention** *followed by* the **market introduction** of that invention to customers, succeeding adoption and diffusion. Stated otherwise, an invention must be introduced into the market for it to become an innovation (Garcia and Calantone, 2002; R. Agarwal et al., 2015).
2. The 'innovation' process is **by its definition iterative** and therefore encompasses the initial introduction of an innovation or the reintroduction of an improved innovation (Garcia and Calantone, 2002).

Technological innovations include inventions from the industrial , scientific, applied and pure sciences (Garcia and Calantone, 2002). The iterative nature of innovations was first described by J. M. Utterback and Abernathy, 1975 and the basic concept is that throughout an innovation process initial emphasis lies on product performance, then on product variety and eventually on product standardisation and reducing costs. Innovation can thus occur during development, manufacturing, marketing, adaptation and distribution. This iterative process therefore assumes different degrees of '*innovativeness*' which provides the basis for a variety of innovation types.

'Innovativeness' is commonly used as a measure for the level of *novelty* or *degree of change* of an innovation (Garcia and Calantone, 2002). 'Highly innovative' products are determined as having higher levels of *novelty* compared to existing products whereas 'low innovative' products are perceived as less novel compared to existing products.

However, what constitutes this 'high' or 'low' level and from whose perspective that is assessed is undefined. The majority of publications take the *viewpoint of firms* towards novelty, others use new to *the world* (Song and Montoya-Weiss, 1998), new to *the adopting unit* (Ettlie and Rubenstein, 1987), new to *the industry* (O'Connor, 1998), new to *the market* (Kleinschmidt and R. Cooper, 1991; Meyers and Tucker, 1989)and new to *the customer* (Atuahene-Gima, 1995). This relative nature of distinguishing novelty has led to the lack of progress in understanding the NPD cycle, because studies can not be compared across different analytical units (Garcia and Calantone, 2002). Despite the differing perspectives towards 'innovativeness' one consistency does exist, it is always described as a **degree of discontinuity** (see Table 2.1). Meaning, 'innovativeness' is a measure of the possible discontinuity that an innovation can create (Garcia and Calantone, 2002; Ghauri and Cateora, 2010).

Table 2.1: Categories for newness

Congruent innovation	Selling the same product, it is just new for that selected market
Continuous innovation	With the new multiple functions, the product becomes an alternative to the existing one
Dynamically continuous innovation	There is not just a new function or style added but there is also a technological alteration on the product
Discontinuous innovation	The product is completely new, did not exist before

Note. Reprinted from Pervez Ghauri and Philip R Cateora (2010). *International marketing*. McGraw-Hill Higher Education, p. 236

These discontinuities are perceived as shifts along technological, market, political and other frontiers and require different approaches for effective management (Day and Schoemaker, 2000; Leifer et al., 2000; Phillips et al., 2006).

It is key not to mistake innovation for *invention* — the finding of previously unknown things (R. Agarwal et al., 2015) as this definition does not allow for representing new ways of delivering products or commercialisation. While an invention can originate from any place, the innovation is commonly kept in a business searching to combine various resources for an innovation to be adopted through commercialisation (Fagerberg, Mowery, Nelson, et al., 2005). Invention and innovation can occur practically simultaneously, however to find the right resources for an invention to become an innovation can take a long time. This time is what is often described as an iterative process (R. Agarwal et al., 2015).

To highlight this combining of resources, the case of our current mobile phones is fitting. Phones and music players have been around for a long time but the way they are combined and delivered in our current mobile devices was novel when first perceived by the consumer and market. Furthermore, it is important to understand that an *invention* does not become an *innovation* until it has been passed into processing and commercialisation to subsequently diffuse into the market (Chris Freeman and Perez, 1988; Christopher Freeman, 1989; Garcia and Calantone, 2002; Klarin, 2019; R. Agarwal et al., 2015).

Therefore, a discovery or solution that does not surpass the laboratory remains an *invention*. A discovery that surpasses the laboratory into production and afterwards adds economic value to a firm is considered an *innovation* (Garcia and Calantone, 2002). Innovation thus not only covers research and product development but also the process of manufacturing, marketing, distribution, service, adaptation and improvement. Furthermore, 'product innovativeness' is not the same as 'organisational innovativeness'. Organisational innovativeness is described as the capacity of a firm to innovate or develop novel products (Ettlie, Bridges, and O'Keefe, 1984). Thus the innovativeness of a firm's product, process or service is not a measure of organisational innovativeness.

These various nuances belonging to innovation create a diversity in innovation definitions that is immense and the added stratification of degrees of 'innovativeness' for instance radical, incremental, or discontinuous innovation introduces even more sophistication.

But there are further complexities. First the nature of innovation is highly contextual and in the definitions of innovation there is little room for context. This means that in one context a set of activities leads to an innovation while these same activities can be very outdated in another context. Secondly, 'novelty' is historically created and socially delineated — as it is not found in the product itself but in the reception of that product. Something can be perceived as novel in an EM while it can be found outdated in a DM. Consequently, there is no guarantee of the disposition of innovation (R. Agarwal et al., 2015). Therefore, innovation is established because of what consumers from a market see them as offering instead of what they actually offer.

Describing innovation is a complex task and it necessitates the organisation of the various constructs and dimensions of innovation. For this I follow Wehn and Montalvo, 2018 and adopt the structuring dimensions of *type of innovation*, *stage of innovation and level of analysis* and the horizontal dimension of *innovation evaluation and impact assessment* visualised in Figure 2.1.

2.1.2 Innovation: constructs and dimensions

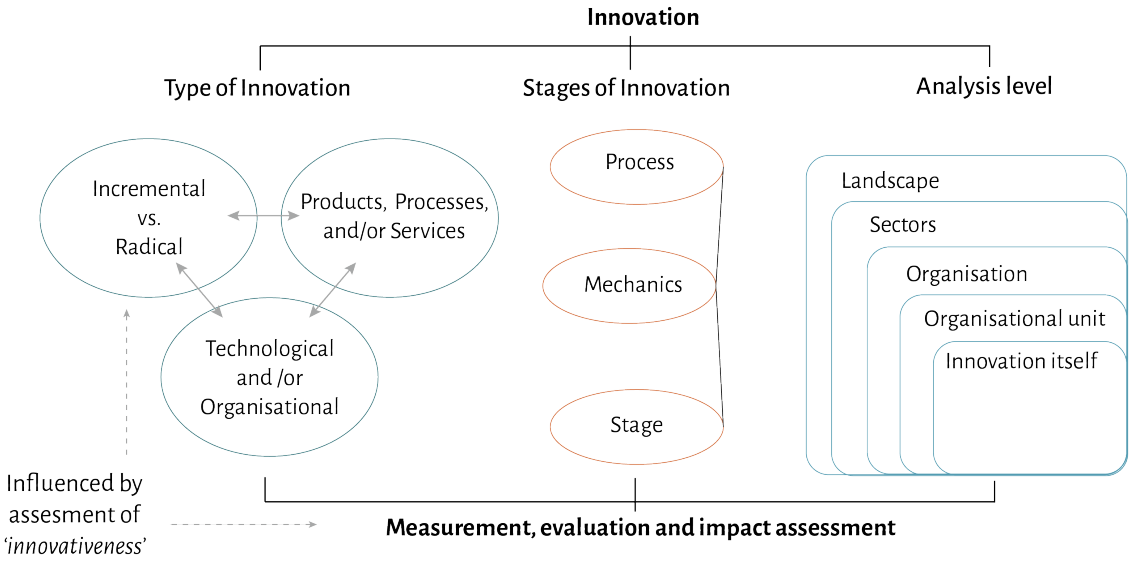


Figure depicting the different constructs and dimensions used in innovation taxonomy's.
Note. Reprinted and slight adaption to include 'innovativeness' from Uta Wehn and Carlos Montalvo (2018). "Exploring the dynamics of water innovation: Foundations for water innovation studies". In: *Journal of Cleaner Production* 171, S1–S19, p. 5

FIGURE 2.1: Dimensions for innovation typologies

Type of innovation

When assessing novelty the first thing we can determine is 'What is new?' or 'What has changed?'. This refers to the *type of innovation* that is being evaluated. Within this dimension three categories exist based on further specification.

> **Products, Processes and/or services**
Reducing the scope of the meaning of innovation can initially be done by referring to the type of innovation such as *product*, *process* and *service* innovation. Porter, 1996 separated innovation in product and process innovation, where product innovation signifies doing novel things and process innovation is about conducting things in a novel way. Porter, 1996 also stated

that the competitive benefit of product innovation is that no one can provide what you can provide. Product innovations stem from new knowledge, materials or the recombination of other innovations (Wehn and Montalvo, 2018). Product innovations are oriented to satisfying customer preferences through enhancing product performance, longevity, quality or attributes (Wehn and Montalvo, 2018).

Although product innovations are more evident than process innovations, process innovations tend to be more abundant than product innovation — as when a novel product has been created and invested in, process innovations can aid in recovering sunk costs made for that innovation (R. Agarwal et al., 2015). Furthermore, innovations in processes can enable new product innovations. Something that has been clear throughout history. These types are thus closely linked, enabling each other.

Service innovations are innovations that do not necessarily relate to the novelty of a tangible item itself, but more often in the tangible areas of customer interaction, distribution, etc. (Gallouj and Weinstein, 1997). Service innovations are usually fostered through application of present products or process and have received notable attention in recent years. As digitisation has generated more intangible products, increasing the importance of services. Table 2.2 highlights key differences.

Table 2.2: Product, process and service innovation characteristics

Product Innovation	Process Innovation	Service Innovation
New or significantly improved product performance, longevity, quality, components or attributes	New or significantly improved production process, distribution method or support activity	New or significantly improved intangible service enabled by new application of existing products or process

Note. Table constructed with definitions obtained from OECD (Mar. 2019). *Society at a Glance 2019*. Society at a Glance. Paris: OECD

Incremental vs. radical innovation

Among the earliest endeavours to develop knowledge on innovation and to develop a systematic approach for distinguishing innovations can be credited to Chris Freeman and Perez (1988). Chris Freeman and Perez divided innovations into four categories and named it *a taxonomy of innovations*. This division is based on the degree of discontinuity of the technology and on the market. The two most commonly referred to types are discussed. *Incremental innovations* are described as continuous improvements or relatively small additions to an *existing* technology in the *existing* market that do not produce dramatic advancement, but that increase long-term productivity of a product or service (Garcia and Calantone, 2002; R. Agarwal et al., 2015; Wehn and Montalvo, 2018). Second, *radical innovations* are discontinuous events, as a consequence of deliberate research. They are innovations that integrate a *new* technology which creates a *new* market infrastructure. They are the product of developing new knowledge and the commercialisation of completely novel ideas or products. Product, process and service innovations can be incremental or radical and thus these types of innovation are related. More on this in Section 2.3.

Technological and organisational innovation

As stated before, this thesis concerns predominantly technological innovations originating from technological change throughout an organisation. However, organisational innovation can also occur in the areas of human resources, administrative process or organisational structures (Wehn and Montalvo, 2018). A commonly described organisational innovation is business model innovation.

Stages of innovation

When describing innovations we can study how innovators have arrived at their innovation. The 'stages of innovation' analyse the series of actions that have resulted in innovation. These stages describe the process of ideation to diffusion and substitution. Three main schools of thought are prevalent in literature.

Process

Developing innovations can be described as being a 'process' that either occurs in a linear or non-linear fashion (J. Utterback, 1994). Linear describes a process of sequential steps arranged in a manner that the preceding step must be finished before progressing to the next step. Non-linear describes the process as iterative and as continuous process of using findings to alter innovations in a prior phase using and describing the importance of feedback loops.

Mechanics

Mechanics describe why innovation occurs. It can either be a solution to an encountered problem which comes from the market place (market pull) or a deliberate decision to innovate through research and development (R&D) driving the development of new products or services without market research(Technology Push).

Stage

To identify, analyse and compare innovation routines which can be iterative in nature, scholars have used and proposed

simplified stage models highlighting key areas of activity. Important to note is that these activities do not take place in a vacuum but can be influenced by conditions associated with the presence and nature of the innovation. These can, but not not necessarily are, highly erratic and iterative. Commonly two groups of innovation stages can be described, the development and the adoption of innovations. The *development* of innovations describes the stages starting with ideation through manufacturing and production. The *adoption* of innovation describes phases of how an innovation is accepted, distributed and integrated by consumers in the market through time (Rogers Everett, 1995). It is a commonly researched topic as how innovations diffuse provides a great amount of variables and it is of great importance for an innovation's success.

○ **Analysis level**

The level of analysis describes how innovation is governed and where it occurs (Wehn and Montalvo, 2018). This creates insights in how to induce it and often describes processes of learning, changing capacities, and developing conditions for innovation. The various levels of where these insights are derived from are presented in Figure 2.1.

The constructs and dimensions described in this section are used in the following section which describes the conceptual evolution of RI.

2.2 Conceptual development of Reverse Innovation

The potential of RI for business practices has resulted in increasing interest on the topic, leading to the definition evolving. Researchers have adopted and proposed various definitions for the concept but some similarities can be found. Generally speaking, the term describes innovations that were first adopted in developing markets and afterwards introduced in advanced/developed markets (Vijay Govindarajan and Ramamurti, 2011). However, a lack of conceptual clarity on intricacies still exists. This section thus concentrates on describing the evolution of the concept and studies the adjustments that have been made. Furthermore, it aims to provide structure in the various described definitions by using major conceptual characteristics.

2.2.1 Reverse innovation conception

Early work of Immelt, Vijay Govindarajan, and Chris Trimble, 2009 first introduced the concept of RI and defined it as the *antithesis of glocalisation*. Glocalisation defines the approach of innovation where MNCs develop products in their country of origin and then distribute them worldwide, with some alterations for local conditions (Immelt, Vijay Govindarajan, and Chris Trimble, 2009). This approach was enabled by the environment of DMs, characterised by a wealth of resources, high level education and experience making it attractive for innovation activities (Immelt, Vijay Govindarajan, and Chris Trimble, 2009).

Glocalisation was the mainstream approach and it was sufficient in a time where DMs held the larger part of the global market and EMs were perceived as offering little opportunity. But with EMs obtaining a dominant global position and the world becoming '*flatter*'[1] (Friedman, 2005) and increasing internationalisation possibilities this approach became outdated (Immelt, Vijay Govindarajan, and Chris Trimble, 2009). This perception towards opportunity in EMs changed as scholars like C.K. Prahalad, 2005 indicated the actual market potential of EMs by regarding the population of the BoP as an entirely new market. However, to benefit, the dynamics and the process of innovation in these BoP markets needed to be understood.

This idea of understanding the local market has similarities to RI. But C.K. Prahalad coined the term '*trickle-up*' innovation referring to any innovation specifically developed for the BoP market which then trickles up to high-income countries. This concept is similar to RI in the sense that it indicates a transfer from poor to rich but that is also the distinction. RI describes meeting constraints specific to EMs, which encompasses cost constraints. However, unlike trickle-up innovation, RI is not restricted to cost constraints but includes, for instance, infrastructural and cultural constraints (Hadengue, Marcellis-Warin, and Warin, 2017; Vijay Govindarajan and Ramamurti, 2011). For this reason Hadengue, Marcellis-Warin, Zedtwitz, et al., 2017 argue that RI can be perceived as a new concept and an old one.

Another concept that changed the perception towards traditional innovation processes was '*blowback innovation*'. Blowback refers to unexpected consequences of direct investments made by MNCs in EMs (Brown and Hagel, 2005). By entering these markets with a glocalisation approach competition with local firms is created. This results in EMs possibly creating a surge of novel product- and process innovations aiding local firms to grow and new entrepreneurs to emerge. With new globally competitive price-performance levels, these EM firms may obtain notable market share in the DMs and become threats to incumbent DM firms. Brown and Hagel described that the way to enter these markets was by not simply adjusting products to EMs needs but to really rethink the business process in these markets.

[1] Metaphor for seeing global trade as an increasingly level playing field, in which all competitors have equal opportunities.

Immelt, Vijay Govindarajan, and Chris Trimble, 2009 clearly incorporated these ideas in their initial description of RI, describing it as an approach to not only enter EMs but also as a way to survive against threats from new economic powers in global competition. In order to succeed MNCs needed to manage and base all their innovation efforts in these local markets.

Although this was the start of RI, it did not have a theoretical base nor did it build upon or add to any innovation concepts and frameworks. Setting out to make this connection Vijay Govindarajan and Ramamurti, 2011 related RI to the product life cycle theory proposed by Vernon, 1966 and the diffusion of innovation model by (E. M. Rogers, 1962). As these theories form the theoretical foundation of RI, they have been summarised in Appendix B. Based on these fundamental theories Vijay Govindarajan and Ramamurti argue that RI is not defined by where the innovation is *developed* but rather where it is *adopted*. This was the first indication of literature beginning to view RI as a market process.

2.2.2 Reverse innovation as a market process

The most common way of explaining RI is to look at innovations according to the markets where they were adopted. According to Vijay Govindarajan and Ramamurti, 'Reverse' indicates the flow of innovation from *emerging to developed markets*. Which is the opposite from the traditional flow of innovation, hence the term *reverse*. Elaborating on this concept of reverse flow through the subsequent product life cycle stages Vijay Govindarajan and Ramamurti assert that RI requires at minimum three of these stages. The first is the adoption of an innovation in an EM. The second is the transition (or flow) of this innovation to other EMs. The third and final step is the transition (or flow) to DMs (Vijay Govindarajan and Ramamurti, 2011). These steps have been visualised in Figure 2.2.

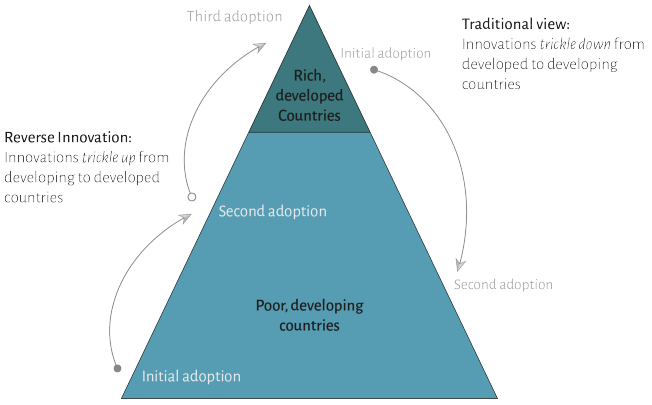


FIGURE 2.2: Reverse Innovation as a market process

This definition makes no distinction for the involvement of EMs in the innovation process itself. It only views RI as the order in which innovations are adopted. Additionally, the markets are differentiated by their economic status and not by their geographical location. For instance, an innovation developed in India which is subsequently adopted in Brazil is not seen as a RI as both these markets are considered as developing.

When analysing the definitions of RI as solely a market process the wording '*adopt*' is used. Both Sinha, 2013 and Garcia-Miranda, 2014 describe RI as innovations that are initially adopted in the EMs and subsequently in DMs. Adoption refers to the mechanism by which consumers becomes aware of an innovation, recognise its importance and start using it (E. M. Rogers, 1962).

Vijay Govindarajan and Ramamurti, 2011 discuss another aspect of RI and utilising work of Von Hippel, 1986 they suggest that RIs may begin through adoption of innovations by '*laggards*'[2] rather than '*lead users*'[3]. An important implication made by Vijay Govindarajan and Ramamurti, 2011 is therefore that laggards resemble EM consumers. He justifies this on the premise that emergent market consumers are "extremely value-conscious, happy with 'good enough' quality, and costly to reach and serve" (Vijay Govindarajan and Ramamurti, 2011, p. 195) therefore resembling laggards. This notion starts to describe more characteristics of RI, namely product characteristics that are desired by EM customers.

2.2.3 Reverse innovation as a product innovation and market process

Interestingly during the conceptualisation phase where RI was viewed as a combination of a product innovation and a market process, the wording changed to *designed* for EMs instead of *adopted* in EMs. Snowdon et al., 2015 and Judge, Hölttä-Otto, and

[2] people who are last to try or adopt a new product (Von Hippel, 1986)
[3] people who are first to try or adopt a new product who have a need before the market and experience great benefit from it (Von Hippel, 1986)

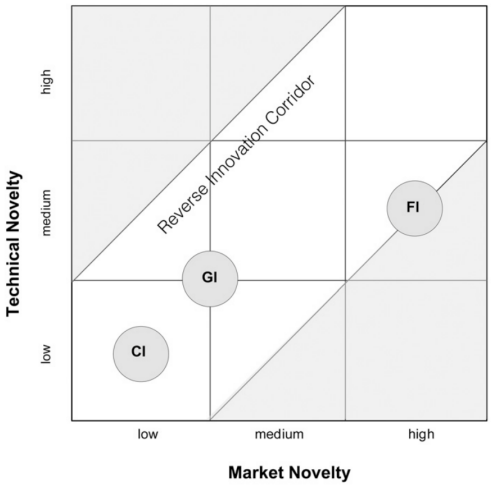
Winter V, 2015 for instance describe RI as innovations that were initially *created* or *designed* for EMs, leaving the idea of adoption (see Table 2.3). The definition by Shan and M. A. Khan, 2016 also uses this idea but includes a focus on the local constraints affecting the innovation. The definitions suggest that the primary objective of the innovation is strongly embedded in the definition of RI. Indicating that the innovation was designed for a market where a plurality of of consumers encounter resource constraints before it was transferred to a DM.

Although the fundamental concept of RI is intuitively clear, it remains conceptually vague (Von Zedtwitz et al., 2015; M. Zeschky, Widenmayer, and Gassmann, 2014). Arguing that differentiating RI from other notions of innovation is difficult. Especially with regards to product innovations for EMs. The development of EM-specific solutions, distinguished by great value and low costs are for instance captured under the terms 'Cost innovation', 'Gandhian innovation', 'Jugaad innovation', 'Frugal Innovation', and 'Indigenous innovation'. M. Zeschky, Widenmayer, and Gassmann, 2014; M. B. Zeschky et al., 2014 set out to clarify the relation of these concepts to RI.

As M. Zeschky, Widenmayer, and Gassmann identify all RIs are also resource-constrained innovations and either; *cost innovations, good-enough innovations or frugal innovations*. In short, they characterise cost innovation as a product that has the same functionality at a lower cost. A good-enough innovation has altered functionality at a reduced cost and frugal innovations provide new functionality at a lower cost. These three types vary from each other regarding the novelty of their technology (innovativeness) but also their novelty to the market. A balance between market and technical novelty creates a corridor where products are able to transfer from emerging to DMs, visualised in Figure 2.4. This distinction considerably affects how firms should approach, create, and market their innovations.

Moreover, they concluded that RI was not compatible with the other types of resource-constrained innovations (M. Zeschky, Widenmayer, and Gassmann, 2014). Clarifying that RIs were always built on cost, good enough, or frugal innovations as they transferred to DMs.

These definitions suggest that RI concerns not only the location of the market but also the innovation itself. They also describe the belief that the reversed innovation was initially a solution designed for a market where the majority of customers encounter resource constraints. In effect claiming RI to be a combination of a product innovation under constraints and a market transfer process. In recent years more innovation types belonging to an EM context have been added to this list. The most eminent will be further elaborated in Section 2.3.



Note. Reprinted from Marco B. Zeschky et al. (July 2014). "From cost to frugal and reverse innovation: Mapping the field and implications for global competitiveness". In: *Research Technology Management* 57.4, pp. 20–27, p. 22

FIGURE 2.4: The resource constrained innovation matrix

2.2.4 Reverse innovation as an innovation process and market process

Elaborating on the notion of RI as a product innovation in combination with a market process, Von Zedtwitz et al., 2015 assert that the focus of Vijay Govindarajan and Ramamurti, 2011 towards where innovation is initially adopted is important. Von Zedtwitz et al. elaborate that this *market introduction based definition* of RI accurately indicates that the novelty of an innovation is dependent on the perspective of the market. However, they argue that this definition lacks the possibility of a reversal of flow in other innovation phases. Their definition uses a more innovation process-based approach to the concept, seeing RI through the perspective of 'innovation flow [4]'. Therefore they adopt the linear innovation model (Godin, 2006) with the four sequential phases of concept ideation, product development, primary target market and subsequent secondary market introduction to allow for these initial development phases (Von Zedtwitz et al., 2015).

Von Zedtwitz et al., 2015 argue that a reversal of the flow of innovation can occur in any these development phases e.g. the ideation phase of a product can be developed in an EM and subsequently be introduced in a DM. Consequently RI is described as any kind of global innovation that, at any stage in the innovation process, is distinguished by a reversal of the flow of innovation from an EM to a DM, and that is ultimately introduced to a developed country's market (Von Zedtwitz et al., 2015).

[4] Innovation flow illustrates the creation of ideas and their transition to an innovation. Flow indicates that this transition is effective, effortless and bears involvement from those concerned

Based on these possible reversals Von Zedtwitz et al., 2015 describe a typology of RI through the four sequential phases of the linear innovation model. A further refinement to the definition of RI is made as *strong RIs* are defined as innovations that have at minimum two innovation phases occurring in an EM. *Weak RIs* only have one innovation phase occurring in an emergent market (Von Zedtwitz et al., 2015).

This description of RI is the first in which the various stages of an innovation process are linked to the possibility of RI. For this reason the concept of RI is described as an innovation process in combination with a market process. Although this is an important contribution to the theory of RI, this typology assumes a fairly strict sequential innovation process, while often innovations are found to be highly erratic and iterative (Trott et al., 2015).

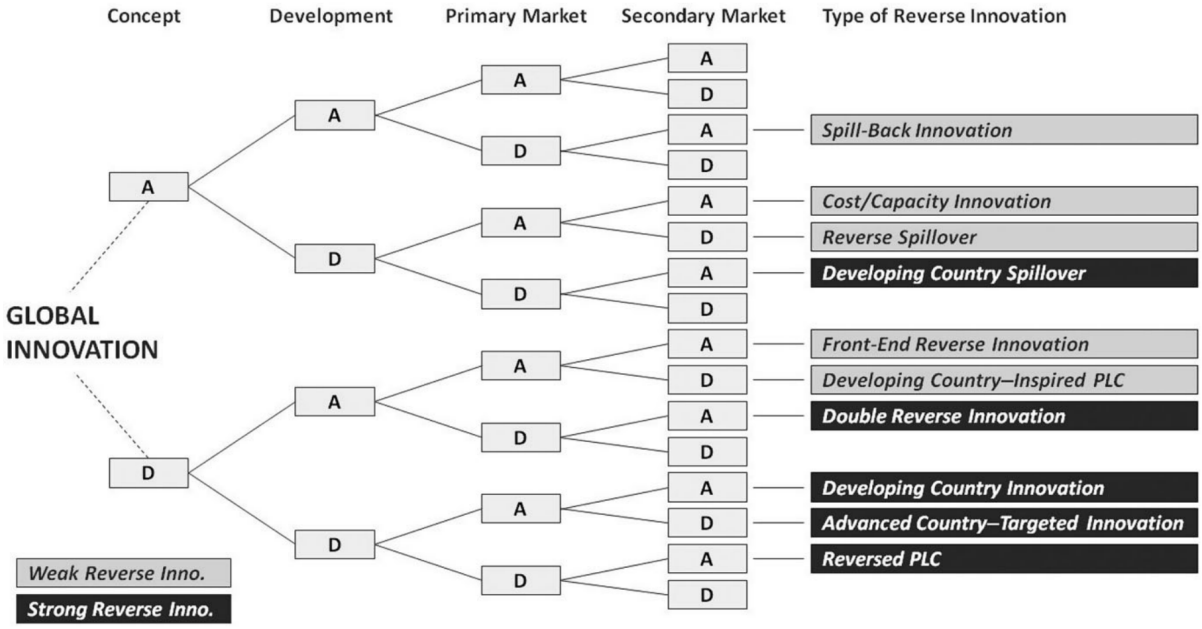


Figure depicting the different phases where a reverse innovation flow can occur. A describes an advanced country and D a developing country. These different possibilities create a reverse innovation typology, where some are perceived as strong and weak reverse innovations.
Note. Reprinted from Max Von Zedtwitz et al. (Jan. 2015). "A typology of reverse innovation". English. In: *Journal of Product Innovation Management* 32.1, pp. 12–28, p. 7

FIGURE 2.5: A map of global innovation flows with reverse innovations in the strong and weak sense

Maybe the most distinct definition is presented by Borini, Costa, and Oliveira Junior, 2016 as they describe RI as the transfer of *ideas* created in EMs to DMs. Still viewing RI as a market process, their definition differs by not limiting the transfer to innovations but expanding it to ideas. As described in Section 2.1 ideas differ from innovations in that they have not created value yet. Arguing that the value created by the market introduction does not have to be in the same market as to where the idea was conceived (Borini, Costa, and Oliveira Junior, 2016).

Important to note is that Borini, Costa, and Oliveira Junior discuss RI solely in the context of MNCs. Therefore assuming that ideas and innovations are transferred within the structures of one organisation. Transfer of ideas thus occurs between subsidiaries in EMs and DMs. This distinction between an idea and innovation might be of importance if the purpose of RI is to differentiate the roles of different markets within the operations of one MNC.

A plausible motive for Borini, Costa, and Oliveira Junior to adopt this perspective to RI may be the significance of the ideation phase for the innovation process. Also transforming ideas into innovations within one organisation might better be done in other locations, e.g. a subsidiary in a DM. However, this interpretation neglects an important element of the original concept. Namely that RI should be introduced and adopted initially in an EM before it transfers to a DM.

Another perspective towards RI is given by Hadengue, Marcellis-Warin, and Warin, 2017. They argue that EMs as a fundamental requisite for RI is confusing and ambiguous, and thus limits the concept. Hadengue, Marcellis-Warin, and Warin, 2017 describe convincingly that RI is essentially driven and dependent on constraints that distinguish the EMs. As a consequence, RI is, primarily and principally, the consequence of a constrained environment, but not necessarily that of a developing or emerging market (Hadengue, Marcellis-Warin, and Warin, 2017). This points to their argument that the concept of a *new and constrained market* should be prevailing in the definition of RI as opposed to a *emerging market* (Hadengue, Marcellis-Warin, and Warin, 2017). As

their article does not really specify a new definition of RI, I summarise their contribution as *RI is an innovation approach used by MNCs responding to global developments by turning their principal innovation efforts to a new and constrained market as their new primary market*.

This is a fundamentally different perspective towards RI and it is something I view as important for the final conceptualisation of RI. In order to make RI a clearly defined concept, it must stand the test of time and adhere to the vast amount of innovation typologies. The future will bring different EMs and thus different characteristics. Current literature is predominantly focused on India and China as EMs, making the concept somewhat contextual. The notion proposed by Hadengue, Marcellis-Warin, and Warin, 2017 reduces this contextuality. Moreover, this adaptation opens the concept of RI for a reverse of the flow of innovation among DMs and EMs with fundamentally different constraints, instead of limiting it to emergent and developed. Conversely, future research must determine the constraints that result in the possibility of RI, something that Hadengue, Marcellis-Warin, and Warin also point out.

The most recent conceptualisation of RI was done by Suresh Malodia, Shaphali Gupta, and Anand Kumar Jaiswal, 2019 who through a thematic content analysis attempted to determine characteristics of the innovations involved in RI. They identified three characteristics for the conceptualisation of RI:

- *Clean Slate*: RI is primarily designed and developed using a ground-up approach to find new solutions to the current problems (Suresh Malodia, Shaphali Gupta, and Anand Kumar Jaiswal, 2019, p. 2).
- *Super Value*: refers to RI generating disproportionate value , i.e. providing superior product value at substantially lower costs (Suresh Malodia, Shaphali Gupta, and Anand Kumar Jaiswal, 2019, p. 2).
- *Technologically advanced*: RI implements cutting-edge technology to produce new, low-cost , high-performance products (Suresh Malodia, Shaphali Gupta, and Anand Kumar Jaiswal, 2019, p. 2).

These dimensions lead Suresh Malodia, Shaphali Gupta, and Anand Kumar Jaiswal, 2019, p.2 to define RI as *"clean slate, super value products that are technologically advanced and created to meet the unique needs of relevant segments, initially adopted in EMs followed by DMs"*.

Suresh Malodia, Shaphali Gupta, and Anand Kumar Jaiswal expand to a certain degree the product innovation dimension of RI, identifying them as technologically superior products with excellent performance at a lower cost, also called as super value products (Suresh Malodia, Shaphali Gupta, and Anand Kumar Jaiswal, 2019). These additions to RI make the involved innovations more comprehensible and clear cut. An important notion they make is that these dimensions only in unison constitute the product of a RI (Suresh Malodia, Shaphali Gupta, and Anand Kumar Jaiswal, 2019). These dimensions, specifically technological superiority is in contrast with (M. Zeschky, Widenmayer, and Gassmann, 2014) 'good enough' innovation on which he partly bases RI. Suresh Malodia, Shaphali Gupta, and Anand Kumar Jaiswal, 2019 argue that 'good enough' products are in contradiction with the value innovation theory W Chan Kim and Renee Mauborgne, 2005, which suggests that value innovations strive for the creation of a super value product. The translation to RI is to further improve the product for the best cost scenario (Suresh Malodia, Shaphali Gupta, and Anand Kumar Jaiswal, 2019).

Moreover, Suresh Malodia, Shaphali Gupta, and Anand Kumar Jaiswal, 2019 adopt Vijay Govindarajan and Ramamurti, 2011's conceptualisation of the market concept of RI which has been adapted and in my opinion improved by more recent publications. Consequently, neglecting that RIs can take place in other stages of the innovation (Von Zedtwitz et al., 2015) and not using the notion of constrained markets (Hadengue, Marcellis-Warin, and Warin, 2017).

Latest research by Cortonesi, Cahen, and Borini, 2019 studies the role of open innovation in RI. Discussing that the typology of RI proposed by Von Zedtwitz et al., 2015 can be expanded by "identifying open innovation occurring in EMs and influencing the process of RI in multinational companies" (Cortonesi, Cahen, and Borini, 2019, p. 94).

They discuss that open innovation is becoming more common in EMs and open innovation and RI coexist. This results in an interplay and new courses emerge, extending the range of RI typology. Cortonesi, Cahen, and Borini, 2019 describe that the model of Von Zedtwitz et al. assumes that the innovation flows happens exclusively within a subsidiary environment (closed innovation) and does not acknowledge open innovation (Chesbrough, 2003). Therefore, as these processes coexist, DMs either adopt open or closed innovation in their ideation and development phase of innovation extending the typology. It is probable that open innovation involving firms from EMs and DMS could possibly lead to RI, however more studies should elaborate on this matter.

2.2.5 Reverse innovation: Phenomenon or strategy

Within present literature, RI is described as a phenomenon, consequence, strategy and mechanism. A conference paper by Furue and Washida, 2014 elaborates on this issue and proposes two different types of RI dependent on the intention of the innovation.

When an organisation strategically plans and targets an EM in which to establish themselves through R&D facilities expecting to develop innovations which they deliberately spread to DMS, we speak of *inductive reverse innovations (IRI)* (Furue and Washida, 2014). RIs that take place unexpectedly are defined as *coincidental reverse innovations (CRI)*. Although this is an important distinction for describing RI in case studies, RI cannot be described as either a strategy or a phenomenon. Interestingly this difference in inductive vs coincidental RI does not contradict the typology proposed by Von Zedtwitz et al. (Hadengue, Marcellis-Warin, and Warin, 2017).

2.2.6 Operational definition of reverse innovation

Despite all the efforts to adjust the definition of RI, a consensus for this fairly novel concept has not been reached. This section has reviewed publications concerning RI to determine an operational definition. Through this review, I have defined conceptual contributions to RI, which have been summarised in Table 2.3. Nearly half of the scholars adopt the definition of RI proposed by Vijay Govindarajan and Ramamurti, 2011 as any innovation that is adopted first in an EM before flowing uphill to the DMs (Hadengue, Marcellis-Warin, and Warin, 2017). The other half has, as described, introduced complementing traits or even altered the definition to varying perspectives.

However, no matter how RI is described, it is commonly accepted to be a strategy to develop resource-constrained innovations that experience a RI flow from an EM or constrained market to a DM (Hadengue, Marcellis-Warin, and Warin, 2017).

Based on this review and the conceptual contributions made by contemporary literature I propose and adopt the following operational definition as a starting point for this study:

Operational definition: Reverse Innovation is a strategy where at any stage during the innovation process of a constrained innovation, a reversal of the flow of innovation takes place from an emergent or constrained market to a developed market.

This definition aims to combine the conceptual contributions in a parsimonious manner and allow for varying perspectives to still hold true. It is thus an effort towards a comprehensive definition.

RI and its overlap with other innovations has been described to some extent. However, some innovation types are often described in the literature as having particularly close conceptual relations or implications for RI. The following section, Section 2.3, introduces these.

Table 2.3: Conceptual Evolution of RI

	Year	Concept of Reverse Innovation	Conceptual contribution	Initial Authors	Supporting Authors
Conception	2009	*Reverse Innovation* is the opposite of glocalisation.	Reverse Innovations are opposite to Glocalization, and MNCs use them as a method to discourage emerging market multinationals from competing	Immelt, Vijay Govindarajan, and Chris Trimble, 2009	Leavy, 2011
Market Process	2011	*Reverse innovation* refers to the case where an innovation is adopted first in poor (emerging) economies before trickling up to rich countries.	+ A RI is adopted first in emerging markets before trickling up to developed markets	Vijay Govindarajan and Ramamurti, 2011	Sinha, 2013; Garcia-Miranda, 2014
	2012		+ Authors provide more clarity by distinguishing and addressing the differences in needs that distinguish emerging markets from established markets and introduce five gaps as starting points for reverse innovation development.	Vijay Govindarajan and Chris Trimble, 2012	Agarwal and Brem, 2012
Product innovation and market process	2012	Innovations conceived in subsidiaries and potentially adopted by the parent	+ RI occurs within organisational boundary	Borini, Miranda Oliveira, et al., 2012	
	2013	RI represents innovations with substantial cost advantages and high value when compared to the innovations of incumbent firms	+ RI often describes innovations with superior price/performance compared to established innovations	Alexander Brem and Björn Ivens, 2013	Snowdon et al., 2015; Judge, Hölttä-Otto, and Winter V, 2015; Brem and Wolfram, 2014
	2014	RI represents the development (or design) of new products in and for emerging countries by DMFs or EMF which will be introduced equally in developed markets if the demand in developed markets is identified.	+ RI represents innovations with substantial cost advantages and high value when compared to the innovations of incumbent firms	Alexander Brem and Björn Ivens, 2013	Snowdon et al., 2015; Judge, Hölttä-Otto, and Winter V, 2015
	2014	RI is a subgroup of disruptive innovation theory arising from emerging markets	+ Establishes relation between RI theory and disruptive innovation theory by adopting geographical component	Corsi and Di Minin, 2014	Suresh Malodia, Shaphali Gupta, and Anand Kumar Jaiswal, 2019; Hadengue, Marcellis-Warin, and Warin, 2017
	2014	Cost, good-enough, or frugal innovations that find a market among customers outside of the emerging markets at which they were originally targeted.	+ Cost, good-enough and Frugal Innovations are the product innovation types on which RI is dependent	M. Zeschky, Widenmayer, and Gassmann, 2014; M. B. Zeschky et al., 2014	Suresh Malodia, Shaphali Gupta, and Anand Kumar Jaiswal, 2019; Hadengue, Marcellis-Warin, and Warin, 2017; Agarwal, Brem, and Dwivedi, 2020
	2014	*Reverse innovation* can be divided based on the intention of the innovation. Strategically planning the innovation process for RI is defined as *inductive* RI. RIs that ensue unexpectedly are described as *coincidental* RIs	+ RI can be sub-categorised based on the strategic intention of the innovation	Furue and Washida, 2014	Hadengue, Marcellis-Warin, and Warin, 2017; Suresh Malodia, Shaphali Gupta, and Anand Kumar Jaiswal, 2019
	2015	*Reverse innovation* is any type of global innovation that, at some stage during the innovation process (ideation, development, primary market introduction, secondary market introduction) is characterised by a reversal of the flow of innovation from a emerging country to a developed country, and that is eventually introduced to an advanced country's market. *Strong reverse innovations* have at least two innovation phases in emergent countries and *weak reverse innovations* one innovation phase in an emergent country.	+ At any stage in the innovation process (ideation, development, primary market introduction, secondary market introduction) RI can take place.	Von Zedtwitz et al., 2015	Borini, Costa, and Oliveira Junior, 2016
Innovation process and market process	2015	RI is a template employable by any enterprise that responses to the shift in stimuli by switching its primary innovation effort to a foreign market or market segment emerging to the enterprise in question as the new primary one.	+ RI is a process of sequential steps where primary and secondary innovation efforts exchange	Radojević, 2015	Hadengue, Marcellis-Warin, and Warin, 2017

	2016	Innovations emerging in the developing world considering the local constraints, and later travelling uphill to find applications in the developed world.	+ RI describes products under local resource constraints which transfer when these constraints are present in the DM	Shan and M. A. Khan, 2016	
	2017	*Reverse innovation* is an innovation approach used by DMNEs responding to global developments by turning their principal innovation effort to a new constrained market as their new primary market	+ Emergent markets should be changed for constrained markets	Hadengue, Marcellis-Warin, and Warin, 2017	Hadengue, Marcellis-Warin, Zedtwitz, et al., 2017
	2019	*Reverse innovation* is clean slate, super value products that are technologically advanced created to meet the unique needs of relevant segments, initially adopted in the emerging markets followed by the developed countries	+ Clean slate, Super Value and Technologically advanced are characteristics of the product innovations on which RI is dependent	Suresh Malodia, Shaphali Gupta, and Anand Kumar Jaiswal, 2019	Agarwal, Brem, and Dwivedi, 2020

Note. Table constructed through literature review where the concept of RI was adapted from cited paper. The described conceptual contribution is based on own analysis.

2.3 Reverse innovation related innovation types

In the field of knowledge creation and the competition for ideas, many emerging concepts of innovation continue to arise. This study is especially interested in those innovation constructs and concepts that assist to clarify innovative pursuit directed at EMs and that are related to RI. When exploring the academic literature on RI several interrelated concepts are commonly referred to. Figure 2.6 positions these concepts according to two common steps in RI and indicates possible market effects that can occur after market introduction. These concepts have complementary interpretations but more importantly also have slight variations. As most of these innovations fall out of the scope of this research but are related to RI the articles that describe the concepts can be found in the figure. However, I have summarised the main characteristics of most used types in Table 2.4 and Table 2.5 which can be used for future referencing.

The following section introduces the most discussed innovation concepts related to RI. The aim of this section is not to cover various theoretical interpretations on these innovation types or an in-depth literature review of each type. Rather to provide a general overarching understanding and introduction to the different subtleties of the these related concepts.

The fundamentals of innovation categorisation based on technology and market impact are presumed as prior knowledge but have been summarised in Appendix C. This section highlights the constrained environment innovation types discussed in RI literature which can subsequently be reversed.

2.3.1 ⇄ Reversible innovation types

The most commonly discussed innovation concepts related to *emerging market* contexts are grassroots innovation, reverse innovation, inclusive innovation, frugal innovation and jugaad innovation (Y. Bhatti et al., 2018). As RI has been discussed, the other often interrelated variants are briefly introduced.

As Figure 2.6 indicates, there are more innovation concepts which have the possibility to allow for a reversal of innovation flow. But as these concepts commonly represent various notions that innovations should be low-cost and uncomplicated yet provide good services for customers overlooked by traditional MNCs, these have been deemed less relevant for further explanation in this thesis.

Grassroots innovation

Grassroots innovations developed its name from its beginnings in marginalised, rural communities and the informal sector (B. Agarwal, 1983). They are commonly described as an initiative triggered by individuals or communities trying to solve a personal or societal problem (Ross, Mitchell, and May, 2012). They often involve developing innovations that may present shifts towards more sustainable modes of consumption and production responding to the local circumstances, concerns and values of the associated communities (Seyfang and A. Smith, 2007). They are not innovations designed for the BoP but innovations designed by the BoP. Examples include community projects in the field of green energy, eco-housing, local organic food initiatives, local currencies such as time banks and local product innovations as shown in Figure 2.8.

Note. Reprinted from The National Institute of Design (NID)

FIGURE 2.8: Load carrier for labor

In contradiction to common sustainable business development, grassroots innovations engage in the arena of civil society and use dedicated activists who experiment with social innovations, besides using greener technologies (Seyfang and A. Smith, 2007, p. 585). Grassroots innovations are often cross-referenced with *social innovation*(Jain and Verloop, 2012) and with *inclusive innovation* (Letty, Shezi, and Mudhara, 2012).

Grassroots innovations have two motives: to answer a social need or due to beliefs more centred on sustainable innovation than on commercial success. Therefore they include local people and knowledge, generating innovation through a community process using skills and materials to adapt to scarcity (A. K. Gupta et al., 2003; Seyfang and A. Smith, 2007; A. K. Gupta, 2013)

Although grassroots innovations are valuable in proving that alternative processes and outcomes have the potential for sustainable development, Monaghan, 2009 indicates that these innovations have commonly been incapable to expand to other markets due to a disconnect or disability to diffuse within developed socio-technical regimes.

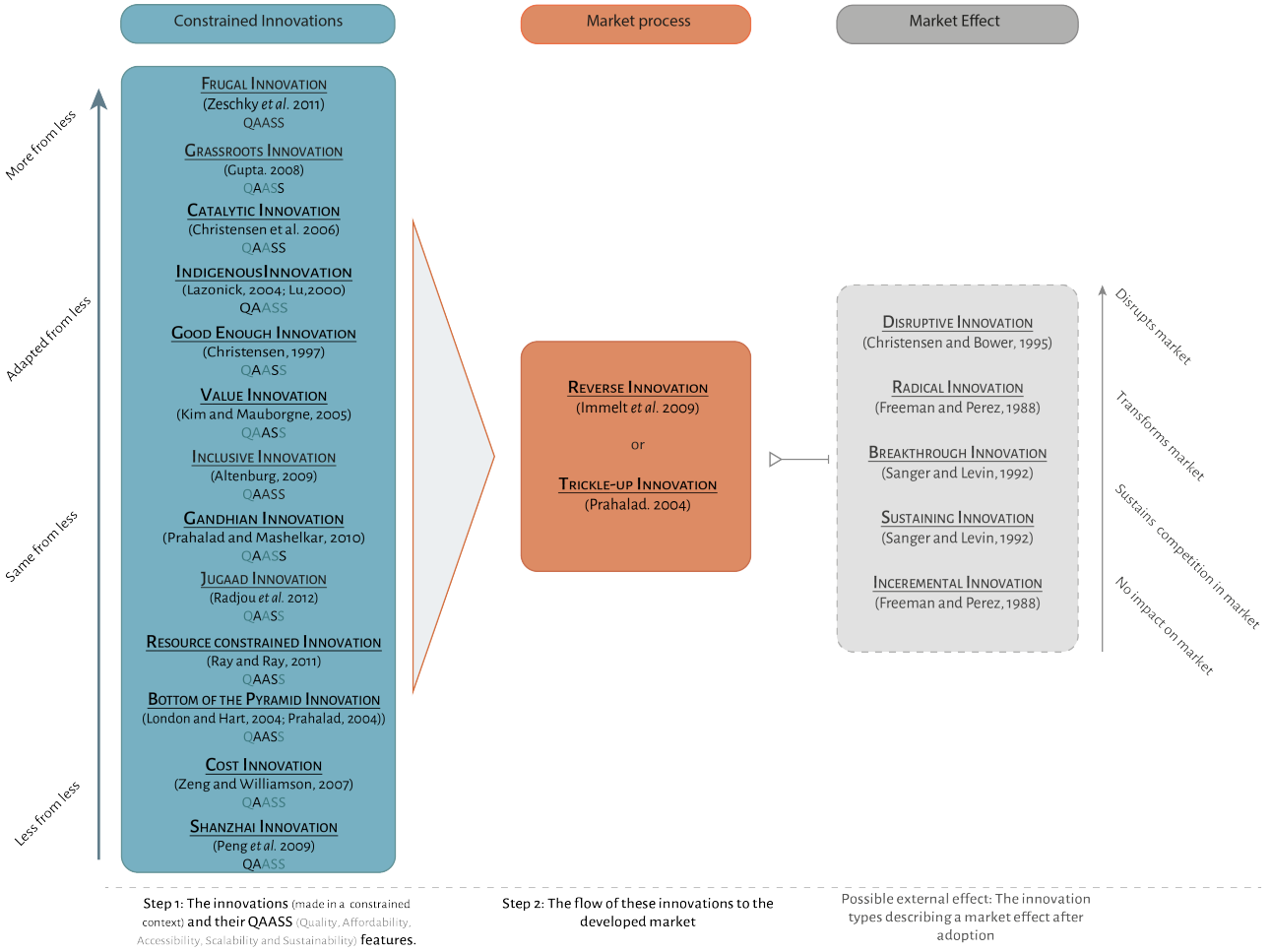


Figure depicting the innovations that can be reversed in step 1. Bold letters in the acronym indicate innovation characteristics that represent essential elements in the innovation definition. Step two indicates that after the flow of these innovations to DMs, we can either speak of reverse or trickle up innovation. The outcome of this flow can result in market effects described in the right side of the figure by innovation types often related to RI.
Note. Own elaboration based on Hadengue, Marcellis-Warin, Zedtwitz, et al., 2017

Figure 2.6: Reversible innovation types and RI related concepts

Inclusive innovation

Inclusive innovation can be described as the developing and implementing new ideas which tend to develop opportunities that enhance the social and economic prosperity of disadvantaged members of society (George, McGahan, and Prabhu, 2012). According to Nijhof, Fisscher, and Looise, 2002, p. 84 inclusive innovation represents the "inclusion of fundamental social responsibilities in both strategy and operations management in organisations"

The term is being used to indicate inclusive innovation systems that allow for context-specific problems, barriers and demands in developing markets (Altenburg et al., 2009). Such innovation is directed at meeting the needs of the underprivileged by reducing costs of goods and services, developing livelihood opportunities and relevant knowledge (Dutz, 2007).

Similar to RI, inclusive innovation describes what should be done but not how or in what manner. To solve this, scholars use frugal innovation to develop concrete actions for more inclusivity (Baud, 2016). However, inclusive innovation is more concentrated towards equity [5] while frugal innovation describes ways to find a balance between greater performance and equity (Bound and Thornton, 2012).

Jugaad innovation

Of the types discussed hitherto, the concepts most commonly associated with RI are frugal and *jugaad* (Y. Bhatti et al., 2018). Where RI describes more a strategy of developing for and learning from EMs to use those innovations to identify new markets, jugaad innovation describes more how to create innovations and what they should be (Y. Bhatti et al., 2018).
In Hindi — a language spoken in India – jugaad means a hack, innovative fix or an improvised solution yielded from inventiveness and dexterity (Radjou, Prabhu, and Ahuja, 2012, p. 4). Jugaad is inclusive and often related to social needs. According to Radjou, Prabhu, and Ahuja, jugaad has 6 principles: frugality, flexibility, simplicity, intuition, opportunity in adversity and inclusion of the margin. Bound and Thornton, 2012 characterise jugaad to be about a culture and mentality of *creative improvisation* required for frugal innovation. For instance a coffee machine would cost much more than this simple pressure cooker shown in Figure 2.10.

Note. Reprinted from Studio Fynn

FIGURE 2.10: Jugaad pressure cooker

Although jugaad can play a significant role in the very early phases of the ideation of an innovation it is not scalable or sustainable for business development (Agnihotri, 2015b; C. K. Prahalad and Mashelkar, 2010; Y. Bhatti et al., 2018; Shepherd, Parida, and Wincent, 2020). Jugaad innovations are developed under such resource constraints that they are technically not commercialisable on a greater scale (Shepherd, Parida, and Wincent, 2020).Frugal innovation incorporates jugaad as only one of several elements to explain its approach to innovation. However, frugal surpasses the notion of a quick fix and aims to do more for less.

Frugal innovation

Frugality is at the heart of low-cost innovation and it describes remodelling products and processes to eliminate unwanted costs (Woolridge, 2010). Frugal innovation is characterised by affordable, good-enough products that answer to the needs in emerging markets through affordability (M. Zeschky, Widenmayer, and Gassmann, 2011).

Another characteristic is that the development of these innovations is under resource constraints—for instance, financial or cultural constraints. Therefore M. Zeschky, Widenmayer, and Gassmann, 2014 describe them as innovations specifically developed for resource-constrained customers in EMs. They often offer new functionality at lowers costs and serve the BoP.

In comparison to good-enough innovations, frugal innovations are not re-engineered innovations but explicitly designed solutions for resource-constrained environments (M. Zeschky, Widenmayer, and Gassmann, 2014).

Basu, Preeta M Banerjee, and Sweeny, 2013, p. 292 294 described eight competencies for frugal innovation: ruggedisation, affordability, simplification, adaptation, reliance on local materials and manufacturing, renewability, user-centric design, and portability. As frugal innovation involves low cost and using local materials and equipment it is often associated with sustainability and reduction of environmental impact.

[5] The quality of being fair and impartial. The distinction between equality and equity is important. While both encourage fairness, equality does this by treating everyone the same regardless of need. Equity accomplishes this by treating people differently dependent on need.

2.3.2 Overview of related innovation types

TABLE 2.4: Overview of typology of emerging market/constrained innovations

	Grassroots	Inclusive	Catalytic	Imitative	Value	Frugal	Reverse	Jugaad
Characteristics	· Community led solutions for sustainability · Innovations for societal problems · Non-scalable · Niche innovations	· For and by low-income groups · Accessible to low income populations · Either high or low technology	· Simpler, affordable but good enough for customers · Scaling · Replication · Subset of disruptive innovation but focused on social change	· Reverse engineering of existing products and services · Similar end products or services	· Niche innovators · Mostly in low end of the market ·	· Serving the Base of the pyramid (BoP) · Off-the shelf products · Built on resource constraints · Scalable · Sustainable	· Frugal and value + expands to developed countries	· Non-commercialisable · Non-scalable · Non-sustainable · Fixes to ease life · Mostly everyday hacks
Product and/or service examples	Community renewable energy initiatives; eco-housing; local organic food schemes;community currencies such as time banks	Bigoas based milk cooling unit for small holder dairy farmer developed by SimGas; Narayana Health; Kibo motorcycle taxi Kenia	Solar energy; M-health; telemedicine	Pharmaceutical generic drugs; Luxury fashion brand imitations	Low-cost airlines; Supermarkets that open smaller marts	P2P lending in India; High volumes surgical procedures	Smartphone-based blood- cell counter; Portable ECG machines	Bleach filled bottles to substitute light-bulbs; Peer-to-peer sharing
Commercial examples	N/A as it is found to be non-commercialisable	Aravind; Haier	OER-Unesco	Some South Korean and Chinese manufacturers began as imitators	TSMC; Ryan-air; Tata Nano;	LifeSpring Hospitals; GE ECG portable machines	Haier white goods; Mahindra tractors; GE Vscan	N/A as it is non- commercialisable in the strict definition
Representative articles and books	(B. Agarwal, 1983)(Ross, Mitchell, and May, 2012)(Seyfang and A. Smith, 2007)(A. K. Gupta et al., 2003)(A. K. Gupta, 2013)	(Heeks, Amalia, et al., 2013) (Heeks, Foster, and Nugroho, 2014) (Fressoli et al., 2014) (Guth, 2005)	(Mohan and Potnis, 2010) (Gundry et al., 2011) (Clayton M Christensen, Baumann, et al., 2006) (Auvinet and Lloret, 2011)	(Schnaars, 1994) (Shenkar, 2010) (W. Chan Kim and Renée Mauborgne, 1977)	(Semadeni and Anderson, 2009) (W. Chan Kim and Renée Mauborgne, 1977) (Dillon, Lee, and D. Matheson, 2005)	(Preeta M. Banerjee, 2013) (Rao, 2013) (Radjou, Prabhu, and Ahuja, 2012)	(Vijay Govindarajan and Ramamurti, 2011) (M. Zeschky, Widenmayer, and Gassmann, 2014) (Von Zedtwitz et al., 2015)	(Agnihotri, 2015a) (Preeta M. Banerjee, 2013) (Radjou, Prabhu, and Ahuja, 2012) (Shepherd, Parida, and Wincent, 2017)
Also referred to as	Social/inclusive	Grassroots/social/frugal	Frugal/Disruptive	Me-too/ copycat/ free-rider	Blue ocean/ strategic/ strategy/good enough	Inclusive/ catalytic/ Base of the pyramid (BoP)	N/A	Hack/workaround

Note. Table adapted and expanded based on Anton Klarin (2019). "Mapping product and service innovation: A bibliometric analysis and a typology". In: *Technological Forecasting and Social Change* 149.October, p. 119776

Table 2.5: Overview of innovations based on innovativeness and impact of the technology

	Radical	Incremental	Disruptive	Sustaining	Breakthrough
Characteristics	· New or revolutionary · Large scale · Create discontinuous shift in the markets · Can be significant improvement to existing	· Evolutionary continuous improvements · Not discontinuous; profit-seeking · Top end of the market	· Simpler solutions · Smaller target markets · Creation of new markets & value networks · Turn non-consumers into consumers · Displacement of earlier technologies	· Aims to sustain market position · Improvement to existing products/services · Low Risk · Satisfy customers current needs · Evolutionary	· New technology or new business model · Step-change in both customer value and a company's financial performance
Product and/or service examples	Penicillin; Steam engine; Nuclear energy; Artificial organs	Mobile phones; Education techniques; Electronic storage	Block-chain technologies; Tablet PCs; Online music streaming services	Television development; Car technologies	Bag-less vacuum cleaners
Commercial examples	Tesla electric cars + energy; Apple iPhone;	Intel CPUs; Microsoft Windows; Dyson vacuums	Some 3D-printing projects Aldi; Netflix; Wikipedia; Spotify	Apple iPhone upgrades; Toyota; TV-HD TV	P&G; Innocentive; Dyson
Representative articles and books	(Dewar and Dutton, 1986) (Hill and Rothaermel, 2003) (Leifer, 2001) (Ettlie, Bridges, and O'Keefe, 1984)	(Ali, 1994) (Garcia and Calantone, 2002) (Lundvall, 1992) (Clayton M Christensen, 2013)	(Clayton M Christensen, 2013) (Clayton M Christensen, Raynor, et al., 2015) (Clayton M. Christensen and Overdorf, 2000) (Clayton M. Christensen, McDonald, et al., 2018)	(Clayton M Christensen, 2013) (Clayton M Christensen, Raynor, et al., 2015) (Clayton M. Christensen and Overdorf, 2000) (Light, 1998)	(Mascitelli, 2000) (O'connor and Rice, 2001) (Kaplan and Vakili, 2015)
Also referred to as	New-to-the-world/ first- mover/ path-breaking/ breakthrough/ lead/ discontinuous/ pioneering	Marginal/ sustaining	N/A	Marginal/incremental	Radical/pioneering/ discontinuous

Note. Table adapted and expanded based on Anton Klarin (2019). "Mapping product and service innovation: A bibliometric analysis and a typology". In: *Technological Forecasting and Social Change* 149.October, p. 119776

2.4 Rationale for studying reverse innovation

As stated briefly in the introductory chapter, RI is described as having As stated briefly in the introductory chapter, RI is described as having great value and business potential. It provides not only value for MNCs but can also play an important role in achieving the social, economic and environmental dimensions of sustainable development (Alexander Brem and Björn Ivens, 2013). These dimensions are becoming more important for MNCs as public opinion is increasingly favouring more sustainable business practices. This section describes how RI installs a balance of economical, ecological and social goals into an innovation approach.

2.4.1 Reverse innovation for sustainable development

In its broad sense, sustainability describes the long-term maintenance of systems based on environmental, economic and social considerations (Crane and Matten, 2004). In this thesis sustainable development relates to a development that addresses

present needs, without undermining future generations' opportunity to meet their own needs.

In 2015 the United Nations (UN) set 17 goals and 169 targets for sustainable development incorporating a focus on people, the planet, peace and prosperity to be accomplished through global partnerships (UN, 2015). Recognising that eliminating poverty in all its dimensions provides the greatest global challenge and is an essential requirement for sustainable development.

These sustainable development goals (SDGs) sparked further development of international policy and collaboration among countries. However, MNCs can also play a significant role in achieving these goals (Kolk, Kourula, and Pisani, 2017). MNCs often desire strong pathways to EMs for the vast amount of potential customers they possess. Possibly hundreds of millions of consumers who are willing to buy their products. But innovating for EMs can besides a positive effect on their competitive advantage also create a meaningful effect on the economic and social progress of these markets and on the firm's sustainable performance. Two main sustainable dimensions are discussed.

Poverty and Inequality

In our innovation current system, people with lower incomes are not able to access many of the innovations that enhance the quality of life — from essential goods and services like healthcare and education; to consumer goods and services, like internet access and technological products. This is partly due to the prices that are being asked for innovations and partly as lower segments of the wealth distribution are simply not targeted.

These customer segments have been perceived as markets where not a lot of financial gains are to be obtained. Currently, households in the top 10% of the wealth distribution own more than half of total household wealth (OECD, 2019).

Excluding these customer segments from our global innovation system not only creates inequality but also hinders disadvantaged people from closing the poverty gap. Currently, it takes on average four to five generations of a family in the bottom 10% of the income distribution to reach an average income (OECD, 2019). The data shows shocking outliers like Colombia, where it will take at least 300 years for low-income family descendants to achieve a mean income (OECD, 2019).

In order to address inequality and create opportunities, countries should implement a holistic policy agenda based on four main areas: encouraging women's participation in the labour market; promoting employment and creating good quality jobs; strengthening quality education and skills growth and development during working life (Alexander Brem and Björn Ivens, 2013; OECD, 2019). These areas can be greatly enhanced when MNCs start operating and innovating in these segments integrating local resources.

RI has been shown to contribute to sustainable socio-economic change as it can contribute to local healthcare (Shan and M. A. Khan, 2016) and provides economic development and growth through collaboration with locals (Hadengue, Marcellis-Warin, Zedtwitz, et al., 2017). As RI. describes an innovation approach which targets these constrained segments and necessitates the use of local resources in the innovation process it advances sustainability in various ways. Furthermore, due to this close collaboration for RI, knowledge is shared interchangeably. MNCs obtain local market knowledge and EMs are introduced to advanced technology and new knowledge. This new knowledge adds to wealth creation which in turn leads to macroeconomic growth (Le Bas, 2016). RI increases private sector growth in EMs and according to Goldin, H. Rogers, Stern, et al., 2002 private-sector growth fuelled by innovation is the most essential aspect for long term development.

Important to note is that although MNCs entrance into EMs can have a positive employment result, it may also have a negative effect when MNCs poach talented employees from local firms (Fortanier and Van Wijk, 2010). Furthermore, MNC strategies can also negatively influence the development of infrastructure in EMs as direct investments can worsen local governments' financial constraints on producing essential infrastructure (Yamin and Sinkovics, 2009). Thus the approach to innovation in these markets is important for harnessing sustainability.

Environment

As RI initially starts with developing resource constraint innovations for EMs these products often have favourable environmental characteristics (Alexander Brem and Björn Ivens, 2013; Le Bas, 2016; A. K. Gupta and Wang, 2009). To develop these innovations, MNCs seek to reduce packaging, minimise transportation, reduce energy consumption, enhance durability and recycle, re-make, or re-use materials (Erik G. Hansen, Grosse-Dunker, and Reichwald, 2009a). This commonly leads to less usage of materials and processes aiding the environmental dimension of sustainability. Sustainability imposes a normative requirement on innovation and technology to be more economically and socially sustainable (Erik G Hansen, Grosse-Dunker, and Reichwald, 2009b). RI offers this new source of innovation whilst adding a competitive advantage.

2.4.2 Reverse innovation for competitive advantage

MNCs increasingly realise the value of formulating strategies which address the dimensions of sustainability (Epstein and Roy, 2001). But besides the positive effects of RI on sustainability performance, these strategies can also result in better business outcomes. Epstein and Roy, 2001 assert for instance that increased sustainability performance also leads to approving stakeholder reactions, improving lasting corporate financial performance.

A firms strategy is a fundamental driver for sustainability performance (Epstein and Widener, 2011). An important aspect of a firms strategy is its innovation practices (Teece, 2010). Thus the connection between innovation and sustainability is of increasing importance. However besides the added competitive advantage due to increased sustainability, RI provides competitive advantage it two other ways.

RI for accessing new markets

RI is a double-edged strategy in that it can be used in one way to create new customers in EM and through another way develop specific products that find new costumers in DMs. It is not just a matter of redesigning products or services, but of rethinking entire company processes and business models to meet the needs of resource-constrained EM customers (Alexander Brem and Björn Ivens, 2013). By turning the BoP into customers, MNCs can access a huge market, providing them with a competitive advantage in the future. Adding that BoP strategies which centre on using the strengths of local market circumstances —non-traditional partners, co-inventing local innovations and developing local capacities — exceed strategies that rely on overcoming the deficiencies of these markets (London and Stuart L. Hart, 2004). Therefore there is increasing awareness among MNCs that these markets are growing and provide opportunities for business. Especially as DMs are becoming more saturated and increasingly lesser market share is to be obtained, the growth potential lies in the EMs (C.K. Prahalad, 2005).

In addition, MNCs that have adapted their product to constrained requirements can redeploy their resource-constrained innovations to DMs to attract cost-conscious customers, or fill gaps in these large markets (M. Zeschky, Widenmayer, and Gassmann, 2014). New ideas that come from EMs, can provide essential inputs for global markets.

RI for harnessing against the threat of emerging market entrants

RI follows from a perception of how innovation differs from emerging to developed markets (Van Agtmael, 2007). In the conceptualisation of RI, the belief is that "competitive advantage is likely to shift from emerging MNEs (multinational enterprises) to developed world MNEs as the onus shifts from developing products to marketing them globally" (Sarkar, 2011, p. 239).

The traditional opinion is that firms located in EMs need to concentrate on cost efficiency to guarantee their competitive advantage in markets distinguished by low purchasing power and customers valuing other characteristics (Cacho, Marshall, and Milne, 2005). However, EMs have begun to catch up by developing their own innovative capacities. Resulting in the number of innovations developed in EMs having increased substantially, especially by MNCs subsidiaries (Brem, 2008; M. Zeschky, Widenmayer, and Gassmann, 2011). As these EM firms seek innovation and technological capabilities they invest in joint ventures and acquisitions of DM firms. MNCs are therefore concerned that if they do not produce innovations for these markets, the emerging firms developing their innovative capabilities will pre-empt them. Creating the possibility of these firms selling innovations in DMs and eventually disrupting them. Through RI, MNCs can harness against this possibility by gaining knowledge concerning product redesign, company process and business model rethinking (Brem and Wolfram, 2014).

RI knowledge creation and reducing innovation inefficiency

As markets are becoming more saturated and regulations more strict R&D costs are getting higher in DMs. Instead of firms becoming more efficient in their innovation practices, MNCs are actually becoming less efficient. This phenomenon is known as *Eroom's Law*—-where increased price-performance due to technological advances is outweighed by higher regulatory approval costs and other marketing costs(Scannell et al., 2012). This means that MNCs have to use more resources for the same innovation output. In addition, Le Bas, 2016 observed that organisations are increasingly putting financial limitations on research activities. This results in friction as more resources are needed for innovation outputs while MNCs do not have these resources readily available.

RI provides a way where innovation knowledge is created in a resource-constrained environment. This emerging market environment is less risky and cheaper to innovate in comparison to DMs. Furthermore, as these markets have fewer restrictions it creates an environment where MNC's can experience greater efficiency and knowledge development.

In addition, through RI MNCs adapt innovations which have already been proven to be successful in EMs. As a consequence, they minimise the risk inherent to the innovation cycle in an environment where they will experience minimal consequences of any mishaps. Subsequently, the knowledge gained in these EMs will aid to reduce the innovation inefficiencies in the DMs.

Slow growth in DMs also decreases the buying power of some of the poorest customers. Low-cost goods that could come from RI could create more appeal in DMs and access these customer segments too.

In this sense, RI provides an innovation strategy where MNCs do not have to reinvent the wheel constantly to stay ahead of fast-changing markets. Rather it creates an innovation approach allowing MNCs to maximise their innovation efficiency as innovations and knowledge for both markets can be constantly shared and adapted to satisfy local needs. This constant sharing of knowledge and iterations between markets through RI could create an innovation environment that is harnessed against the constantly changing markets of the future.

2.5 Summary Chapter 2

In short, this chapter laid the theoretical groundwork of RI through a literature review of key topics. The main takeaway from the first part of the literature review is that an *innovation* differs from an *invention* in that it produces economic value and diffuses to others besides the inventors. Thus the working definition for innovation is **the creation of novelty which brings economic benefit by developing new products or services or through the development of better processes** (R. Agarwal et al., 2015). '*Innovativeness*' describes the degree of change by an innovation. Through a macro perspective 'innovativeness' is the possibility of innovation to create a paradigm shift or discontinuity in science, technology or the market of an industry. From a micro perspective '*innovativeness*' can be regarded as the potential of an innovation to affect a firm's marketing resources, technological resources, skills, knowledge, capabilities, or strategy (Garcia and Calantone, 2002). Various constructs and dimensions have been used to describe innovations. The most prevalent are; type of innovation, stage of innovation and analysis level. Throughout the conceptualisation of RI described in the second part of the literature review, these terms have been used to extend the concept of RI.

RI is commonly described as a strategy that reverses the traditional flow of innovation. This approach initially entailed developing products that are adopted first in EMs and then adapted and adopted in DMs. Throughout the conceptualisation, scholars have proposed to extend the definition to allow for varying perspectives. Contributions have generally discussed the possibility of a reversal in any stage of the innovation process and specific product characteristics that are associated with RI. Although these have been valid contributions, a consensus on a new and extended definition has not been reached. By analysing the evolution and important contributions an operational definition of RI has been proposed. This research views RI as *a strategy where at any stage during the innovation process of a constrained innovation, a reversal of the flow of innovation takes place from an emergent or constrained market to a developed market*.

As the reversal of flow can occur in different stages and in combination with varying product characteristics, various innovation types have been found to be associated with RI. These have been examined and divided through the linkages they have with RI. The most referred to innovation types are frugal innovation, jugaad innovation, grassroots innovation and inclusive innovation. These types are related in the sense that they describe the same constrained innovation characteristics which RI describes. Furthermore, to determine these specific characteristics and constraints, local knowledge is vital. By accessing and using local knowledge in the innovation process opportunities that enhance social and economic prosperity are developed.

These sustainable aspects were further emphasised as sustainability is becoming increasingly important for business practices. By addressing the impact which RI can have on social, financial and environmental aspects, the interest towards RI was highlighted. RI provides access to new and previously excluded markets, thus reducing poverty and inequality by providing opportunities and knowledge creation resulting in macroeconomic growth of emerging markets.

However, besides the positive effect of RI on sustainability performance, RI also enhances competitive advantage. It does this by accessing the vast amount of possible consumers in the BoP of EMs and by harnessing against EM disruptive threats that have emerged in recent years. The learnings derived from innovation for and in these resource-constrained environments will subsequently aid in reducing innovation inefficiency in DMs. These aspects make it a compelling choice to extend our knowledge of RI.

It is imaginable that some of our most important contributions to sustainable innovation will originate from EMs since, when confronted with adversity, creativity emerges to solve the issues tormenting them. Hence understanding and harnessing the dynamics of RI should be of interest to individuals, authorities, MNCs and non-governmental organisations (NGOs). For this reason, tools are necessary to analyse and further enhance knowledge on RI described in this chapter. The following chapter describes the background of the methods and tools used for acquiring that knowledge in this thesis.

Chapter 3

Methodology: Analysing research papers and scientific fields

"To be confused is really a very exiting thing."

—Brian Cox

Chapter overview

In order to achieve the research objective of this thesis, various forms of literature analysis will be used. This chapter is a systematic, theoretical review of the methods used in literature reviews and more specific, bibliometric studies. It covers the theoretical origins of the methods and principles associated with qualitatively and quantitatively assessing literature. This chapter, therefore, encompasses the concepts, classification, theory, techniques and phases of various types of literature reviews. It serves as the rationale for the research approach and methods used in this thesis.

› The structure of this chapter is as follows. The first section, Section 3.1 introduces the various types of literature reviews. Section 3.2 discusses the basic concepts on which quantitative analysis methods, like bibliometric analysis are build. Subsequently, Section 3.3 explains the various types of bibliometric networks which can be analysed to asses literature structures. Common bibliometric indicators to assess impact are discussed in Section 3.4. Section 3.5 describes the visualisation software that has been used in this study.

3.1 Introduction and Classification of Literature Reviews

When starting a research project, multiple questions arise. What papers should I read? What are the most important publications on my topic? What topics are in need of research in my field and who are important scholars to follow closely? Scholars make frequent assessments on how to devote their finite time and resources. Assessments that are becoming increasingly tough as the sheer volume of scholarly publications increases.

To make these assessments scholars have to review the literature. A *literature review* is a library or desk-based approach that involves a secondary explicit knowledge analysis, thus analysing abstract concepts of explicit and tacit knowledge (Jesson, L. Matheson, and Lacey, 2011). A literature review can thus be a research in its own right. According to Denyer and Tranfield, 2009, it is important to perform these periodic reviews of present literature and research fields to distinguish the contributions to knowledge and to develop validated arguments regarding the evolution and advancement of a field. Tranfield, Denyer, and Smart, 2003 explain that a literature review is an essential tool for managing diversified knowledge and can assist to evaluate relevant intellectual structures for additional knowledge-base advancement. Besides, it gives novices, scholars, or individuals from outside the field insights towards principal authors and publications.

A general classification of these review types can be made based on the data they use. *Qualitative literature reviews* evaluate and interpret the concepts and content described in the literature. Qualitative reviews therefore bring together research on a topic, searching for research evidence from previous studies and drawing the findings together in perhaps a novel way (Seers, 2015). *Quantitative literature reviews* use quantitative methods based on numerical data, like statistical methods to evaluate the literature.

The following main types can be identified:

- ***Qualitative***
  - **Literature Review:**
    Analysis and synthesis of knowledge, *focusing on results, and not just bibliographic citations*. Summarising the literature material and forming conclusions from it. (H. M. Cooper, 1988)
  - **Traditional Literature Review:**
    Typically uses a *critical approach* which could test theories or hypotheses by critically examining the methodology and outcomes of single primary research, with a emphasis on precedent and contextual content (Jesson, L. Matheson, and Lacey, 2011).
  - **Systematic Literature Review:**
    A review using a *clear stated purpose, a question, a defined search approach*, setting out criteria for inclusion and exclusion, producing a qualitative assessment of the articles (Jesson, L. Matheson, and Lacey, 2011)
- ***Quantitative***
  - **Bibliometric analysis:**
    Bibliometrics is a method which includes *statistical analysis of published articles and quotations* in order to measure their effect (Maditati et al., 2018). In addition, Bibliometric analysis reveals key papers and demonstrates objectively the connections between and between publications on a specific research subject or area by evaluating how many times other published articles have co-cited them (Fetscherin and Usunier, 2012).
  - **Visualisation Analysis/Bibliometric Mapping:**
    Quantitative methods to represent scientific literature visually, based on bibliographic data (J. Daniels and Thistlethwaite, 2017). Visualisation analysis therefore makes use of bibliometric data to provide information in a more intuitive manner.

As this thesis uses both a qualitative and and a quantitative approach, both approaches and important concepts will be introduced in the following sections.

3.2 Concepts in literature analysis

Presently, not just the number of scholarly publications resumes to grow but also new forms of information and publications arise. To tackle this abundance of information, scholars have continually used filters. In the beginning these filters were manually assembled *Compendia*— collections of concise but detailed information about particular bodies of knowledge and *Corpora* — structured set of texts. However, during the mid-20th century these filters build on manual indexing began to fail as a result of the large number of publications produced after the Second World War. Garfield, 1955 and others proposed an innovative bibliographic system for science literature: automated filters that maximised scholars own impact assessments by accumulating citations as notions of peer recognition. Better known as *citation indexing*.

Citation indexing makes connections between books and articles that were written in the archive of scientific literature and articles that make reference to — '*cite*'— these older publications. In other words, it is a method that permits scholars to track the use of an idea (or article) *forward* to others who have used and thus 'cited' it. The citation index thus has a quantitative value, for it may aid a scholar to measure the influence of an article, it's 'impact factor' (Garfield, 1955). The citation indexes were initially developed mainly for information retrieval and identifying relevant publications independent of language, title words or keywords. These citation-based filters have spectacularly increased in importance and have become the principle of how scholarly literature is quantitatively measured.

3.2.1 Citation or Reference

To start, it is important to distinguish the terminological difference between '*citation*' and '*reference*'. Price, 1986, p. 284 gives a clear explanation: "It seems to me a great pity to waste a good technical term by using the words *citation* and *reference* interchangeably. I therefore propose and adopt the convention that if Paper R contains a bibliographic footnote using and describing Paper C, then R contains a reference to C, and C has a citation from R. The number of references a paper has is measured by the number of items in its bibliography as end-notes, footnotes, etc., while the number of citations a paper has is found by looking it up in a citation index and seeing how many others papers mention it.". This has been visualised in Figure 3.1.

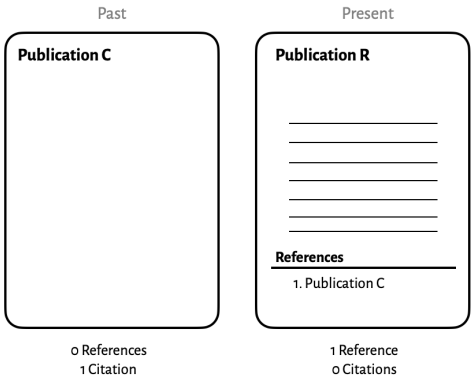


FIGURE 3.1: Terminological difference between references or citations

Citation	Reference
· A specific source that is mentioned in the body of work · Includes the name of the author and publication date or page number · Found in the body of work	· A list of sources mentioned at the end of the work · Includes more information like author, title, publication date and page number · Found at the end of the work

TABLE 3.1: Practical differences between citation and reference

In other words, citations signify a conceptual relationship acknowledged by the publishing scholars. Through the references they cite in their works, scholars give precise relationships between their present research and prior literature. Thus, explicit references indicate that an author has determined a specific published work, theory or finding useful for the development of his contribution.

Besides, the conceptual differences, there are some well-known practical differences which have been summarised in Table 3.1. These concepts provide the basis of quantitative literature analysis on which this chapter will further build.

3.2.2 Bibliographic Databases

Bibliographic Databases contain metadata about publications and their citing publications. The data in these databases often includes:

- Authors
- Affiliations
- Publication
- Source
- Volume
- Issue
- Pages
- Publications year
- DOI
- Title
- Abstract
- Keywords
- Document Type
- Cited references
- Scientific Field
- City

Various databases are used in different disciplines of which numerous have been reviewed for this study (see Table D.1). Based on findings of Visser, Jan van Eck, and Waltman, 2019, accessibility and software integration possibilities, the following databases have been used for this study:

- Web of Science/ Web of Knowledge
  Formerly created and supported by the Institute of Scientific Information (ISI), subsequently by Thomson Reuters and currently by Clarivate Analytics (Clarivate, 2020). This database gives the possibility to seek publications, citations and h-indexes. It has three sub-databases: Science Citation Index (SCI), Social Sciences Citation Index (SSCI) and Arts and Humanities Citation Index (A&HCI) (Clarivate, 2020). A limitation of Web of science is that author names have not been standardised (Clarivate, 2020). For instance, the name of an author, institution or journal containing the letters ü or ømay be found with multiple spelling variations. Thus when using bibliometric analysis, all variations should be included.
- Elsevier's Scopus
  Scopus is one of the most extensive abstract and citation literature database which contains academic papers, books and conference proceedings. Scopus covers a large amount of documents that are not covered by ISI Web of Science (Visser, Jan van Eck, and Waltman, 2019). It is a multidisciplinary bibliometric database created and sustained by Elsevier (B.V., 2020). Its strength compared to Web of Science is that it does standardise author and institution names. Furthermore, it like Web of Science also provides the possibility to search for publications and gather bibliometric performance indicators.

3.2.3 Bibliographic Networks

As mentioned in the introduction of this chapter, scholars have determined various ways to classify knowledge and data in order to cope with the large quantities of information produced through science. In information sciences, there are various methods

to classify and represent this information, like info-graphics, images, point clouds and networks. *Networks* are graphical representations of models of real systems. In its most basic form, a network is a collection of points connected by lines. In information science terminology, a point is termed a *Node* and a line as an *Edge*, see Figure 3.2. Nodes represent data and edges represent relations between that data. Therefore, networks of nodes and edges represent systems of knowledge and their interactions which can be from various sources (Barrat, Barthelemy, and Vespignani, 2008; Dorogovtsev and Mendes, 2013; Newman, 2018; J. Daniels and Thistlethwaite, 2017).

Many systems of interest in the physical, biological, and social sciences can be represented and viewed as networks. Four broad categories can be distinguished: technological networks, social networks, biological networks, and information networks (Newman, 2018). A well-known example of a technological network is the Internet, a computer data network where nodes represent computers and edges the data connections between them such as cables or telephone lines.
In literature analysis scholars discuss *Bibliometric Networks*, where nodes can be for example publications, journals, researchers, or keywords. The edges in bibliometric networks signify the relations between the selected type of nodes. Through the construction of these networks, we are able to study the body of knowledge of interest.

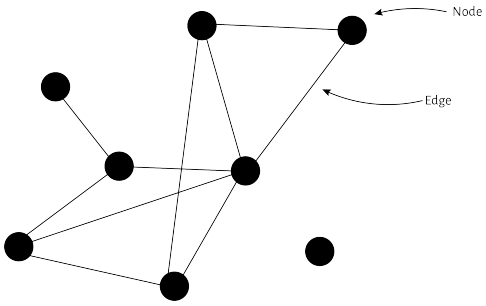


Figure 3.2: A small network composed of 8 nodes and 10 edges

There are various practical reasons why we would like to study the structure of bibliometric networks. The function of literature is to transfer knowledge from one person to another to progress humanity's knowledge. This is achieved by writing down new ideas and concepts which are transferred from node to node so others can access this at different times from all over the world and build upon it. The structure of the network determines how efficiently this function is performed and when the structure is known we can address many issues of practical significance. What is the node through which most knowledge is transferred? What are the dead ends in the network? What nodes have the strongest relations? Where should new capacity be added if the possibility arises?

Bibliometric networks are part of information networks and also illustrate another concept of network theory, the *Directed Network*. Academic publications often include references to other previously published articles. This can be viewed as references forming a network in which the articles are the nodes and there is a directed edge from article A to B if A cites B. The edges run in one specific singular direction and thus a citation network is deemed a directed network. These types of networks represent, at least partly, the structure of the body of knowledge contained in the publications. Therefore, the aim of bibliometric analysis, of which networks form the basis, is to aid scholars and practitioners to filter the vast amount of research to find useful publications and identify possible research areas.

3.3 Bibliometric Analysis

Our present scientific knowledge is the aggregate effect of previous research publications as every academic publication references/cites to earlier publications. Every present publication is a continuation of earlier research topics and intellectual relations are established between prior and present research fields.

For knowledge progression, it is vital to classify scientific research to comprehend the conceptualisation and evolution of it in a better way. Throughout history, different methods of classifying knowledge have been developed and numerous efforts have been made to understand the structures of scientific fields. Bibliometric analysis is one of the most useful and efficient methods of mapping knowledge (J. Daniels and Thistlethwaite, 2017). In bibliometric analysis scholars study relations between publications.

According to Diodato and Gellatly, 2013, bibliometric analysis consists of three fields of study: Bibliometric laws, Citation Analysis and Bibliometric performance indicators. For this study the two latter mentioned fields of study are of importance and will be discussed.

3.3.1 Citation Analysis

When an author cites another author, a relation is created. Citation analysis utilises citations in scholarly publications to determine linkages. Many different linkages can be determined, for instance between scholars, publications, scientific journals, research fields and countries. Over time, publications start to build complex relations among them which can be analysed through the formation of bibliometric networks.

By creating the bibliographic networks based on what relation is to be studied, one can assess an entire field of research. Bibliographic networks are also weighted networks, meaning that the edges determine not only a relationship but perhaps, more importantly, the strength of that relationship (Eck and Waltman, 2014).

These relations *from* (backwards) and *to* (forwards) a certain publication can be analysed through citation analysis. A popular application of citation analysis is to assess the impact of publications, journals or scholars. This is achieved by computing the number of times a publication, for instance, has been cited by others. The higher the number, the stronger the relationship and the greater the impact that publication has had. The following different approaches can be used to analyse the relations in bibliometric networks.

Direct Citation

A Direct citation relation occurs when one publication references another (Boyack and Klavans, 2010). In Figure 3.3 cluster (A, M, N) forms as A cites M and N. Therefore, clusters of direct citation relations are created if the articles have referenced common publications. The term 'direct' corresponds to the direct indication of relatedness between the publications. Creating a bibliographic network based on direct-citation relations are relatively uncommon. This is because direct citations often result in sparse networks, however they do indicate the strongest relations within a network (Eck and Waltman, 2014).

Bibliographic-Coupling

Kessler, 1963, first introduced the term *Bibliographic Coupling*. Two publications are bibliographically coupled if there is a third common publication, referenced by both publications (Kessler, 1963). So as demonstrated in Figure 3.3, if papers C and D both reference paper O, you could say they are related and bibliographically coupled, even though they don't directly cite each other.

The larger the number of references two publications have in common, the stronger their bibliographic coupling relationship is (Eck and Waltman, 2014). Alternatively, bibliographic coupling is about the overlap in bibliographies and thus references of publications. Bibliographic coupling is therefore applied to deduce how similar the subject matter of two publications is. Important is that it asses the similarity in the *research front*— recently published and not yet cited publications (Boyack and Klavans, 2010).

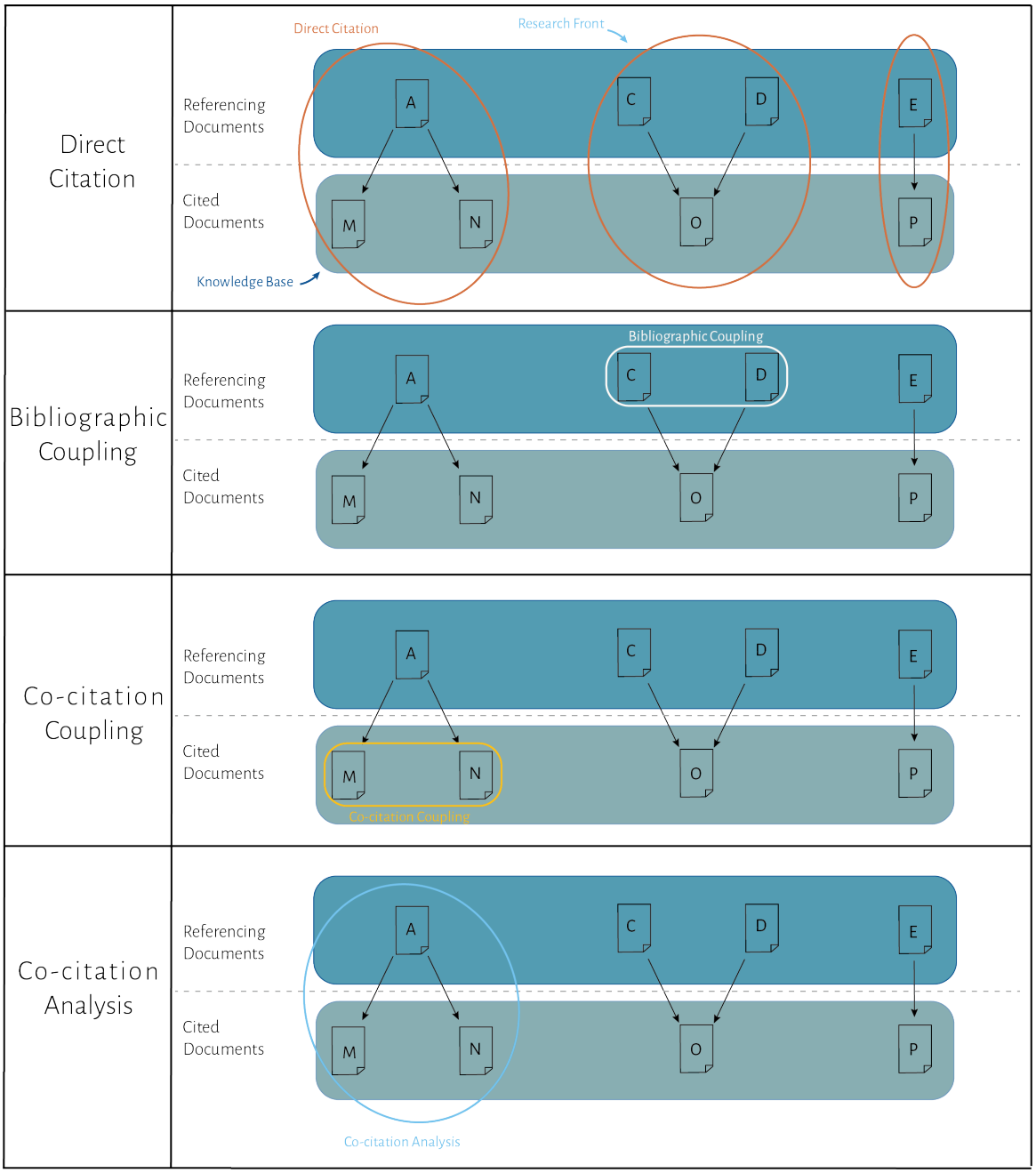
Co-citation Coupling

In 1973 Henry Small proposed a new indicator for similarity, co-citation coupling (Small, 1973). Co-citation coupling works on a similar principle as bibliographic coupling, but in an opposite way. Two publications have a co-cited relation when there exists a third publication that cites both publications (Marshakova, 1973; Small, 1973; Eck and Waltman, 2014). So as demonstrated in Figure 3.3, if papers A references paper M and N, they may be said to be related and co-citation coupled. The co-citation frequency is specified as the frequency by which two publications are cited together.

Co-citation is also a method of establishing the similarity of subjects between two publications. However, this time it assesses the similarity in the *knowledge base* of a scientific field—older publications which have been cited by more recent publications (Boyack and Klavans, 2010). Noteworthy is that this method is therefore not based on references but on citations to determine similarity, hence the name. Again the idea holds that if papers M and N are both cited by various other publications, their relationship is stronger.

Co-citation Analysis

The term *co-citation* is adopted differently throughout bibliometric studies but describes two different methods (Boyack and Klavans, 2010). *Co-citation coupling* is just the creation of clusters of co-cited publications. *Co-citation analysis* studies the result of co-citation coupling to determine bibliometric indicators discussed in Section 3.4. As analysis is often the goal of bibliometric studies, co-citation analysis is the most common approach.



Example networks for different citation-based analysis approaches for bibliometric analysis.
*Note.*Constructed by Bas Tijhof with information acquired from Boyack and Klavans, 2010; Eck and Waltman, 2014; J. Daniels and Thistlethwaite, 2017

FIGURE 3.3: Citation-based analysis approaches

The purpose of evaluating publication relationships is to classify based on the publication itself, the author, and the possible journal that includes the publication. Publication co-citation relations are used to search for similar publications. Journal co-citation relations are used to determine core journals. Author co-citation relations are used to analyse the intellectual structure of scientific fields. Co-citation analysis can thus actually map the structure of academic fields.

Limitations of citation analysis

In general, research using citation analysis and bibliographic coupling inherently has two main limitations:

(i) The *assumptions* which govern co-citation analysis.
According to Cawkell and Newton, 1976 the two main assumptions of co-citation analysis are:

1. Highly cited publications are of greater importance than lesser cited publications.
2. Highly co-cited publications are significant and content-wise associated with another.

Although in the vast majority of cases these assumptions are correct, some publications which can be of importance could be left unidentified. However, considering that this abnormality is not significant, co-citation analysis techniques are useful tools for evaluating literature and scientific activities (Cawkell and Newton, 1976; Osareh, 1996).

(ii) *Source issues* of citation data.
In the data-set which is used for citation analysis, some inaccuracies can occur. These inaccuracies can be self-citations, multiple authors, homographs, synonyms, sources, time variations, scientific field variations, the incompleteness of the bibliometric database, language issues, and errors (Vinkler, 1986; L. C. Smith, 1981). However due to the literature selected for bibliometric studies commonly having a high referencing consensus these issues fall into the category of statistical and acceptable "noise" having minor implications on accuracy and reliability (Osareh, 1996; Franklin and Johnston, 1988; J. R. Cole and S. Cole, 1974).

(ii)a. Another drawback of citation analysis, often described in literature, is it only determines relations, but it cannot determine the content and context of that relation (Osareh, 1996; Eck and Waltman, 2014; J. Daniels and Thistlethwaite, 2017). These are termed *negative citations* and are part of source issues of citation data. But as it is often mentioned, it is highlighted here separately. For instance, an author can cite a publication to criticise the content. In citation analysis a relation is then determined but actually it is not a positive one and should be left out as it is not a measure for similarity.

Other data from bibliometric databases can also be used for the development of networks. Apart from citation relations, the most commonly used types of analysis are keyword occurrence relations and co-authorship relations as these give different insights (Eck and Waltman, 2014).

Keyword co-occurrence

While a citation analysis focuses on researching the structure of academic literature, a keyword or concept co-occurrence network (KCN) focuses on studying the *knowledge components* and *knowledge structure* of a field by analysing the relations between the keywords (Radhakrishnan et al., 2017). Every keyword in a KCN is represented as a node, and every co-occurrence of a pair of words is represented as a link. The number of times a pair of words co-occur in multiple publications gives the weight to the relation connecting the pair. The network built in this way represents the cumulative knowledge of a research area and serves to discover relevant components of knowledge and insights based on the patterns and strength of links (Radhakrishnan et al., 2017). So instead of mapping publications, these networks structure the knowledge that is frequently discussed and described.

The keywords or concepts are extracted from publication titles and abstracts and sometimes from keyword lists given by authors. In general, the metrics used to evaluate a network's topographical structure are represented by two measures: 'betweenness-centrality' and 'modularity'. *Betweenness-centrality* of a node measures the number of times the node is included in the shortest paths in the keyword network among all pairs of nodes. If it is included in multiple short paths, the value increases. *Modularity* represents the ability of the network to decompose into meaningful components. This indicates if the network has specific sub-networks that are highly related or if the research field is more integrated.

By creating different time spans in the literary data, the evolution of keywords can be analysed. This provides insights into when certain topics were discussed or it can indicate what knowledge components have recently been of more interest.

Co-authorship

Co-authorship works on the exact principle as keyword co-occurrence except instead of using keywords, authors are used for analysis and network construction.

The constructed network gives insights into collaboration networks and research groups. Through co-authorship networks, the most important networks can be identified and even across what countries and organisations collaboration occurs.

As described in this section, each created network provides its own information and insights. No singular network can provide all the wanted information on a scientific field. However, in unison, these networks provide great and comprehensive insights into the literature.

3.4 Indicators of Research Performance

Bibliometrics is often applied to measure the impact of an author, a publication, topic or subject area. However, constructing networks is not always practical and can be time consuming. Therefore, scholars have developed specific metrics based in bibliometric data to quickly asses the impact or influence of an author, journal or publication. These metrics for impact are called research performance indicators and are used by numerous databases. The most well-known bibliometric indicators which have been used for this study are a journals impact factor and the h-index. This section will introduce these two bibliometric indicators.

The Journal Impact Factor (JIF)

The Journal Impact Factor (JIF) also as referred to as the impact number, impact measure or citation factor is an indicator of the impact of a scientific journal in terms of how often its articles are cited. It is a measure of the frequency with which the average article in a journal has been cited in a particular year or period. The JIF is thus calculated as the average number of citations received per paper published in that journal during the two previous years, see the following formula:

$A =$ The Journal's total citations in 2019
$B =$ The Journal's citations in 2019 to all items published in 2017-2018
$\cdot B$ is a subset of A
$C =$ The number of citable articles published in the journal in 2017-2018
$D = \frac{B}{C} =$ 2019 Journal Impact Factor

$$\text{2019 Impact Factor of Journal X} = \frac{B}{C} = \frac{\text{Number of references in 2019 to all articles published in 2017 and 2018 in journal X}}{\text{Number of articles journal X published in 2017 and 2018}}$$

For instance, the *International Journal of Emerging Markets* had an impact factor of 2.067 in 2018 (InCites Reports, 2018).

$$JIF_{IJoEM_{2018}} = \frac{94_{2016} + 61_{2017}}{36_{2016} + 39_{2017}} = \frac{155}{75} = 2.067$$

This indicates that each article published in the *International Journal of Emerging Markets* has been cited on average 2.067 times during the previous two years. For indication, the top 5% of journals have impact factors approximately equal to or greater than 6 and approximately two-thirds of the journals tracked have an impact factor equal to or greater than 1.

The ISI Web of Science InCites Journal Citation Reports (JCR) announces the annual JIFs, as well as supplementary metrics such as a 5-year Impact Factor, Immediacy Index, and the Cited Half Life. The values are published once a year, normally in June.

It is important to highlight that the JIF only refers to a journal and not to an article, collection of articles in that journal nor the work of a specific author. The JIF indicates citation patterns of research disciplines and they also indicates the size of the research community of a discipline (Duberman and Sieving, 2018). Higher JIF numbers indicate larger research communities.

H-index

Scientist Jorge Hirsch created the h-index, the first widely used bibliometric indicator to judge the impact and productivity of an individual researcher. The h-index is defined as the highest *h* value where an author has published *h* articles that have all been cited at least *h* times (Alonso et al., 2009).

The h-index is often determined by taking the number of articles published by an author and order them by the number of citations each article has; the h-index is then how many articles have received at least that amount of citations (Duberman and Sieving, 2018).

Example

- Publication (A) = 25 citations
- Publication (B) = 10 citations
- Publication (C) = 8 citations
- Publication (D) = 4 citations
- Publication (E) = 3 citations

For the example above, the author's h-index is 4, it implies that they have four publications that have all been cited at least four times.

The h-index thus connects the number of publications to the number of citations to review both the author's current career growth and the importance of their publications. The quicker a scholar can increase their h-index, the more 'effective' and 'impactful' they are regarded. Just like the JIF, the h-index is reliant on the research area, as different areas have different citation patterns.

The h-index is commonly found in citation reports from various bibliometric databases, like ISI Web of Science .

These metrics are often used in a descriptive analysis in order to summarise data and to quickly asses literature. This then forms the starting point of further research. These metrics are often visualised in diagrams and tables. However, visualising bibliometric networks necessitates computer software.

3.5 Adopted Visualisation Software

To analyse and visualise the bilbliometric data, software has been used. Prior to choosing the adopted software, various software was reviewed. The advantages and disadvantages of reviewed software have been summarised in Appendix E. VosViewer and Bibliometrix have been chosen as providing best visualisation and analysis options. As the visualisations require more explanation, basic terminology is described in the following section.

3.5.1 VOSviewer

CitNetExplorer and VOSviewer are two highly integrated free Java applications for analyzing and visualizing citation networks developed by van Eck and Waltman and het CWTS Ledien. CitNetExplorer enables the user to [1] examine over time the growth of a research area, [2] identify the core literature on a research subject, and [3] explore a researcher's publication work and its impact on other researchers' publications (Aria and Cuccurullo, 2017a). VOSviewer covers the visual representation of bibliometric maps and is particularly useful for visualising large bibliometric maps in an intuitive way.

When using and interpreting the output of VOSviewer, it is essential to understand the terminology and structure used by the software.

Maps generated, visualised, and examined by VOSviewer include *items*. Items are the unit of analysis. Items thus may be documents, authors, organisations, countries or terms. A map usually involves only one type of item. This is to determine relations between the unit of analysis.

Among the items there can be *links* which indicates the relation between items. These links can be chosen before construction of a map and for clarity, I have added this choice to every map constructed. Examples of these links are bibliographic coupling links among documents, co-authorship links, and co-occurrence links connecting concepts. A bibliographic map includes only one type of link and between items, there can only be one link (Van Eck and Waltman, 2019). The strength of the link and thus the relation is assigned a numerical value and the greater this value, the stronger the link.

The links indicate the following:

- **Co-authorship links**: The number of publications two authors have co-authored.

- **Co-citation links**: Co-citation links indicate the amount of time two publications appear together in a reference list but that aren't directly linked together.
- **Bibliographic coupling links**: The links indicate the number of cited references two publications have in common.
- **Co-occurrence links**: the number of publications in which two keywords occur together.

Items and links collectively compose a network. A bibliographic network is thus a collection of items connected by links based on the relatedness between the items.

Items can be grouped into *clusters* if they have a high degree of relatedness. VOSviewer groups items into clusters automatically but does not specify on what bases the items are clustered. An item may only belong to one cluster and the clusters are assigned a colour and number in VOSviewer.

Items hold various *attributes*. A cluster number is an example of such an attribute. VOSviewer further assigns *weight* and *score* attributes represented by numerical values.

The *weight* attribute determines on what basis items are presented and how prominently they are displayed in the visualisation of the map. The weight of an item can be selected and should indicate the importance of the items. Resulting in an item with greater weight being more important than an item with a lower weight. This is shown in the maps by the label size of the items. The greater the size, the greater the weight.

Score attributes may indicate several numerical properties of items. Yet, since weight attributes already designate the importance of items, score attributes are used to indicate other numerical properties, for instance, year of publication. The score attributes are only visualised in the overlay visualisation of a bibliometric network. These different visualisations can be observed in Figure 3.4.

Network Visualisation

For the network visualisation, items are visualised by their label and by default also by a circle. The size of the label and circle is determined by the weight of the item and therefore defines the importance of an item. The distance between the items in the visualisation indicates the relatedness of the items among one another. The closer two items appear, the greater their relatedness. The links are represented by lines in the map.

Overlay Visualisation

The overlay visualisation is the same as the network visualisation. However, the items are coloured based on their scores which can be selected. The standard colours range from blue (low score) to green to yellow (high score) (Van Eck and Waltman, 2019). In each map, a colour bar is shown with the corresponding score value and colour.

Density Visualisation

The density visualisation offers two possibilities; *item density visualisation* and *cluster density visualisation*.

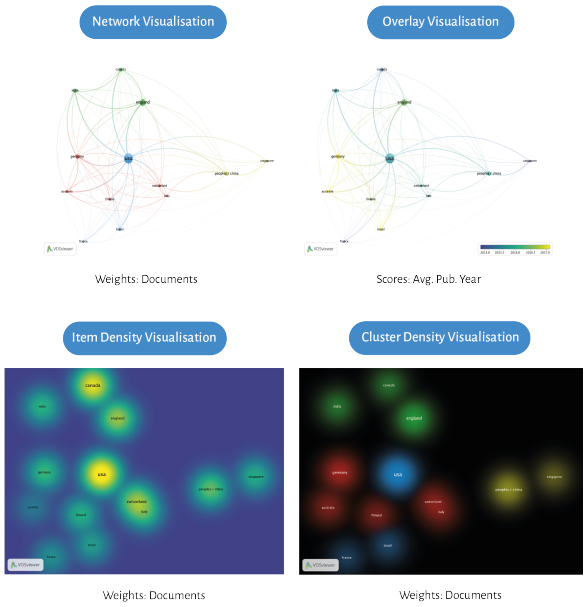


FIGURE 3.4: Network visualisation types in VOSviewer

The *item* density visualisation depicts items by their label in a comparable manner as in the network visualisation and the overlay visualisation. Each position in the item density visualisation has a colour showing the density of items at that position. The density at a specific position in a map depends on the number of neighbouring items and the importance of those items (Van Eck and Waltman, 2019). The higher the number of neighbouring items and the higher the weights of the neighbouring items at the position of interest, the greater the density. The greater the density, the closer the default colour of a position is to yellow. Alternatively, the smaller the number of neighbouring items at a position and the lower the weights of those items, the closer the colour at a position is to blue.

The *cluster* density visualisation is comparable to the item density visualisation. However, the density of the items is illustrated separately for each cluster of items. The colour of a position is in this case reached by combining the colours of the different

clusters. The weight attached to the colour of a cluster is dependent on the number of items belonging to that cluster in the neighbourhood of that position. This weight is visualised by the brightness of the corresponding colours.

3.5.2 Bibliometrix R-package

The bibliometrix R-package offers a collection of methods for bibliometric and scientometric quantitative analysis. It is developed in the R language, which is an open-source environment (Aria and Cuccurullo, 2017a). R is a language and environment for computational statistics and graphics. R can be regarded as another version of the S language. There are some major differences but a lot of code written for S runs unchanged within R. R is fully configurable and offers a broad array of mathematical and graphical techniques.

Perhaps the key characteristics to prefer R over other programming languages for scientific computation are the presence of large, efficient statistical algorithms, access over high-quality computational processes, and integrated data visualisation software.

Within this environment the package *bibliometrix* runs. This package offers advanced bibliometric tools but necessitates some programming knowledge. It provides integration with most bibliometric databases and uses similar clustering techniques as VOSviewer.

Thus by adopting these two programs the scientific field of RI can be analysed from various perspectives. Important to note is that these programs only distinguish relations and the weight/importance of these relations. These relations give objective insights into the structure of the scientific field. However, for proper analysis and interpretation of these relations, the content of areas of interest needs to be reviewed. Therefore, this study combines bibliometric analysis and content analysis in the following chapters.

3.6 Summary Chapter 3

This chapter has introduced various methods for analysing literature. Two main categories can be assigned based on whether research uses quantitative or qualitative data. Qualitative research reviews the content of knowledge in literature. Quantitative research analyses the relations and structure between knowledge components.
The most common method for analysing these relations is by using citation analysis. Scholars create knowledge by referring and elaborating on previous publications and theories. By referring to previous publications known as citing, scholars build bibliometric networks.
These networks consist of nodes— data points in the network— and edges—the relations between the nodes. The data that makes up these networks is obtained from bibliometric databases. This study uses Scopus and ISI web of science as databases for data collection. In combination, these databases have been found to provide a comprehensive array of literature in the domain of the technical and social sciences.
Through direct citation, bibliographic coupling, co-citation coupling and co-citation analysis, similarities among publications, scholars and institutions can be determined. Co-citation analysis is the most used method in bibliometric research. Two publications have a co-cited relation when there exists a third publication that cites both publications. Through these relations, the academic structure of the field can be mapped.
Keyword co-occurrence gives insight into the knowledge structure of the scientific field as important keywords and the evolution of keywords can be analysed. Co-authorship networks give insight into the collaborative networks within a scientific field. These networks are commonly visualised through mapping. The visualisation software that have been chosen for this study are VOSviewer and Bibliometrix R-package. These programs allow for easy integration with databases, elaborate analysis options and powerful visualisation.
Bibliometric indicators are metrics impact and influence. The journal impact factor (JIF) is a measure for the impact of a scientific journal or publication. The H index is a measure for the impact and productivity of an author. These measures are comprehensible metrics that are often used as a starting point for literature reviews. They allow for quick determination of relevant and influential authors and are used for descriptive analysis where bibliometric data is summarised.

This chapter has described fundamental bibliometric concepts and relevant knowledge regarding the methods used in this study. The following chapter adopts these methods and executes the initial step of bibliometric and content analysis; data collection and descriptive analysis. As the following chapter should stand alone according to Jesson, L. Matheson, and Lacey, 2011 some overlapping but mostly additional information on the methodology is presented.

Chapter 4

Data Collection and Analysis: Procedures prior to analysis

"Basic research is like shooting an arrow in the sky and, where it lands, painting a target."

—Homer Burton Adkins, American Chemist

Chapter overview

Recall that this thesis aims to present a thorough study of the intellectual structure of the RI field through the application of bibliometric visualisation analysis and content analysis. Particularly, the objectives of this analysis are to [1] study the evolution of research topics in the RI field and identify research streams; [2] determine important scholarly associations and collaborative networks; [3] map and analyse the intellectual structure of the field and [4] analyse and interpret the most influential works. These objectives aim to acquire an understanding of possible research gaps and future research opportunities for RI. Additionally, through a content analysis, a conceptual framework will be proposed which identifies and structures interrelating drives and antecedents for RI regarding differences between EMs.

› To achieve these objectives a complete database of RI publications is required.Section 4.1 describes the procedures though which data was collected and the intricate steps that led to a data set readable for bibliometric visualisation software. Based on this data s short descriptive analysis is presented in Section 4.2. Section 4.3 shortly summarises the data analysis methods and their reason for use in this research.

4.1 Data Collection

The first step of any literature review is the extraction of data. For this research, various data was collected consisting of abstracts, keywords, authors, citations etc. from two bibliographic databases. The data collection process and general research flow which leads to answering the research questions has been visualised in Figure 4.1.

4.1.1 Data extraction

For the review, I strived to create a complete database of RI related publications published between 2009 and 2019 without distinction of scientific discipline or journals. This time-frame covers the period in which RI was first described (Immelt, Vijay Govindarajan, and Chris Trimble, 2009) to the most recent year for which reliable citation data can be found.

Data collection for RStudio-Bibliometrix and VOSviewer

To collect the data sample, I initially consulted the ISI web of Science database in May 2020—the most prominent academic research database. It includes several databases, is multidisciplinary and provides reliable bibliographic data. Furthermore, it is one of the largest databases of scientific documents. First, I did a topical Boolean search in ISI Web of Science for any publications using the term *"Reverse Innovation"* in their titles, abstracts and keywords. The results were then refined by language (English). This initial step resulted in 148 publications.

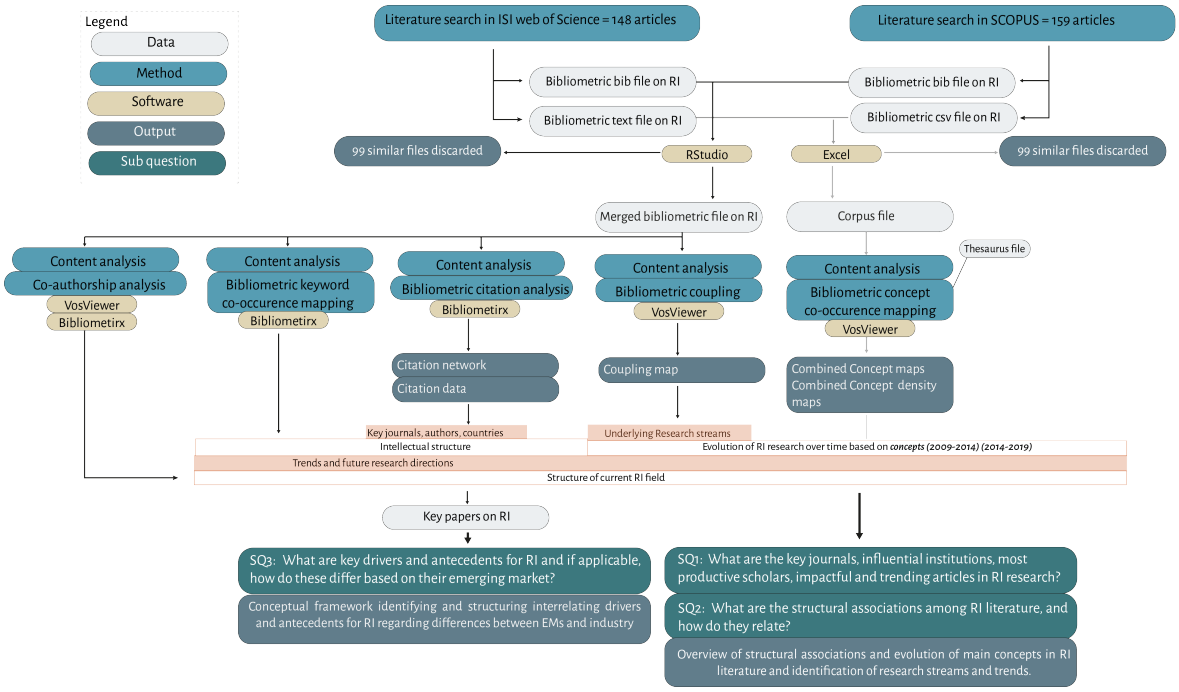


FIGURE 4.1: Data collection and analysis diagram

Due to RI being a fairly new topic and only having searched in one bibliographic database I had some doubt concerning the possibility of left out relevant publications or differences in databases which could lead to differing results. To prohibit this, Eslevier's Scopus was used and the same initial step was repeated. For "*Reverse Innovation*" Scopus yielded 189 publications between 2009 and 2019 without distinction of scientific disciplines.

Both databases provide comprehensive information for each publication, including title, abstract, keywords, authors, institutional and country affiliations and cited references (B.V., 2020; Clarivate, 2020). This data is of importance for doing structural analysis, co-occurrence analysis, co-authorship analysis, bibliographic coupling and co-citation analysis.

However, when reviewing the articles in each database, the coverage was quite different. Scopus had a strong focus on publications related to healthcare and ISI Web of Science did not contain conference proceedings.

As comprehensiveness was important I sought for solutions to combine the ISI Web of Science and Scopus data to analyse the entire field. However, in current literature no information could be found on how to achieve this. Besides, due to multiple databases being used, different file formats and categorisations (.text and .csv) were retrieved with overlapping publications. As data extraction is an important step for correct bibliographic analysis according to Osareh, 1996, a cleaning and formatting procedure was needed to merge the ISI Web of Science and Scopus data.

For this reason, I contacted the Centre for Science and Technology Studies (CWTS)[1] — a research institute for bibliometric and scientometric tools — and more specifically came in contact with Nees Jan van Eck. He provided me with some solutions to combine files on which I built further solely.

To start, I exported all the resulting data to Excel and ordered all publications based on their DOI to identify duplicates in both data sets. To merge all the data into a for VOSviewer readable text file, *Rstudio* software and the *Bibliometrix* package were used. Through a programming code I wrote myself and some iterations, I merged both files into one file including all bibliometric data. The programming code I wrote included the extraction of duplicates to reduce the possibilities of manual errors. The code can be found in Appendix F. The development of this code took some time and iterations but eventually resulted in a single extensive file, readable for bibliometric visualisation software. This file contained 208 publications related to RI.

When using the file some errors were given by both visualisation software proclaiming missing data (e.g. publication year of documents). These missing data points were manually added to create a complete file on RI.

For assuring the reliability of the developed file and of the analysis I used another bibliometric database called Dimensions file for triangulation purposes. Dimensions produces its bibliometric data from other sources like Crossref and PubMed and adds

[1] https://www.cwts.nl

to this data with information obtained from publishers (Waltman and Larivière, 2020). Dimensions does provide bibliometric data and has strong integration possibilities with VOSviewer and RStudio-Bibliometrix (Dimensions, 2020). The dimensions sample contained 187 relevant publications. For this reason it was deemed a proper data set to ensure the figures corresponded to some degree with other data. The used databases and the amount of publications they produced can be found in Section 4.1.1

The final constructed file containing ISI Web of Science and Scopus data was used for all types of analysis in Bibliometrix and VOSviewer apart from the concept and concept density maps. The following section explains how the data collection for these specific analyses took place.

Data collection for concept and concept density maps

For the concept and concept density maps through VOSviewer I constructed a corpus file. This was done by extracting all abstracts, titles and keywords of publications obtained through the previous collection method and merging them into one *text* file. For VOSviewer to recognise the file I opened the saved file and removed the first line in the original plain text file: *FN Thomson Reuters Web of Science™VR* and replaced it with *FN ISI Export Format VR*. Furthermore, I changed the encoding to "ANSI" for VOSviewer to recognise the file.

Important to note is that their is no difference in publications represented in the two data sets. The only difference is that the first *merged file* contains all bibliometric data and the second *corpus file* contains only text found in the corpus of the literature. Furthermore they use different formats to be used with the differing software.

The advantage of VOSviewer is that thesaurus files can be used to strengthen the conceptual structure of a bibliometric map. Bibliometrix/Biblioshiny does not allow for this option. The following section explains how the thesaurus file was created.

Table 4.1: Extracted data

Database	Extracted data	Publications
Dimensions	Bibliometric data of all publications related to reverse innovation	187
ISI Web of Science	Bibliometric data of all publications related to reverse innovation	148
	Titles, Keywords, Abstracts	148
	Manual download of all files	148
Scopus	Bibliometric data of all publications related to reverse innovation	159
	Titles, Keywords, Abstracts	159
Merged file	Bibliometric data of all publications related to reverse innovations	208
Corpus file	Titles, Keywords, Abstracts	208

4.1.2 Thesaurus Preparation

For the construction of the *concept maps* and *concept density maps* a thesaurus file has been used. This thesaurus file is used to merge different variations of concepts or synonyms (e.g. 'multi national' and 'multi-national'). This is useful when certain concepts are spelled differently or when various terms are used with the same meaning. The thesaurus file thus indicates that different concepts in fact refer to the same. Additionally it can be used to remove terms that muddle the map and do not add any conceptual meaning (e.g. article). To construct the thesaurus file all keywords used by the authors were collected and noted in an excel file. Then manually I went though the list and labelled the concepts in need of replacement and specified the term by which they needed to be replaced. Terms that were found irrelevant, like publication, were excluded from the concept maps. More importantly if concepts had synonyms they were identified. Identifying these synonyms is important as they affect the relations and thus the concept occurrence (Van Eck and Waltman, 2019). This process was also done manually. Finally an iterative process took place through which unidentified terms were extracted when found that they blurred the maps.

The output list was transferred to a text file with two columns; '*Label*' and '*Replace by*'. Transcribing the excel file to this format is essential for VOSviewer to understand the thesaurus file. Appendix G shows the concepts and terms that were most commonly spelled differently and by what they have been replaced. It also indicates the structure of the thesaurus file.

4.2 Descriptive Analysis

A descriptive analysis is an important first step for conducting bibliometric analyses as it summarises and describes the characteristics of a data set (Osareh, 1996). Through this descriptive analysis the body of literature is described by presenting initial figures.

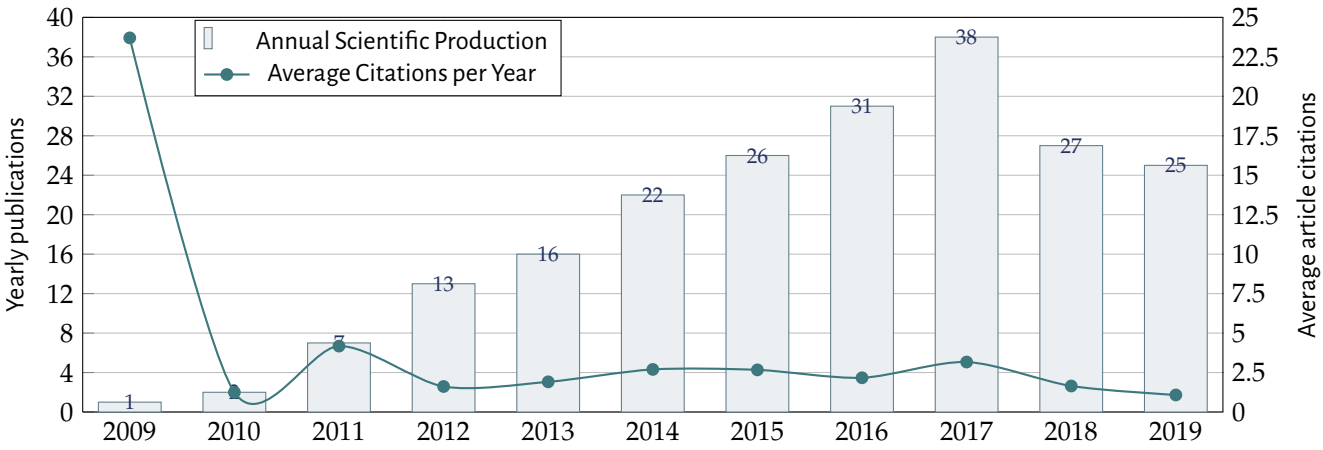


FIGURE 4.2: Publications and average citation count per year on reverse innovation

Figure 4.2 shows the number of publications of RI publications per year from 2009 to 2019. The first paper published on RI was in 2009, and it has since experienced steady growth till 2018 where a sudden decline of publications can be seen . External phenomena have been proposed to affect the advancement of scientific research (C. Chen, 2006) but why the sudden decrease of publications occurs and subsequently declines remains unclear. I propose two possibilities that could have resulted in this effect. According to Kincsö Izsak and Markianidou, 2013 the global financial crisis of 2008 affected Europe's science and innovation activities tremendously. The crisis negatively affected primarily research and innovation (R&I) budgets and the availability of R&I human resources (Kincsö Izsak and Markianidou, 2013). This could have led in a surge of interest in RI starting from 2008 as MNC's sought alternatives for their practices. But as the influence of the crisis decreased the necessity for alternative practices like RI dissipated. Alternatively, Larivière, Archambault, and Gingras, 2008 explains that the common life cycle of research interest and citations begins with a rapid increase during the initial years, followed by a peak, and a slow but steady descend afterwards. Perhaps, this is what can be observed in provided most publications and several reviews (Hadengue, Marcellis-Warin, Zedtwitz, et al., 2017; Agarwal, Grottke, et al., 2017; Zhu, Zou, and H. Xu, 2017), research interest decreased as future research directions were unclear.

As shown in Table 4.2, the top 10 source journals accounted for 25.48% of RI publications. Globalisation and Health is the most prominent of all journals and account for nearly 10% of all publications on RI. A total of 136 other sources counted for the remaining 155 publications.

Of all publications 107 had specified a country or origin. Of those the U.S., U.K., and Germany were the top three source countries contributing to almost 46,73% percent of publications (Figure 4.3, Appendix H). In total 501 authors have written on RI and there exist a high degree of collaboration as on average 2.41 authors write a single document.

The source publications featured citations to 8834 different works, which forms the foundation for the later presented citation analysis.

TABLE 4.2: Top 10 journals publishing on reverse innovation (2009-2019)

Source	Articles	Percentage	H index	JIF 2019	Citations	First publication year
Globalization And Health	20	9,62%	12	2.650	340	2013
Research Technology Management	10	4.81%	4	1.350	116	2012
Journal Of Cleaner Production	5	2.40%	5	7.100	155	2016
International Journal Of Automotive Technology And Management	3	1.44%	3	0.740	14	2014
Journal Of Product Innovation Management	3	1.44%	3	5.270	134	2012
Harvard Business Review	3	1.44%	2	13.210	272	2009
International Journal Of Innovation Management	3	1.44%	2	1.300	5	2015
Journal Of Innovation Economics & Management	3	1.44%	2	1.059	14	2012
BMJ Innovations	2	0.96%	2	1.760	13	2017
Future Medicinal Chemistry	2	0.96%	2	3.040	25	2010
Total represented in journals (*of 208*)	54	25.96%				

4.3 Data Analysis

Moral-Muñoz et al., 2020 compared eight bibliometric analysis tools, finding that no single software could provide a comprehensive set of bibliometric analyses. Nonetheless, Bibliometrix and its user interface Biblioshiny stand out as it provides the most extensive suite of techniques for various bibliometric networks and multiple analytical methods (Moral-Muñoz et al., 2020).
Numerous types of bibliometric networks can be built in Bibliometrix / Biblioshiny (Moral-Muñoz et al., 2020; Aria and Cuccurullo, 2017b) and VOSviewer holds great visualisation tools (Moral-Muñoz et al., 2020; Eck and Waltman, 2010). Therefore both tools have been used for this bibliometric study.
The subsequent analysis techniques have been used in the present study: [1] visualisation analysis of concept co-occurrence, [2] Bibliographic coupling analysis, [3] keyword co-occurrence analysis, [4] direct citation analysis, [5] co-authorship analysis of authors and associated countries, and [6] co-citation analysis dependent on references. Through these analyses, the structural associations and relevant information concerning the scientific field of RI can be analysed.

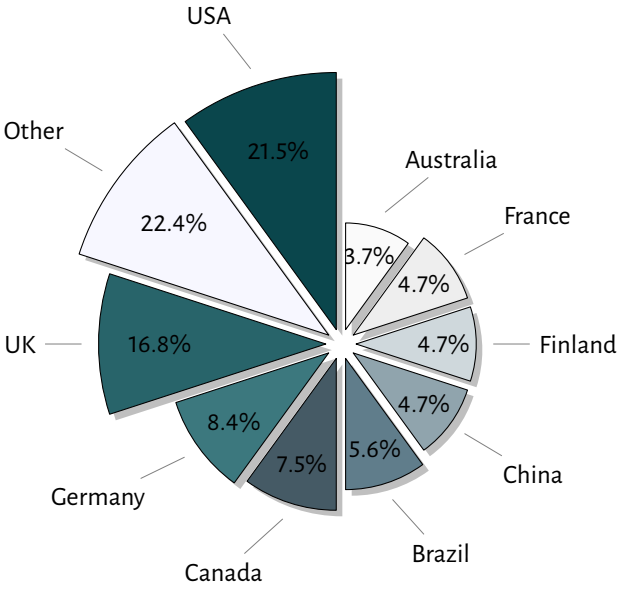


FIGURE 4.3: Contributing Countries

Co-occurrence analysis is a form of quantitative analysis, which perceives the co-occurrence of coupled words (e.g keywords) in a source text to distinguish associations between such terms (He, 1999). With this analysis, terms are being divided into clusters and presented using a bibliometric map to give perspective into a field's central concepts and the strength of the relations between these. Both Bibliometrix / Biblioshiny and VOSviewer utilise their cluster detection algorithm to segment the network into subsets and mark them with specific words extracted from the text (Aria and Cuccurullo, 2017c).

Co-citation analysis offers insights into the intellectual framework and emerging trends in a field as it allows citations to be clustered based on how much individual works were co-cited in the sample's source papers (C. Chen, Ibekwe-SanJuan, and Hou, 2010). Document co-citation networks are based on pioneering work from Small, 1973 but have in recent years been expanded from a single time-frame series analysis to multiple time-frame analysis to identify important transitions over time (C. Chen, Ibekwe-SanJuan, and Hou, 2010)). By setting threshold values, Bibliometrix / Biblioshiny determines items to pick the most appropriate networks from each slice. VOSviewer does not have this integrated into the software and thus this must be done manually by selecting time-frames and limiting the publications for that time-frame. Visualised networks can be viewed in various different modes which will be specified at each figure.

Co-authorship analysis describes the underlying patterns of collaboration between researchers working within a field. Authors, organisations, or countries are associated when authorship is shared among the collection of source articles. Bibliometrix / Biblioshiny and VOSviewer use this data to construct a network map to determine a field's social structure. Authors or documents published together tend to form network clusters.

To build specific bibliometric networks, threshold settings are needed to allow selection of items leading to the visualisation of the networks. Most studies using bibliometric software do not explicitly define their data threshold settings (— for example Jiang, Ritchie, and Benckendorff, 2019) making it tough for researchers to reproduce the networks. Therefore all threshold values and relevant metrics will be specified. For explanation of these metrics, refer to Table H.1.

4.4 Summary Chapter 4

In summary, this chapter has described the precise process of how the data for the subsequent bibliometric analyses was obtained. The data set contains relevant publications from ISI Web of Science and Scopus as it was found that their coverage varied substantially. As these data-sets used different formats a data merging, cleaning and formatting procedure was coded and executed in Rstudio. This generated file will be referred to in this thesis as the 'merged file'.
For the concept and concept density maps, a 'corpus file' was created by extracting data from titles, keywords and abstracts of Scopus and ISI Web of Science . This data was coded into a singular text file which will be used for keyword co-occurrence analysis. These two data files do not contain different publications, the only contain different data of the publications.
The main takeaway from the descriptive analysis is that scholars show a high degree of global collaboration. The most productive journals are Globalisation and Health and Research Technology Management. The U.S., U.K. and Germany are the top source countries. The greatest publication production year was 2017.
Lastly, the analysis techniques which will be performed through Bibliometrix and VOSviewer were briefly introduced.

Following this chapter is chapter 5, which provides and interprets the findings of the bibliometric study. It fulfils the first objective of this thesis to examine and interpret from bibliometric and visual analysis the intellectual network structures, evolution, significant studies, influential scholars, notable topics and the recent trends in the literature on RI.

Chapter 5

Bibliometric Analysis Results: Current state of the scientific field

"The purpose of computing is insight – not numbers."

—R. W. Hamming (1962)

Chapter overview

This chapter presents the results of the bibliometric analysis. In particular, the conceptual, intellectual and social structure of the scientific field are highlighted through various methods. The goal and scope was to determine the structural associations and most influential scholarly networks and publications on RI. Each subsection briefly describes how the specific results were obtained, key parameters and how to interpret certain figures. By thoroughly analysing the figures and the content of relevant publications, results are presented and discussed. Therefore, the answers to the the first two research sub-questions which correspond to the first objective of this study can be found in this chapter.

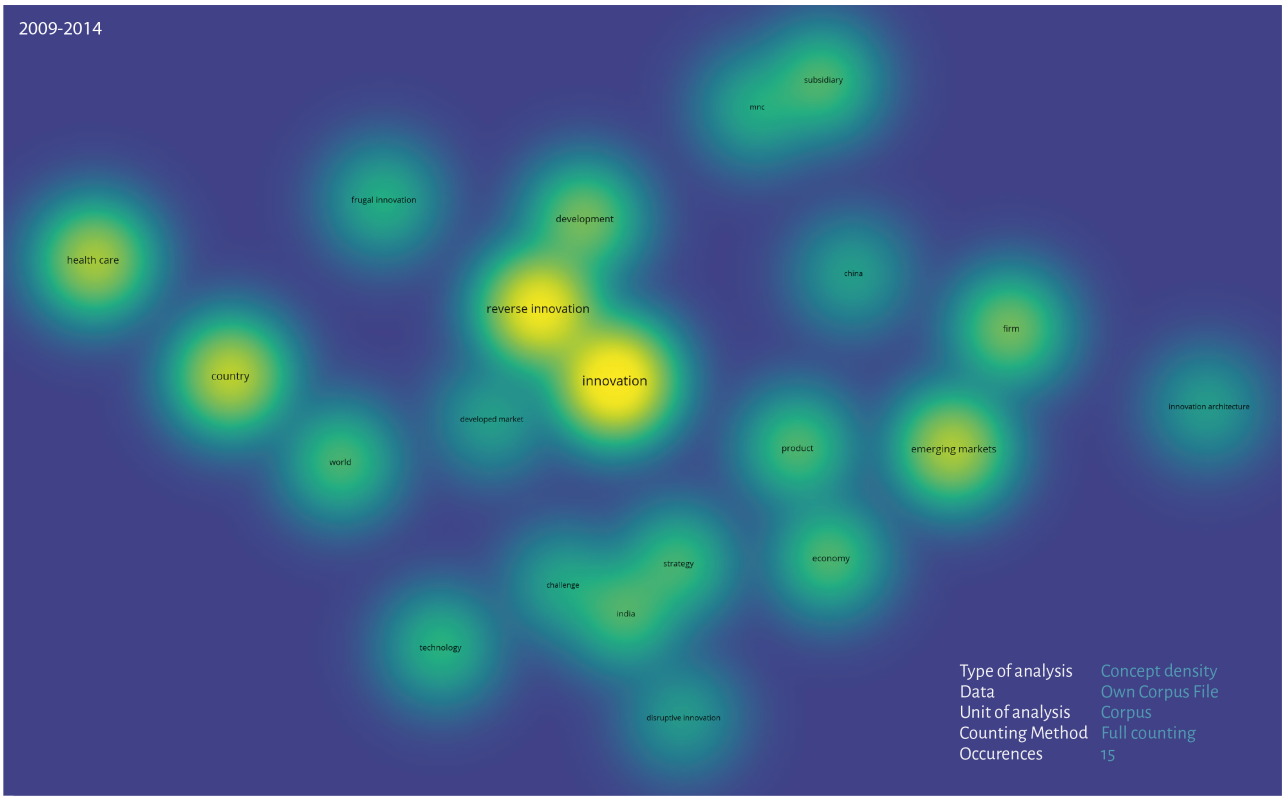
› The results and their interpretation are organised around the research objectives introduced earlier in this thesis. Section 5.1 presents the results of the concept and keyword co-occurrence analysis to obtain insights into the conceptual structure, relevant research topics and their evolution. The following section Section 5.2 identifies the research streams within the field. Section 5.3 discusses the evolution of these streams and the conceptual structure in more detail, based on keywords. Section 5.4 uses a citation analysis to determine the most influential scholars and publications within the field. The following section, Section 5.5, applies co-authorship analysis to explore the social structure by identifying scholarly communities and global collaborations. Section 5.6 presents insights on the intellectual structure and future directions of the field. Finally, Section 5.7 provides an integrated interpretation and summary of the bibliometric results.

5.1 Concept co-occurrence analysis: mapping the conceptual structure of the field

To determine the conceptual structure of the RI field, concept co-occurrence analysis was conducted using VOSviewer . The relatedness of the words is calculated by counting the number of times words occur together in the titles, abstracts and keywords. The greater the number of co-occurrences, the stronger their relationship. Visualisation is done by positioning the words based on similarity on a two-dimensional map. To clarify, the size of the word is the occurrence and therefore defines the importance of an item. The distance between the words in the visualisation indicates the relatedness of the words. The closer two items appear, the greater their relatedness. In combination with content analysis, the following section describes the current structure of the field and the evolution of the field over the last decade.

5.1.1 Conceptual evolution of the RI field

To evaluate the conceptual evolution of the RI field, Figure 5.1 and Figure 5.2 are considered. The figures indicate the variations of concept occurrences among two time-frames: 2009-2014 and 2015-2019. To recall, each position in the concept density visualisation has a colour showing the density of concepts at that position. The density at a specific position in a map depends on the number of neighbouring items and the importance of those items (Van Eck and Waltman, 2019). The higher the number of neighbouring items and the higher the weights of the neighbouring items at the position of interest, the greater the density. The greater the density, the closer the default colour of a position is to yellow. Alternatively, the smaller the number of neighbouring items at a position and the lower the weights of those items, the closer the colour at a position is to blue.



Note. Concept density map of RI literature from 2009 to 2014 with a keyword occurrence of 15 to be included in the map. Constructed with VOSviewer .

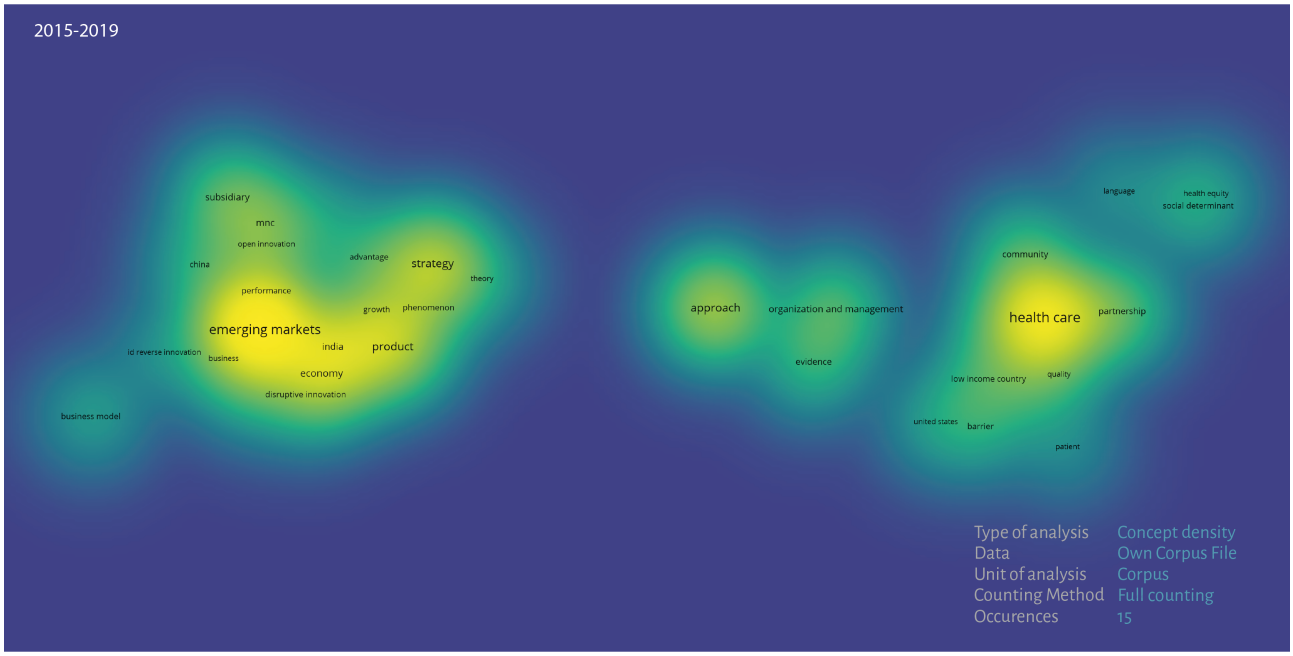
FIGURE 5.1: Concept Density Map 2009 - 2014

Conceptual structure 2009-2014

The concept density map of the first time-frame developed through VOSviewer shows 21 terms with an occurrence greater than 15. During the first time-frame, the field had quite a scattered conceptual structure and no clear structural division can be found among the clusters. The central part of the map (*reverse innovation*, *innovation* and *development*) contains the most occurring and most related terms. This is expected as in the initial phase of conceptualisation, the term was introduced and related to innovation and its development. Furthermore, some market characteristics can be seen in the in the map: *Emerging markets*, *country* and *developed market*. This is also expected as these terms describe the fundamental basis of RI, describing the reverse pattern of introduction and diffusion.

Some other innovation types have also been relevant in this first period. *Disruptive innovation* and *Frugal innovation* can be observed as separate terms. These areas were related to RI early on, as efforts were directed at connecting the concept to other innovation types (Hang, J. Chen, and Subramian, 2010; Vijay Govindarajan and Chris Trimble, 2012; Agarwal and Brem, 2012; M. Zeschky, Widenmayer, and Gassmann, 2014; Mani, Annadurai, and Danasekaran, 2014; Corsi and Di Minin, 2014). A major research domain started to form around *healthcare* but it is quite separate on the map. Interestingly also the relation between a *MNC* and its *subsidiary* is indicated. This relates to research concerning how RI should be managed within the context of a large organisation. *China* and *India* are the only countries represented on the map. China is found somewhat separate on the map. India however, has a more interesting position, which is perhaps related to the initial conceptualisation of RI by Immelt, Vijay Govindarajan, and Chris Trimble, 2009. In their publication, RI is described as a strategy to face the challenges in EMs and uses predominantly case studies in India. This could explain the relationship between these three terms and their occurrence.

Some characteristics of the innovations that reverse are also described. The higher occurrence of the terms *technology* and *product* indicate the RI mostly describes innovations that are technological products. This has also been confirmed in the literature review.



Note. Concept map of complete RI literature from 2015 to 2019 with a keyword occurrence of 15 to be included in the map. Constructed with VOSviewer .

FIGURE 5.2: Concept Density Map 2015 - 2019

Conceptual structure 2015-2019

When reviewing the map of the second time-frame of 2015-2019 in Figure 5.2, some clear structural changes can be observed. First, the map displays a more distinct conceptual structure which can be categorised in the main clusters of ***healthcare*** on the right-hand side, ***Organising for RI*** in the middle and the ***Conceptual development of RI*** on the left-hand side. These cluster are discussed.

- **Conceptual development of RI**
  Various concepts have grown in occurrence indicating an increase in interest on that topic. Interestingly, *frugal innovation* has disappeared from the map as perhaps its relevance and relations to RI have been sufficiently described. Interest in *disruptive innovation* has grown and the term *open innovation* has emerged. Apparently, the connection between RI and open innovation has been of interest to scholars. Also, when reviewing the location of the term *open innovation* it is positioned near *MNC* and *subsidiary*. The idea of open Innovation — the usage of purposeful information inflows and outflows to drive internal innovation and extend markets to use technologies externally (Chesbrough, 2003)— is apparently of interest to the organisational relationships between an MNC and its subsidiary. The idea of using local market knowledge obtained through a subsidiary for usage in other areas of an organisation is therefore clearly expressed in the concept density map.

  Furthermore, *China* and *India* are represented again as the most common countries where a RI process has originated. As these countries are not main contributing countries according to Figure 4.3, one can assume that most case studies use RI in India and China. Another interesting notion is that in recent years RI has not only been described as a *strategy*, but also as a *phenomenon*. The term strategy is still more dominant in the map, but this indicates a clear conceptual conflict which has also been determined in Section 2.2: Conceptual development of Reverse Innovation.

  Within the structural domain some business terms are also represented: *growth*, *performance* and *business*. These terms are closely related to the term *emerging markets* and this shows the business possibilities that are described in the literature as present in these markets. Compelling is also the term *product* in the map. Product innovations are most described in RI literature, leaving out other types of innovations like service and process innovations. Rather separate from this cluster the term *business model* occurs. Perhaps, this describes either business model innovations as an innovation type or business model innovation which is necessary for disruptive innovation. This could be a possibility as disruptive innovation is fairly close to this term indicating relatedness. However, one cannot speak of a strong relationship.

- **Organising for RI**
  The middle cluster shows associations among the terms *approach*, *organisation and management* and *evidence*. These are viewed as terms related to organising for RI. For RI to transpire creating management and organisations which allow for the transfer of innovation flow is important and researched extensively. However, for a global approach to RI, factors and antecedents should be identified which results in the determination of specific business practices that could induce RI. Through empirical evidence the practices can be verified and evaluated. Chapter 6 is an effort to describe an integrate the factors and antecedents that have been found in literature.

- **healthcare**
  healthcare is a term with many occurrences in the map and the term has since the start been associated to RI as the first products described experiencing a reversal of the flow of innovation were healthcare products (Immelt, Vijay Govindarajan, and Chris Trimble, 2009). In the first time-frame, the term was already present but in more recent years its research interest has increased. As healthcare services are increasingly attempting to optimise their cost-effectiveness, the efficient and adaptable solutions used in EMs provide opportunities in achieving this (Y. A. Bhatti et al., 2017; M. Prime et al., 2018). As DM health systems endure increasing resource constraints, they seek for the adoption of innovations and practices from EMs (Skopec, Issa, and Harris, 2019; Shamsuzzoha B Syed, Viva Dadwal, and G. Martin, 2013). The notion that more can be given for less is thus very appealing for healthcare systems.

  Interestingly the terms *community* and *partnership* are most occurring in relation to healthcare. Perhaps in addition to the opportunity for revolutionary cost savings, RIs are also a source of innovative ideas, encouraging DM professionals to expand their horizons while levelling the power balance of global information development. This is however only achieved through partnership and communities. These scholarly communities will be identified in Section 5.5. The *united states* is most concerned with RI for healthcare, this could be due to general electric (GE) having a dominant position in the literature. But alternatively one could argue that the united states have a healthcare system that is most in need of cost reductions as it seeks to increase the accessibility to healthcare for lower-income groups.

  The concepts *barrier* and *quality* are also highly occurring in the map and positioned close to healthcare. General barriers for RI include recognising the potential of innovations, resourcing and coordinating their adoption and the assumption that low-resource countries' technologies are not sufficient or appropriate for high-income settings (Skopec, Issa, and Harris, 2019; Shamsuzzoha B Syed, Viva Dadwal, and G. Martin, 2013; Rowthorn, Plum, and Zervos, 2016). The map indicates that especially in healthcare where safety and reliability are of the utmost importance, lower-quality issues and perceptions towards RIs create barriers to adoption.

To summarise, in recent years the structural associations in the RI field have become more distinct. Emerging areas are healthcare and further conceptual development of the concept. Open innovation and disruptive innovation have had more scholarly interest than frugal innovation. Within the conceptual development, authors describe the concept either as a phenomenon or as a strategy. The term approach is used more often than strategy and phenomenon but has no clear structural associations to either conceptual development or healthcare. Furthermore, RI is associated more with product innovations than other innovation types.

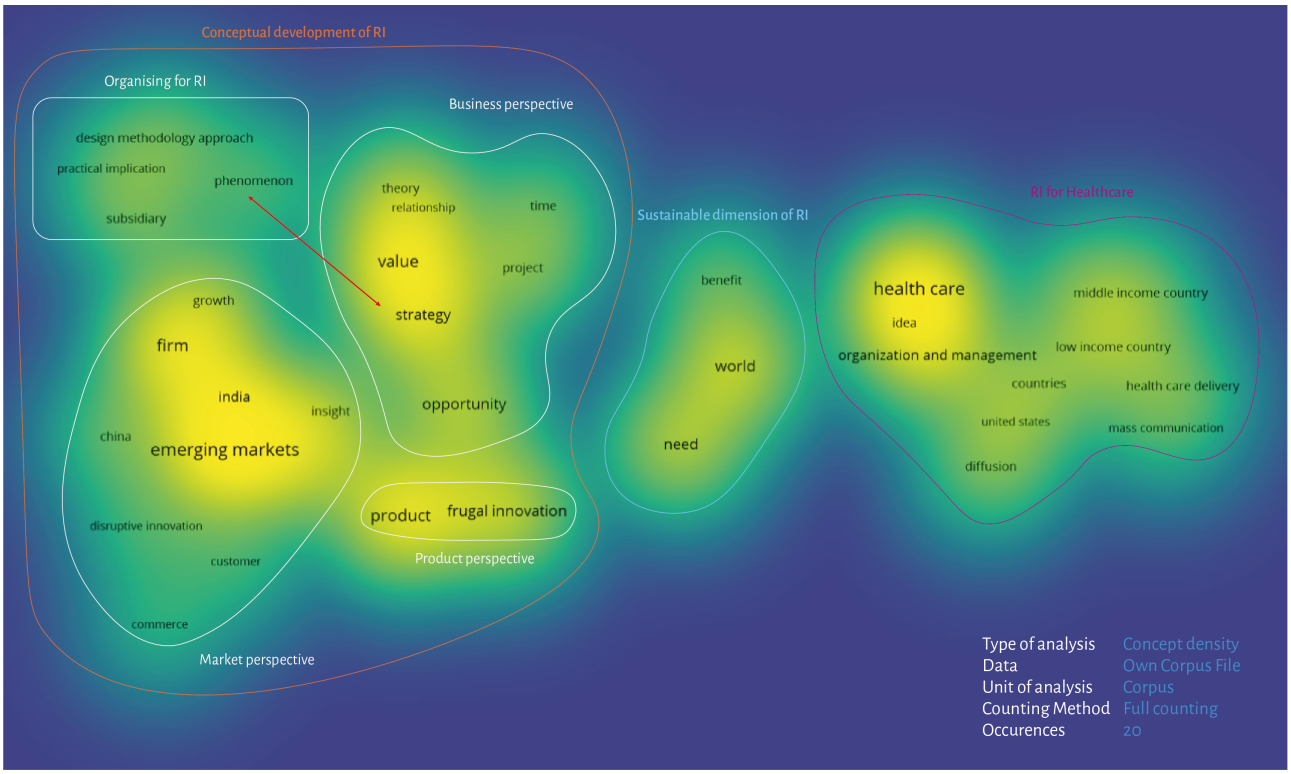
5.1.2 Overall conceptual structure of the RI field

When the two time-frames are combined, Figure 5.3 is created. The combination of the two time-frames results in an overall view of the RI field throughout its conceptualisation and indicates the concepts that have been most prevalent in the literature. As more literature is being used as source data for this map, the concept occurrence has been set to a value of 20, for items to be included in the map. Using the concept density map three fairly separate main clusters can be observed and the structure represents to some degree the structure of Figure 5.2. However, some differences in the occurrence of the concepts and their structural associations can be observed.

- **Conceptual development of RI**
  The cluster described in this study as the conceptual development of RI is still present in the literature but encompasses various inter-related sub-clusters which define the RI concept.

  - Product perspective
    The term *product* and *frugal innovation* are closely associated in the map and indicate that RI mostly describes a process of product innovations with frugal characteristics.

  - Business perspective
    The product perspective and business perspective are somewhat associated with the term *opportunity*. The frugal product characteristics of RI are often described as providing business opportunities. Something which has been



Note. Concept map of complete RI literature from 2009 to 2019 with a keyword occurrence of 20 to be included in the map. Constructed with VOSviewer .

FIGURE 5.3: Concept Density Map 2009-2019

covered extensively in literature throughout the field (Vijay Govindarajan and Chris Trimble, 2012; M. Zeschky, Widenmayer, and Gassmann, 2014; Von Zedtwitz et al., 2015; Skopec, Issa, and Harris, 2019; Klarin, 2019; Agnihotri, 2015a). Within the business perspective cluster, the term *strategy* has a high occurrence. Literature in a business context thus often relates to RI as a strategy. Furthermore, *value* has a high occurrence in the map which indicates the value that is sought from a business perspective in RI.

- Market perspective
  Another cluster in the map can be described as the market perspective of innovation. Geographic keywords like *India* and *China* are also evident in the map. As discussed before, China and India reflect research which has described RI in these locations. *Disruptive innovation* is also found as a term in this cluster. This indicates that research is interested in exploring the relations of disruptive innovation to RI.

- Organising forin RI
  In this cluster the practical implications of reverse innovation are represented. Design methodology approach refers to the development of a system or method for RI. Within this cluster, is referred to as a phenomenon, while in the business perspective cluster RI is described as a strategy. This conceptual friction was present in Figure 5.1, but in this overall structure of the field, this conceptual friction is even more clear. From a business perspective, RI needs to be an outlined strategy to reduce the risk. While from an organising perspective researchers are more interested in the causes or explanations of why RI happens. Although related, for RI to prevail these causes and explanations should be transcribed into a strategy for RI adoption in business practices. This could be of importance for the conceptual development of RI. When RI can be induced through a strategy, the antecedents and factors which lead to the RI phenomenon would become more clear as empirical research could outline these. Once more the term subsidiary is apparent in the map, indicating research has an interest in describing the organising relation among an MNC and its subsidiaries.

- Sustaistnable dimension of RI
  A cluster which has not been identified in previous maps contains terms relating to the sustainable dimension of RI. Terms like *benefit*, *world*, and *need* describe the possibility of enhancing sustainability through RI. As a central theme in the map, this dimension is of importance to both healthcare and the conceptual development of RI.

- **RI for healthcare**
  As described before RI is prevalent in literature related to healthcare. However, the term *idea* has a large occurrence in the map and is closely associated with healthcare. This further exemplifies that within healthcare, scholars indicate that with reducing healthcare resources EMs are not just interesting for their resource-constrained product innovations. But for their resource-constrained ideas—whether technologies, processes, models or policies. Moreover, as this map represents conceptual similarities and these clusters prove to be fairly distinct the concept of RI is found to be used differently.

  Concluding that these maps indicate a conceptual conflict between the description of RI in healthcare opposed to RI related to the industrial/managerial domain. Based on this concept co-occurrence analysis and content analysis of relevant papers it has been found that RI in the context of healthcare means the reversal of flow of ideas and policies, while for the industrial/managerial domain RI means the transfer of an innovation. This is further exemplified by the size of *organisation and management* in the healthcare cluster. The size of the term indicates that research within this cluster is mostly interested in organisation and management ideas from EMs. This was further verified through analysing the content of Faheem Ahmed et al., 2017; Y. A. Bhatti et al., 2017. This conceptual difference sparks interest in whether RI should be approached differently for both research domains. Chapter 6 elaborates further on this notion and Section 7.1 reflects in this finding.

Key Findings — Concept co-occurrence analysis

- Based on concept co-occurrence analysis the scientific field of RI can be structured into three different main clusters: Conceptual development, the sustainable dimension of RI and RI for healthcare.
- The conceptual development cluster can be divided into three perspectives (*market, product, business*) and one cluster related to how MNCs should organise to foster RI.
- The field has over the last decade become more structured into separate conceptual domains.
- In recent years, research interest has focused more on organising for RI and RI for healthcare.
- Based on the concept density maps their is a conceptual divide where RI in the conceptual research regards RI as products with frugal characteristics that have a disruptive nature when they transfer from an EM to a DM. In the healthcare domain where RI describes a process reverse transfer of knowledge and ideas focused around organisation and management.

5.2 Bibliographic Coupling: identifying research streams

The previous bibliometric method analysed the conceptual evolution and the structure of the field through analysing the relatedness of concepts in RI research corpus. Based on conceptual similarities the structure was analysed and related to the field. This type of analysis is deemed one of the most accurate measures for analysing the structural associations of the field (Klavans and Boyack, 2017). However, information about scholars and their connection to these structures are lost. Therefore a bibliographic coupling analysis is presented which distinguishes similarities in the field based on bibliographic coupling. VOSviewer has been used to map these relations and is presented in Figure 5.4. The threshold value was 12 to be included in the map and a fractional counting method was used. The size of the circles represents the number of reference a work has received and links indicate a connection. The closer the circles are to another the greater their similarities in coupling. In combination with a content analysis of the publications research streams were identified. The advantage is that scholars can now be related to these streams and individual works can be reviewed. Table A.1 presents the most coupled papers and their general content. As a result the following 5 research streams were found .

Conceptual development of reverse innovation

The green cluster in the map represents publications that research the foundational aspects of RI. It is the second largest cluster in the map. Vijay Govindarajan, Kopalle, and Danneels, 2011 were the first to describe the theoretical underpinnings of RI. Other articles have described the value of RI and why RI has value for MNCs (Sarkar, 2011; Subramaniam, Ernst, and Dubiel, 2015; Chittoor and Aulakh, 2015). Von Zedtwitz et al., 2015 has enhanced the concept of RI by indicating that the reversal can occur at any stage in an innovation process. It is important to note that this research stream is associated primarily with technological product innovations (Borini, Miranda Oliveira, et al., 2012; Li, Zhang, and Lyles, 2013a; Subramaniam, Ernst, and Dubiel, 2015; Herrerias, Cuadros, and Luo, 2016).

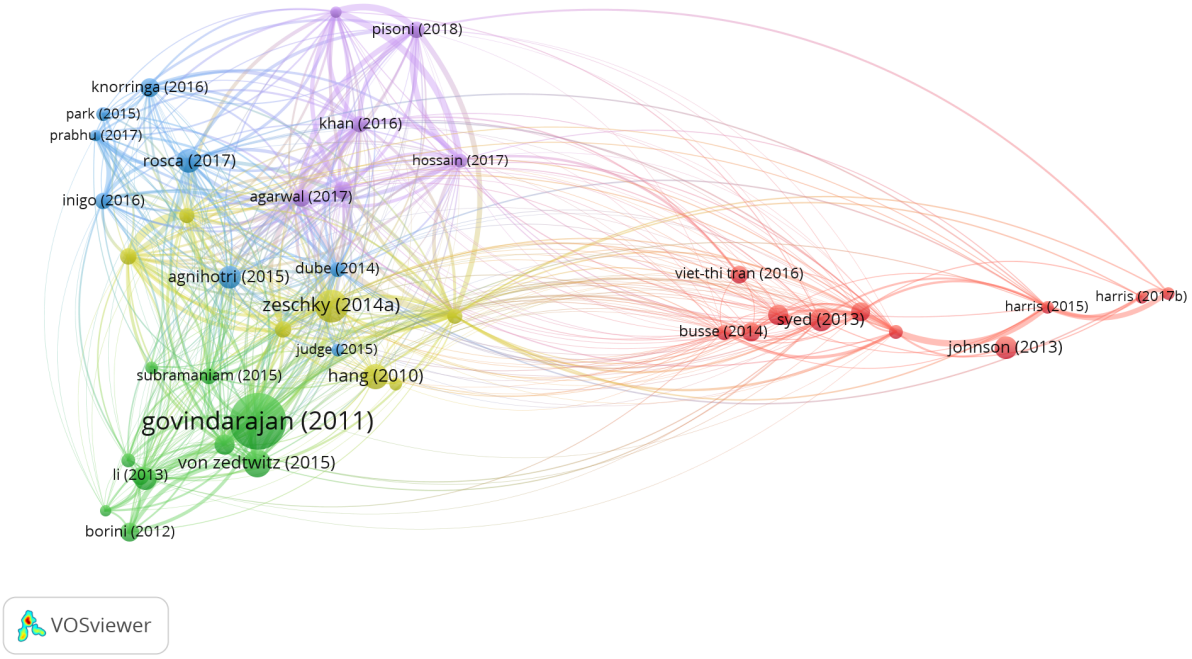


FIGURE 5.4: Bibliographic Coupling network

Reverse innovation for healthcare applications

The red cluster represents a research stream that is focused on healthcare applications for RI. This clusters is the largest cluster in the field. This is probably due to healthcare research being a large domain in science. This means that more scholars work in this field which increases the number of of possible references. Shamsuzzoha B Syed, Viva Dadwal, and G. Martin, 2013 was the first to describe the value of RI for healthcare indicating that the developed world could learn greatly from the knowledge and practices in the developing world. Various articles in this research stream discuss how to manage human resources based on EM practices (Johnson et al., 2013; Busse, Aboneh, and Tefera, 2014; Crisp, 2014). This affirms the conceptual findings in the previous section. The research stream related to healthcare is not limited to the reversal of flow to only medical product innovations (e.g.(Binagwaho et al., 2013)) but also indicates and studies the value of EM organisational practices and ideas for DMs. Other studies have centred on policy's for RI, biases and perception barriers (Matthew Harris, Macinko, et al., 2017; Matthew Harris, Marti, et al., 2017; Harris, Weisberger, et al., 2015; Rodriguez and Montalvo, 2007). Indicating that within healthcare, EM innovations encounter quality biases where people deem these innovations as inferior on the basis of their country of origin.

Conceptual and organisational reviews of RI and relations to other typologies (disruptive, open innovation)

The yellow research stream focuses on identifying relations to other innovation typologies. This is either done through overarching qualitative reviews of literature (Hadengue, Marcellis-Warin, Zedtwitz, et al., 2017; M. B. Zeschky et al., 2014) or researching direct relations. Within this stream disruptive innovation theory plays an important role and various scholars relate RI theory to disruptive innovation theory (Hang, J. Chen, and Subramian, 2010; Corsi and Di Minin, 2014). Reverse knowledge flow and open innovation is also part of this research stream (Patrice Talaga, 2010). This cluster also contains some publications that analyse emerging market business models in general (Winterhalter, M. B. Zeschky, Neumann, et al., 2017; Winterhalter, M. B. Zeschky, and Gassmann, 2016).

Frugal Innovation and sustainable innovation development

Like in the concept map, frugal innovation is highly related to RI. The blue cluster represents a research stream devoted to frugal innovation. The stream studies mostly frugal product characteristics (Agnihotri, 2015a; Prabhu, 2017). Within this research

stream the sustainable dimension of frugal and RI is also studied (Rosca, Arnold, and Bendul, 2017; Knorringa et al., 2016; Inigo and Albareda, 2016; Dubé et al., 2014).

Conceptual reviews of emerging market innovations and frugal innovation

The purple cluster reviews first and foremost the concept of frugal innovation (Mokter Hossain, 2018; Hossain, 2017; Agarwal, Grottke, et al., 2017) and their possible diffusion patterns (Mokter Hossain, Simula, and Halme, 2016). Other researchers in this stream devote their time to describing the sustainable performance of frugal and other constraint based innovations (R. Khan, 2016; Pisoni, Michelini, and Martignoni, 2018; Agarwal, Grottke, et al., 2017). Within RI literature this research stream is the smallest cluster and displays overlaps to the previous cluster.

Key Findings — Bibliographic Coupling analysis

- Based on documents and bibliometric similarities the field can be divided into 5 distinct research streams.
- These research streams correspond greatly to the conceptual structure identified in previous analysis.
- The two biggest research streams are 'Reverse innovation for healthcare applications' and 'Conceptual development of reverse innovation'.
- Through the identification of these research streams scholars and managers can quickly identify which stream is of most interest to them and what publications are significant in that stream.

5.3 Keyword co-occurrence analysis: evolution of the research themes

The first analysis used the combination of keywords, titles and abstracts to determine the conceptual structure of RI. Through manual division in two time-frames, the conceptual structure and their relations could be analysed over two time periods. Although this is a comprehensive method for analysing the conceptual structure of the field, the topical evolution of the field remains fairly general. To achieve more precise insight into the topical evolution of the research-front this section examined the co-occurrence networks of authors' keywords. A disadvantage of this methodology is that thesaurus files cannot be used in Bibliometrix/Biblioshiny and thus some keywords, although being synonyms, are being shown separately. Furthermore, it is complex to analyse relationships as these are not clustered based on relatedness.

Figure 5.5 shows the trending topics that have emerged over the years based on co-occurrence analysis of author keywords. The threshold value was three occurrences to be shown on the map.

The figure starts from 2012 onward, as previous years produced too little publications with keywords to be included in the map. So the growth of keywords started from 2012 when *product development* and *knowledge spillover* were the main keywords.

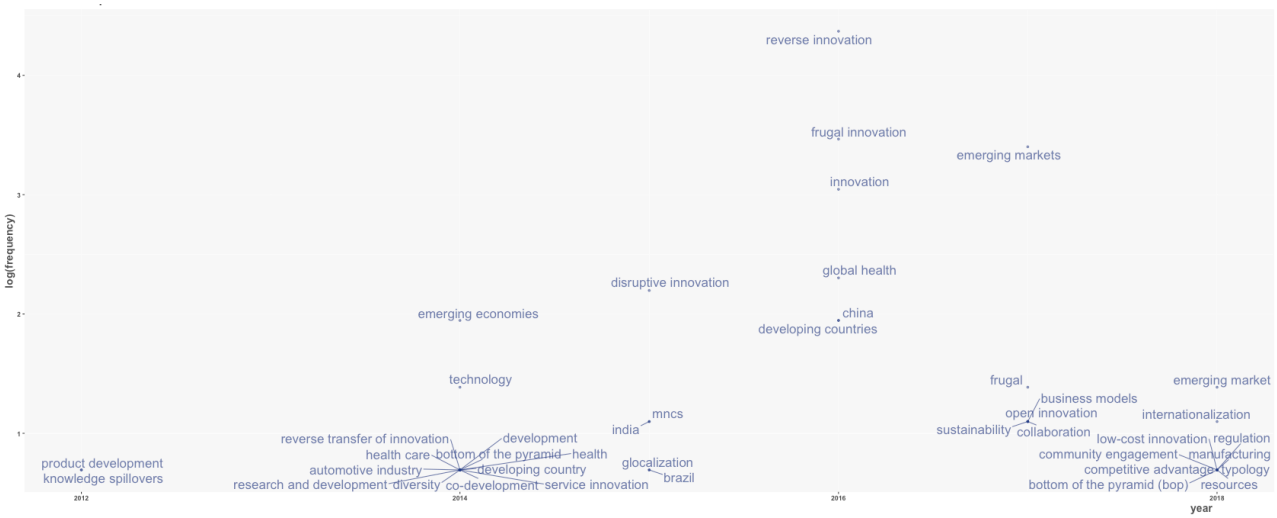


Figure 5.5: Trending topics RI 2009-2019

These terms describe the initial domain of RI quite well, using knowledge from EM for product development. Additional general keywords appeared from 2014 when more precise keywords were used like, *BoP*, *EMs*, *reverse transfer of innovation*, *co-development*, *technology* and the relation to *healthcare*.

In 2015 new and more specific keywords appeared with more focus on specific elements like related theories (*disruptive innovation*) and geographic keywords like *India* and *Brazil*. The geographic keywords indicate a focus on case-study research in that year. In 2016 RI was dominantly used as a keyword and one can thus assume that in 2016 the term *"reverse innovation"* was an accepted term by the scientific community as it was used by authors to designate their research to this specific keyword. Furthermore, the keyword *frugal innovation* was highly used as research focused that year on the relation among the two types. Besides, the physical location of case studies transferred more towards China. The main difference for 2017 is that *open innovation* and *business models* were added to the research interest that year. In recent years RI literature has become increasingly specific, investigating the topic and its relations and barriers. The year 2018 indicated interest from a business perspective as keywords were used like *regulation*, *resources*, *manufacturing*, *competitive advantage* and *manufacturing*.

Key Findings — Keyword co-occurrence analysis

- Research themes on RI have become increasingly specific over the years.
- The most occurring concepts and keywords identified in RI literature are:
  - RI and relations to *disruptive* innovation were of interest most in 2015
  - RI and relations to *frugal* innovation were of interest most in 2016 and 2017
  - RI and relations to *open* innovation were of interest most in 2017
- Most RI case studies were performed between 2015 and 2016 in India, Brazil and China.
- In recent years, research interest has focused more on studying RI from a business perspective.

5.4 Citation Analysis: analysing scholarly influence

This section, which is more evaluative, studies the body of literature by using citation analysis. Therefore the unit of analysis are documents and not concepts or keywords. Citation analysis is a method of calculating the relative significance or influence of an author, journal or publication by counting the number of times that author, article, or publication has been cited by other works (Osareh, 1996).

Within citation analysis a differentiation is made between *global citations* and *local citations*. Global Citations implies the Total Citations (TC) a publication has received from documents indexed in any bibliographic database. Therefore TC contains the citations a publication has received from all over the world. Local citations (LC) measure how often an author or a publication included in the collection has been cited by other authors within the collection.

5.4.1 Most impactful authors

The most impactful authors are presented in Table 5.1. Impact has been determined based on the Hirsch index (H-index). The H-index is an author-level metric which attempts to measure the impact of a researcher's or scholar's publications on both productivity and citations. It is determined by calculating the number of publications for which an author has been cited by other authors at least that same number of times. To exemplify, M. Harris has produced 7 publications that have each been cited at minimum 7 times by other authors. The higher that index the greater the impact of the author on the field. Despite having a single number which is desirable for measuring scientific success, the h-index is just a rough measure of scientific performance and should be regarded as such (Hirsch, 2005). The index for example does not regard the size of the scientific field, the field of healthcare literature is much larger than that of innovation literature which could result in a higher H-index, over representing the impact of an author. For this reason the table also presents the total citation scores of the authors and their research interest indicating possible reasons for a higher H-index. It can be observed that literature describing RI for healthcare and the relation between RI and frugal innovation create higher impact values.

TABLE 5.1: Top 10 most impactful authors

Author	H-index	Total Citations	Publications	First publication year	Research interest
M. Harris	7	133	12	2013	RI for healthcare
V. Govindarajan	5	532	8	2009	Reverse innovation conceptualisation
Y. Bhatti	4	39	6	2017	Frugal innovation and reverse innovation
F. Borini	2	43	5	2012	Reverse innovation antecedents and managerial implications
A. Darzi	4	39	5	2017	RI for healthcare
A. Brem	3	124	4	2012	Frugal innovation and reverse innovation
M. Hossain	4	80	4	2015	Frugal innovation and reverse innovation
J. Macinko	4	63	4	2015	RI for healthcare
M. Prime	3	21	4	2017	Frugal innovation and reverse innovation for healthcare
M. Von Zedtwitz	2	88	4	2015	Reverse innovation

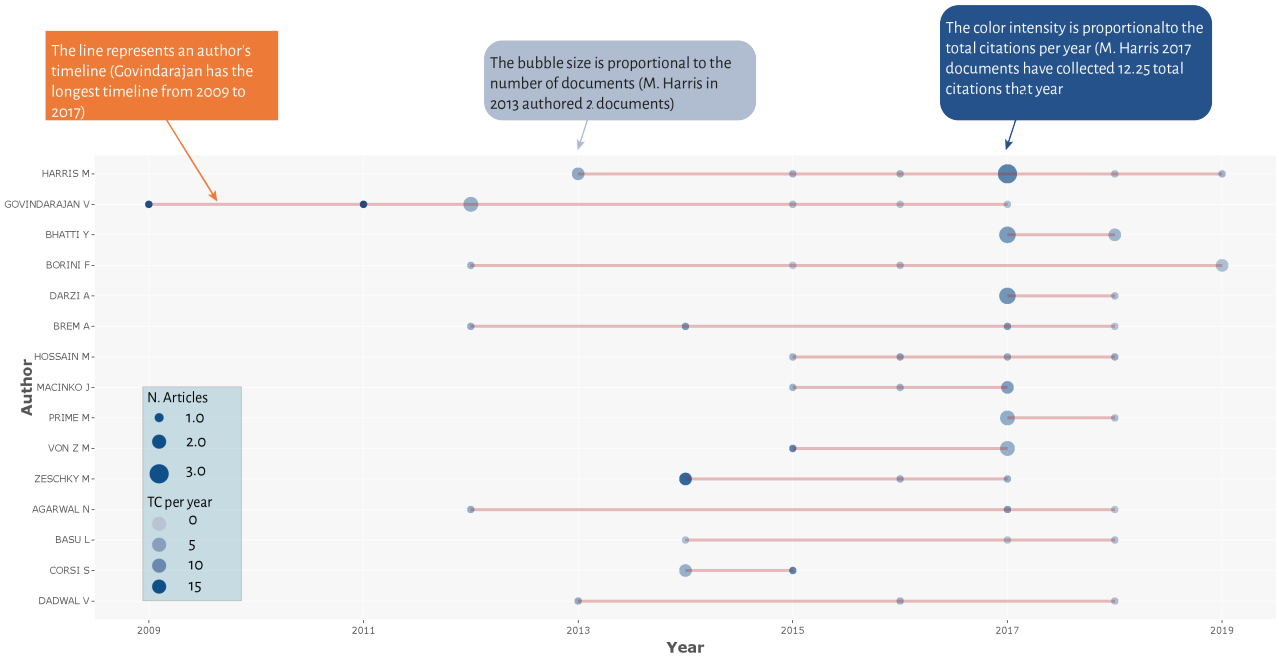


FIGURE 5.6: Authors production 2009-2019

To asses the impact and scholarly success of authors Figure 5.6 is presented. This figure represents the production of publications of the most impactful authors over time. It indicates the spread of publications over the years and how consistent scholars have published on the topic. The line represents the timeline over which the author has been active in the field. A circle means a document was published that year and the size of the circle corresponds to the number of documents published. The intensity of the colour corresponds to the total citations per year of the document. The intensity of the blue therefore indicates the impact/importance of the publications.

Govindarajan has the longest timeline, followed by Borini and Harris. The production of impactful RI publications is fairly even spread over time, however 2017 was the most productive and impactful year for RI literature. Govindarajan and his articles (Vijay Govindarajan, Kopalle, and Danneels, 2011; Immelt, Vijay Govindarajan, and Chris Trimble, 2009) have acted as a foundation for RI literature and have been cited throughout the years with good consistency. Interestingly his first article on RI has as lesser average citation count (21,750) than his article in 2011 (22,200). In 2012 and later he produced more articles on the topic but these have created less impact on the field. Harris has produced the most articles on RI and its relations to healthcare. Although he has the highest H-index, possibly due to his relation to the healthcare literature, his publications have had less impact than those of Govindarajan. Other noteworthy authors whose publication burst into the field and have been relevant ever since are M. Zeschky with "Frugal Innovation in Emerging Markets" and M. von Zedtwitz and S. Corsi with "A typology of reverse innovation".

5.4.2 Top locally cited publications

Table 5.2 presents the top 10 locally cited articles. These articles are most referred to by researchers in the field. The interesting element to consider is not just the articles themselves but rather their topics of interest and how these relate or have build upon one another. Figure 5.7 represents a historical direct citation network of these articles and explains the evolution of research over the years based on direct citations. This therefore indicates the intellectual structure of the field based on articles. The arrows in the map direct to the works on which the newer articles build. Therefore one can analyse with this figure the articles and knowledge scholars have used to develop their own research. Figure 5.8 presents this structure of the top 50 articles.

For example, consider Figure 5.7. Vijay Govindarajan, Kopalle, and Danneels, 2011 was the first article which really explained the ins and outs of RI, the article also indicates what type of innovations were likely to come from EM and why these would transfer to DMs. Furthermore the article indicates strategic decisions for firms who want to organise for RI. M. Zeschky, Widenmayer, and Gassmann, 2014 suggested that effective RI needs a subsidiary established in an EM to create frugal products. This article thereby provides first insights as to how MNCs can foster and allow the production of RI in general. These studies contributed directly to Winterhalter, M. B. Zeschky, Neumann, et al., 2017 who proposed business models for frugal innovation in EMs and demonstrated through case studies how firms should construct their value creation networks to foster innovation.

When the field is analysed the dominance of frugal innovation research becomes apparent for the intellectual structure of RI. Of the top 10 locally cited articles, 7 articles refer directly to frugal characteristics. The articles have clear overlaps with the structures identified in the previous structural analysis of the field.

Table 5.2: Top 10 locally cited articles

Publication	Title	Year	LC	TC	Aim/ main topic
(Vijay Govindarajan and Ramamurti, 2011)	"Reverse innovation, emerging markets, and global strategy"	2011	27	222	First article structuring the various theoretical underpinnings of RI
(M. Zeschky, Widenmayer, and Gassmann, 2014)	"Organising for reverse innovation in Western MNCs: the role of frugal product innovation capabilities"	2014	13	34	This article investigates how MNCs of the healthcare and electronics industries can organise their international R&D practices for RI.
(Agnihotri, 2015a)	"Low-cost innovation in emerging markets"	2015	6	39	Defines four types of low-cost innovations in emerging markets: jugaad, frugal, value and reverse. Their features, their similarities and their differences are described.
(Mokter Hossain, Simula, and Halme, 2016)	"Can frugal go global? Diffusion patterns of frugal innovations"	2016	6	30	Identifies four main diffusion patterns of frugal innovation labelled: local diffusion, proximity diffusion, distance diffusion, and global diffusion.
(Corsi and Di Minin, 2014)	"Disruptive Innovation … in Reverse: Adding a Geographical Dimension to Disruptive Innovation Theory"	2014	5	9	Provides an overview of how the reverse innovation theory relates to and within the disruptive innovation theory.
(Pisoni, Michelini, and Martignoni, 2018)	"Frugal approach to innovation: State of the art and future perspectives"	2018	5	23	Systematic literature review of 113 contributions published on frugal innovation to identify different typologies of innovations and evolution of the frugal innovation concept
(Knorringa et al., 2016)	"Frugal Innovation and Development: Aides or Adversaries?"	2016	4	27	Publication explores the sustainability dimension of frugal innovation and argues that an empirical approach is needed to asses where and when frugal innovation fosters inclusive development.
(Rosca, Arnold, and Bendul, 2017)	"Business models for sustainable innovation - an empirical analysis of frugal products and services"	2017	4	53	Analyses the relationship between frugal and RI and their sustainability performance and describes business models for sustainable development
(Matthew Harris, Emily Weisberger, et al., 2016)	"That's not how the learning works - the paradox of Reverse Innovation: a qualitative study"	2016	3	15	Discusses that the term RI is used differently among industries and reviews the wat in which RI is used within healthcare
(Winterhalter, M. B. Zeschky, Neumann, et al., 2017)	"Business Models for Frugal Innovation in Emerging Markets: The Case of the Medical Device and Laboratory Equipment Industry"	2017	3	17	Investigates various business models that foster frugal innovation within the healthcare domain

Note. LC= local citations, TC= total citations

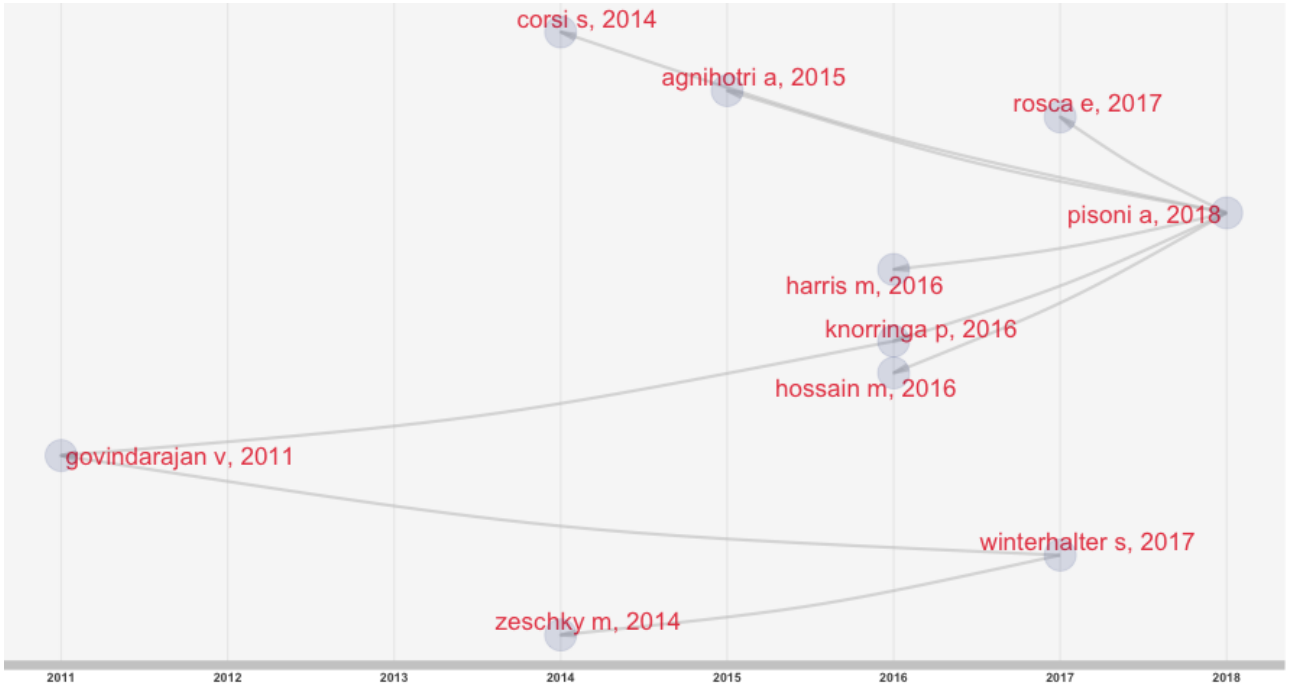


FIGURE 5.7: Historical direct citation network of top 10 locally cited articles

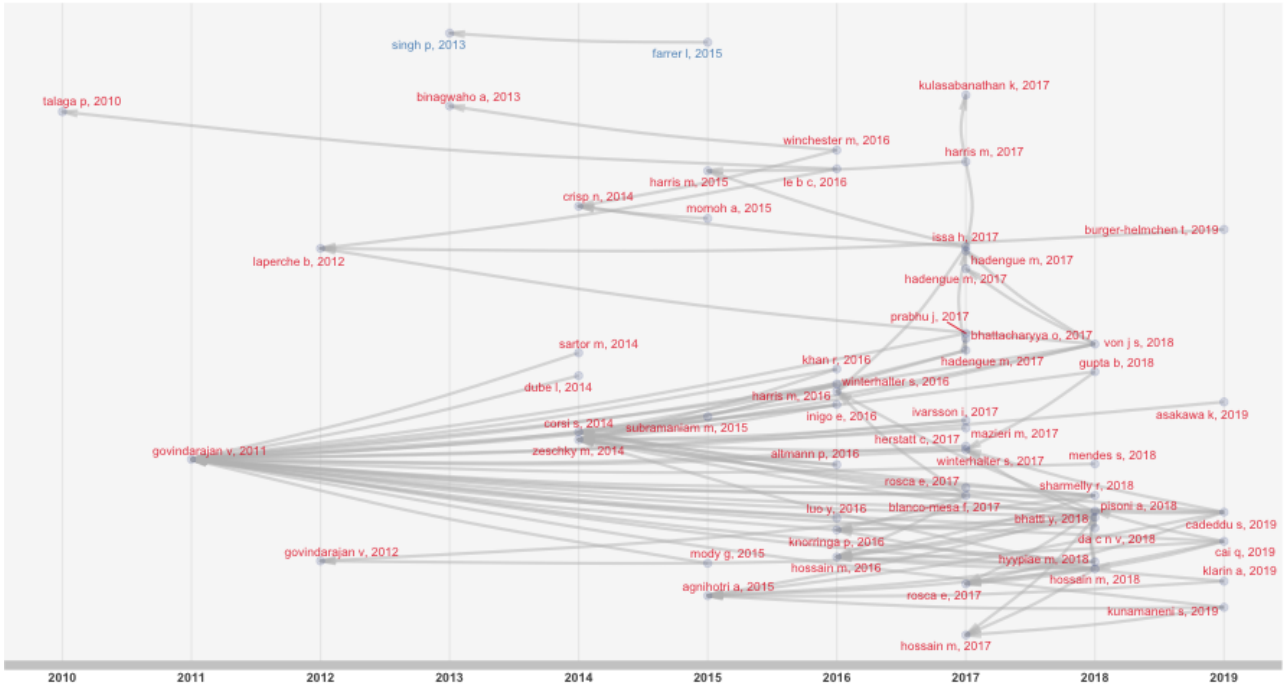


FIGURE 5.8: Historical direct citation network of top 50 locally cited articles

Key Findings — Citation analysis

- Based on citation analysis M. Harris, V. Govindarajan and Y. Bhatti are deemed the most impactful authors within RI literature. These top three authors belong to three of the main clusters identified in the previous structural analysis as their main research interests are the conceptual development of RI (Govindarajan), RI for healthcare (Harris) and the relations between frugal and RI (Bhatti)
- Vijay Govindarajan and Ramamurti, 2011, M. Zeschky, Widenmayer, and Gassmann, 2014 and Agnihotri, 2015a are the articles that have been cited most consistently and highly within the field.
- M. Zeschky, Widenmayer, and Gassmann, 2014 is the most influential and highly cited publication describing how MNCs should organise for RI.
- Corsi and Di Minin, 2014 is the most cited paper which relates RI theory to disruptive innovation theory.
- The most influential and cited articles in RI literature actually describe primarily frugal innovation characteristics.

5.5 Co-authorship Analysis: Mapping the social structure of the field

Collaboration networks and research communities can be visualised using co-authorship occurrences of countries, authors and institutions. These co-authorship networks are presented in Figure 5.9 and have been constructed using the VOSviewer software. The figure on the left side has documents as weights, meaning that the size of the circle indicates the amount of documents published. The scholars who produced the most papers are generally found at the middle of the networks. The coloured clusters have been manually added to the left figure after analysis. A minimum of two co-authored documents were the threshold value.

The right figure in Figure 5.9 has citations as weights. Thus the larger the circles, the greater the number of citations that author has received and thus the influence of that collaboration on the field. The colour demonstrates the average publication year, which aids in analysing when the collaboration networks were most active. The thickness of the lines (edges) visualises the strength of the collaboration and if collaboration is present.

5.5.1 Author collaboration network

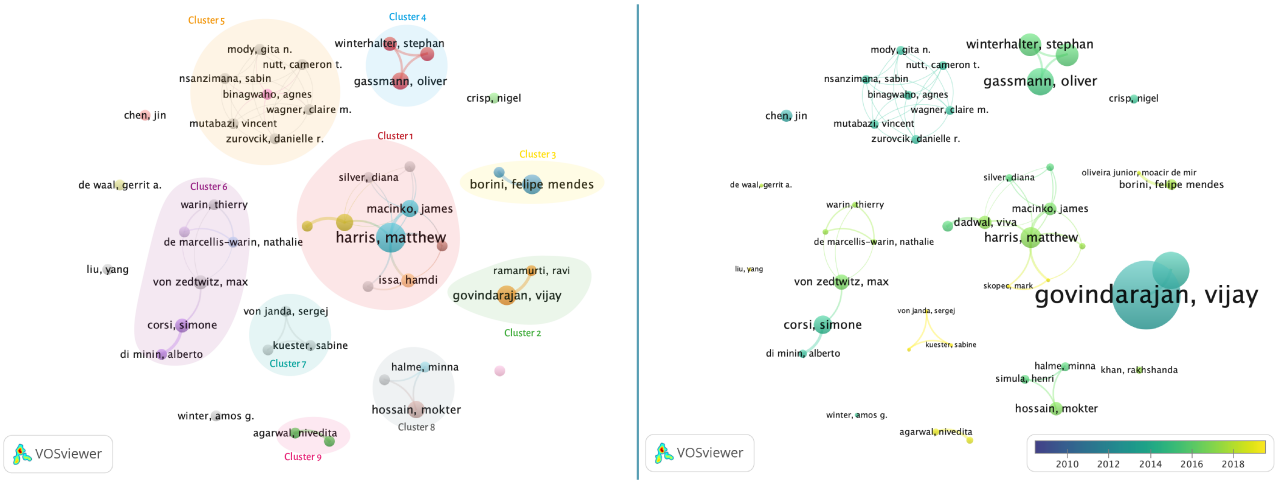


FIGURE 5.9: Authors collaboration network

The co-authorship network of the RI field is fragmented, with a number of isolated nodes (authors) and nine small disconnected clusters. Furthermore, the overlay visualisation on the right indicates when these collaborations were present. These nine clusters have been analysed in combination with Figure 5.10, Figure I.5 and content analysis. The collaboration clusters will now be summarised.

Cluster 1 – Scholarly community who collaborate based on their research interest for **RI for healthcare**.

- The most productive author and central in this cluster is M. Harris who has co-authored with Macinko (Matthew Harris, Macinko, et al., 2017).
- Harris is researcher for Imperial college London and Macinko for NYU. This geographical difference results in their relations to other researchers. Therefore in general the bottom half of cluster 1 is situated in the UK (Imperial College London) and the top half works in the USA (NYU)
- Dadwal and Syed are related through the world health organisation (WHO).
- This cluster has been active more recently in the scientific field.

Cluster 2
- Scholarly community on two who collaborate based on their research interest for **RI conceptual development**.
- Strong collaboration between Govindarajan and Rammamurti which led to (Vijay Govindarajan, Kopalle, and Danneels, 2011)
- Both professors based in the USA (Tuck School of Business and Northeastern University) with an Indian background.
- Collaboration is of high influence on the scientific field.
- The have laid the conceptual foundation of RI.

Cluster 3
- Scholarly community of two who collaborate based on their research interest for the **Business perspective of RI**.
- Borini and Oliveira Junior research RI in relation to Latin America (Brazil) which is where their institution is situated.
- They collaborate on research for RI antecedents (Borini, Costa, and Oliveira Junior, 2016) and organisation (Borini, Miranda Oliveira, et al., 2012)
- More recently their research has focused on frugal innovation (Santos, Borini, and Oliveira Júnior, 2020).
- Have been active in recent times.

Cluster 4
- Scholarly community of three who collaborate based on their research interest for the **Business perspective of RI**.
- Winterhalter, Zeschky and Gassman are all from The University of St. Gallen, Switzerland
- Research focus is towards business models for frugal innovation and EMs.
- This scholarly community has a high amount of citations and is this important for the field.

Cluster 5
- Scholarly community who collaborate based on their research interest for **RI for healthcare**.
- Scholarly community based in Rwanda, Africa.
- Binagwaho has the highest centrality and research focuses on shared learning and health equity.

Cluster 6
- Scholarly community based on their research interest for **RI conceptual development**.
- European based scholarly community covering France, Denmark, UK .
- Corsi and Di Minin focus on disruptive innovation Corsi and Di Minin, 2014.
- Corsi and Von Zedtwitz have written an article together (Von Zedtwitz et al., 2015).
- Hadengue, de Marcellis-Warin and Warin have collaborated on a systematic literature review (Hadengue, Marcellis-Warin, and Warin, 2017) and have a French background.
- Hadengue, Zedwitz, de Marcellis-Warin, Warin have written a case study research on RI together (Hadengue, Marcellis-Warin, Zedtwitz, et al., 2017).
- Von Zedtwitz has the highest centrality in this cluster, he is professor at Copenhagen Business School (CBS), but more importantly he is the director of GLORAD, Center for Global R&D and Innovation. He is perceived as a knowledge broker in the cluster.

Cluster 7
- Scholarly community based on their research interest for **Business perspective of RI**.
- German research community from University of Mannheim.
- They have been a novel research group active since 2018 (Janda, Schuhmacher, and Kuester, 2018).

Cluster 8
- Scholarly community based on their research interest for **Product perspective of RI and more specific frugal innovation**.
- Halme and Simula are scholars from Finland (AALTO University).
- Hossain is from Qatar University.

Cluster 9
- Scholarly community based on their research interest for **Product perspective of RI and more specific frugal innovation**.
- German based research collaboration from Friedrich-Alexander-University Erlangen-Nürnberg (FAU).

Collaboration in the RI field is largely influenced by geographical restrictions, with many clusters defined by their source countries. It is not surprising, as in many bibliometric studies the impact of geography is apparent (Frenken, Van Oort, and Verburg,

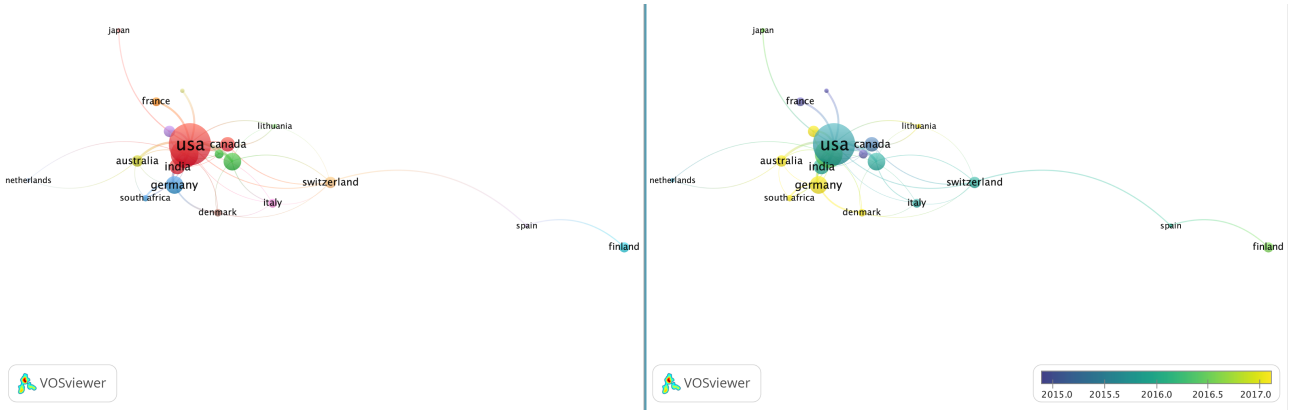


FIGURE 5.10: Collaboration network countries

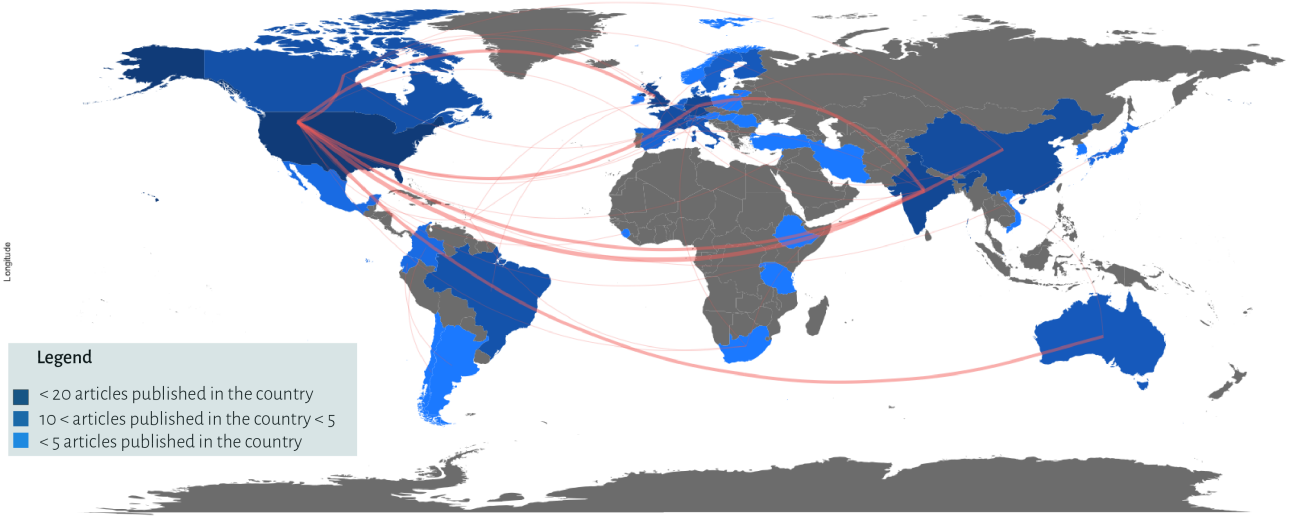


FIGURE 5.11: Collaboration world map

2007). Institutional distance also has a huge impact on collaboration. Collaboration has been found to occur mostly among colleagues at the same university or institution and previously working partnerships. Interestingly, most authors were related in different degrees to GLORAD[1]. This is the Centre for Global R&D and Innovation with offices in St. Gallen (Switzerland), Kaunas (Central and Eastern Europe), Moscow (Russia), Shanghai (China), Silicon Valley (USA), and Sao Paulo (Latin America). Most co-authorship networks surround these universities and locations. For *RI for healthcare* Imperial College London has major influence and almost all health care related articles are a collaboration between the USA and the UK. Figure 5.10 visualises the centrality and influence of countries in the field. The top rated country by centrality is the USA, followed by the UK and Germany. In recent years mainly Germany, Brazil, Australia and Denmark have formed the research front. To visualise the country collaborations and production on a world map, Figure 5.11 is presented.

[1] http://www.glorad.org/

Key Findings — Co-authorship analysis

- Based on co-author analysis and content analysis there is one centre that connects most prevalent researchers in RI called GLORAD. It is the Centre for *Global R&D and Innovation* with offices in Switzerland, Central and Eastern Europe, Russia, China, USA and Latin America. Through this network most collaborations have been formed.
- RI research related to health care is mostly produced through a collaboration between the USA and UK, where M. Harris is a knowledge broker—facilitating a two-way or multi-way exchange of knowledge between the USA and UK. For this network, Imperial College London has the greatest influence on the field.
- Conceptual research on RI and frugal innovation is mostly produced through collaborations among GLORAD which is most prevalent in Central and Eastern Europe.
- Geographical and institutional limitations have a major influence on collaboration for RI research.
- Although various scholarly communities study similar aspects of RI, little collaboration between these communities can be found.

5.6 Co-citation Analysis: Mapping the intellectual structure

Co-citation analysis is often used in bibliometric studies as it gives insight into the intellectual structure and future directions of a scientific field (C. Chen, Ibekwe-SanJuan, and Hou, 2010). However some scholars find that direct citation is better at clustering and connecting references than either bibliographic coupling or co-citation (Klavans and Boyack, 2017), for that reason the global citation map is also presented. The analysis uses both maps. Figure 5.13 visualises a publication co-citation network and Figure 5.14 a global citation network based on the citations extracted from the data-set. The map depicts the combined pattern of citations in the RI field from 2009 to 2019. Both maps have been constructed with VOSviewer and are evaluated by studying the size, colour, and closeness of nodes and links (edges).
Nodes in the network represent publications. The size of the nodes represents the number of citations received. The distance in the visualisation between two publications roughly indicates the relatedness of the publications in terms of co-citation or citation links. Generally speaking the closer two publications are located to each other, the greater their relatedness (Van Eck and Waltman, 2019). On the right side in the figure the overlay visualisation is presented, the blue colours represent older connections and yellow more recent connections (Van Eck and Waltman, 2019).

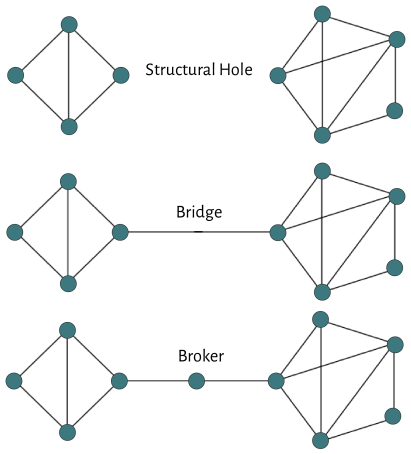


FIGURE 5.12: Network relations

The figure identifies that most the research activity has been generally well spread across the time-frame. The citation networks show a focus on the foundation papers produced from 2011 to 2014 (Immelt, Vijay Govindarajan, and Chris Trimble, 2009; Vijay Govindarajan, Kopalle, and Danneels, 2011).

Various insights can be obtained when analysing the proximity and location of the various nodes. Nodes that have many links or connections are also prone to form clusters, whereas nodes that are disparate and unsuccessfully connected are located more are the edges of the map.

For this reason, the main foundational publications on RI (Immelt, Vijay Govindarajan, and Chris Trimble, 2009; Vijay Govindarajan, Kopalle, and Danneels, 2011) are located at the centre of the map. This is expected as they are frequently co-cited in similar source documents, enhancing relatedness and centrality. The lack of ties within the network between different nodes creates structural holes, which are detected by the extra space around nodes and clusters (Burt, 2004; Ronald, 1992). Structural holes connect *nodes* that might otherwise remain disconnected, facilitating access to information and resources from various fields (Tan, Mookerjee, and Singh, 2007; Burt, 2004). Structural holes thus show an opportunity for scholars to fill a knowledge gap by producing publications that bridge these nodes or clusters. (Haythornthwaite, 1996). These bridges represent a valuable strategic position as they connect different areas of the literature and as a cause are likely to receive citations from both research areas.

Structural holes thus provide an opportunity to broker the flow of knowledge among scholars and manage the research endeavours that collaborate people from opposing sides of the structural hole.

Table 5.3 presents the top 10 papers with their global citation counts to offer a better image of the citation networks. The top publications have provided the conceptual foundation of RI and can be seen as central in the network. Other publications correspond to the previous identified research domains within the field. Relating most to healthcare and other emerging market innovations.

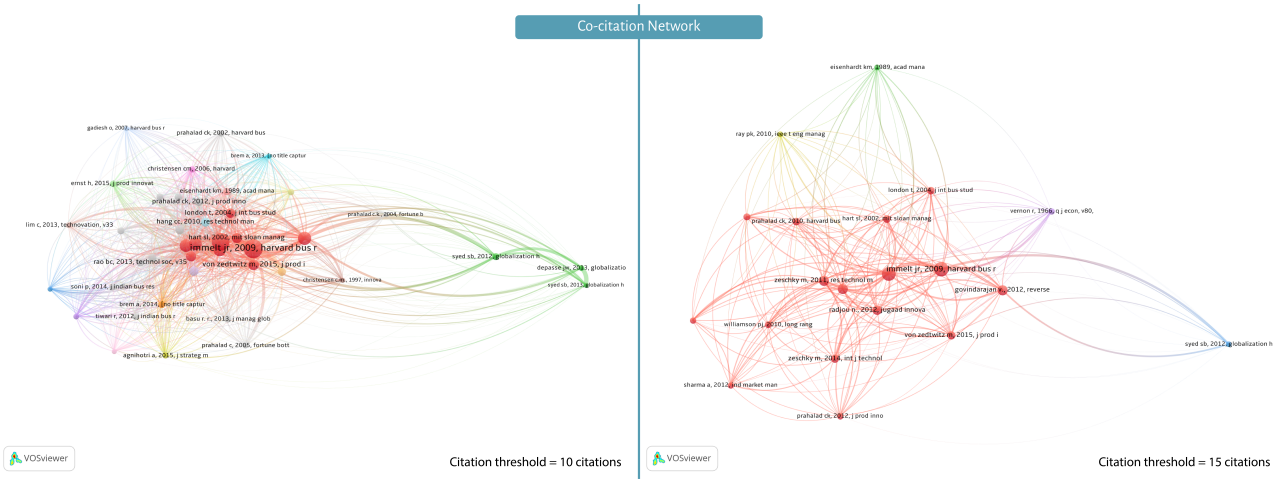


FIGURE 5.13: Co-citation and global citation network

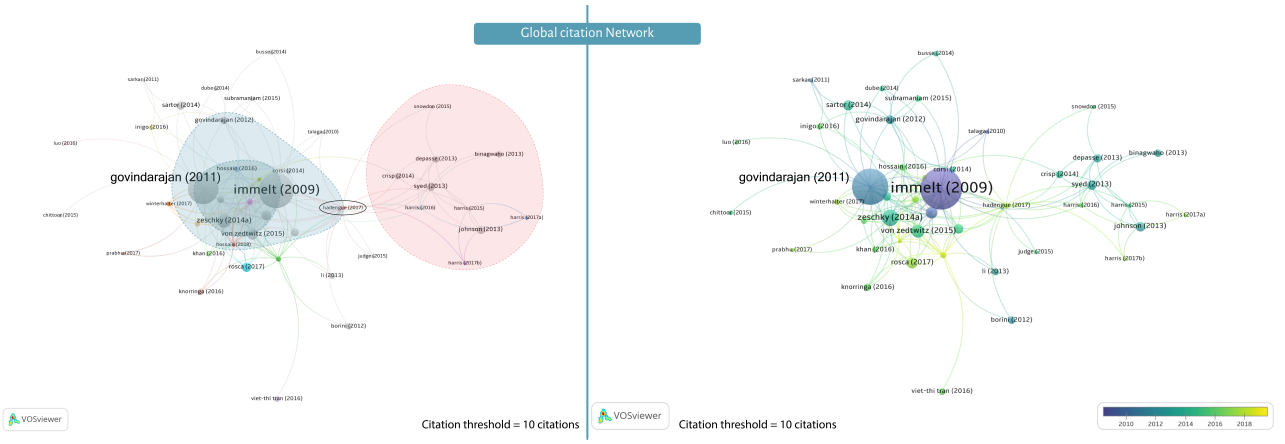


FIGURE 5.14: Global citation network

5.6.1 Structural holes and brokerage

For this research, structural holes represent publications that have connected different research interest and channelled them in the scholarly discourse on RI. A number of structural holes are fairly evident between the main area in the middle and the clusters surrounding (Shamsuzzoha B Syed, Viva Dadwal, and G. Martin, 2013) and (Vijay Govindarajan and Chris Trimble, 2012)

The first structural hole is between the domain related to healthcare (visualised in the red area) and the conceptual development of RI visualised in the green area. This division has been analysed in previous sections. Hadengue, Marcellis-Warin, and Warin, 2017: "Reverse innovation: a systematic literature review" forms an important bridge between these research domains. Shamsuzzoha B Syed, Viva Dadwal, and G. Martin, 2013 has had the same function within the intellectual structure but at an earlier time. Vijay Govindarajan and Chris Trimble, 2012 also bridges the conceptual development of RI with the business perspective of RI with his publication.

Identifying the brokers is useful for understanding power, influence, and dependency in the network. Brokers can be interpreted as people that connect different *domains* and aid in knowledge transfer from one area to another (Burt et al., 2005). Betweenness-centrality measures brokerage (Aria and Cuccurullo, 2017c). The betweenness values can be found in Appendix H. For the field (Vijay Govindarajan, Kopalle, and Danneels, 2011), (Immelt, Vijay Govindarajan, and Chris Trimble, 2009) and (M. B. Zeschky et al., 2014) emerged as having the most linkages. Vijay Govindarajan, Kopalle, and Danneels, 2011 and (Immelt, Vijay Govindarajan, and Chris Trimble, 2009) provide the theoretical building for RI and (M. B. Zeschky et al., 2014) was the first to relate frugal innovation to RI. These publication thus stemmed the various research domains.

5.6.2 Future research areas based on structural holes

Other structural holes and knowledge brokers which relate more recent publications to the main area in the middle may indicate new research area's. The top three publications with the highest linkages in recent 3 years are:

- Pisoni, Michelini, and Martignoni, 2018: *Frugal approach to innovation: State of the art and future perspectives*
- Agarwal, Grottke, et al., 2017: *"A systematic literature review of constraint-based innovations: State of the art and future perspectives"*
- Mokter Hossain, 2018: *"Frugal innovation: A review and research agenda"*

These publications address a need for clarification within the field of resource-constrained innovations. The conceptual overlaps with a large number of other concepts are hindering the progression of various fields and scholars seek to clarify the overlaps and plea for the disentanglement of conceptual definitions (Pisoni, Michelini, and Martignoni, 2018; Agarwal, Grottke, et al., 2017; Mokter Hossain, 2018). Through previous analyses the interest for RI was described as moving towards publications discussing RI from a business perspective. Although this is of interest and relevant for global progression, research is apparently in more need of disentanglement and consensus towards what exactly is being studied. This could be a major research area in the future.

A different research stream focuses more on the sustainable dimension of RI and related concepts in a business perspective (Rosca, Arnold, and Bendul, 2017). This thus combines two of the previously defined conceptual domains of RI.

Table 5.3: Top 10 globally cited articles

Publication	Title	TC	TC/year	Aim/ main topic
(Immelt, Vijay Govindarajan, and Chris Trimble, 2009)	"How GE Is Disrupting Itself - Harvard Business Review"	261	21,75	First article describing RI.
(Vijay Govindarajan and Ramamurti, 2011)	"Reverse innovation, emerging markets, and global strategy"	222	22,20	First article structuring the various theoretical underpinnings of RI.
(M. B. Zeschky et al., 2014)	"From cost to frugal and reverse innovation: Mapping the field and implications for global competitiveness"	89	12,71	The paper analyses the various types of resource-constrained innovations — cost, good-enough, frugal and reverse innovation— and conceptualises the variations between them. It explores the implications for a strategy that offers a structure for managers to systematically examine their own approaches to resource-constrained innovation.
(Von Zedtwitz et al., 2015)	"A typology of reverse innovation"	73	12,17	This article adopts a linear innovation model with the four successive stages of concept ideation, product development, primary target market introduction and subsequent secondary market introduction to expand the definition of RI beyond its market-introduction context allowing for the reversals of the flow of innovation in other stages.
(Brem and Wolfram, 2014)	"Research and development from the bottom up - introduction of terminologies for new product development in emerging markets"	55	7,86	This paper offers a detailed description of the widely used words jugaad, frugal innovation, frugal engineering, constraint-based innovation, Gandhian innovation, catalytic innovation, grass-roots innovation, indigenous innovation and reverse innovation. A conceptual framework is introduced based on this description, consisting of three main dimensions: sophistication, sustainability and emerging market orientation.
(Rosca, Arnold, and Bendul, 2017)	"Business models for sustainable innovation - an empirical analysis of frugal products and services"	53	13,25	Analyses the relationship between frugal and RI and their sustainability performance and describes business models for sustainable development
(Farrer et al., 2015)	"Advocacy for Health Equity: A Synthesis Review"	46	7,667	This article brings together scholarly and gray research data, and provides a foundation for attempts to campaign for health equity.
(Barczak, 2012)	"The future of NPD/innovation research"	42	4,67	Defines four types of low-cost innovations in emerging markets: jugaad, frugal, value and reverse. Their features, their similarities and their differences are described.
(Agnihotri, 2015a)	"Low-cost innovation in emerging markets"	39	6,5	In this article, four types of low-cost innovation for emerging markets are described: Jugaad, frugal, value and reverse innovation. The article discusses the features, similarities and differences between them and indicates misconceptions associated with these types of low-cost innovation.
(Agarwal and Brem, 2012)	"Frugal and reverse innovation - Literature overview and case study insights from a German MNC in India and China"	39	4,33	This article concentrates on how MNCs are establishing themselves and their innovation strategies in the emerging markets. Initially, the article differentiates between frugal & reverse innovation and goes on to evaluate a German MNC 's innovation practices. The paper concludes that end-to-end localisation, core value identification & a healthy portfolio mix of both types of innovations is vital to success in emerging markets.

Note. TC= total citations

5.7 Interpretation and Summary of Chapter 5

The bibliometric methods used in this chapter all provide specific information concerning the structure of the RI field. This has led to expected and unexpected results.

This section integrates and interprets the main bibliometric findings to provide a more generic perspective and highlight the study's outcomes with regard to the first research objective posed earlier in this paper. The objective was to analyse and determine the intellectual network structures, evolution, significant studies, influential scholars, notable topics and the recent trends in the literature on RI.

Concept and keyword co-occurrence analysis was used to recognise keywords that occur most often, and to classify patterns and emerging research topics. The findings suggest that RI research shifted from broader, scattered subjects (e.g. innovation, management, emerging markets) to more specific research (e.g. disruptive innovation, strategies, barriers) as the field matured. Topics such as research into the relationship between disruptive, frugal and open innovation became of interest from 2015 onward. More recently, important research efforts have been towards disentangling the vast amount of innovation typologies and empirical/practical research aiming to identify what practices lead to RI.

Through this bibliometric analysis, it was found that the field is not structured around the specific characteristics of RI or related typologies. Surprisingly, frugal, grassroots, or other low-cost innovations have failed to be strongly represented in the various maps. Rather, the field is structured around applications or sectors. The general conceptual, intellectual and social structure of the field can be divided into research linked to the industrial/managerial industry where the term originated, and the healthcare industry.

This division results in separate research interests, collaboration networks and most importantly different definitions of the concept. The findings have shown that within healthcare literature RI is described more as a bi-directional transfer of ideas and policies from low-income to high-income settings (Ahmed et al., 2017; Y. A. Bhatti et al., 2017).

In research from the industrial/managerial industry, the concept describes more a process of innovations transferring from EMs to DMs within an organisation (Immelt, Vijay Govindarajan, and Chris Trimble, 2009; Vijay Govindarajan, Kopalle, and Danneels, 2011; Von Zedtwitz et al., 2015; M. B. Zeschky et al., 2014). This is highlighted by the occurrence and strong correlations of terms like 'MNC', 'subsidiary', 'strategy' and 'disruptive innovation'. These two major clusters in the field are related by the sustainable value they both provide.

The findings also identified major scholarly communities and collaborative networks which also comply with this major structural division based on industry. Collaboration between scholars seems to be based on geographic and institutional proximity. The country collaboration maps reflect author networks and are dominated by the US, UK, and Germany. Initial research in the field originated from the USA and in recent years most publications originated from Europe. A major network in the EU which has a strong focus on conceptual development is called GLORAD. It contains the most prevalent authors in the field and can be seen as the research front in RI literature. RI research related to healthcare is mostly produced through a collaboration between the USA and UK, where M. Harris has been identified as a key player in the network. Most empirical studies were found to use case studies from China, India and Latin America.

The intellectual structure was visualised by identifying the researchers most influential publications. Several research trends were identified, as well as future opportunities. The study not only shows the works most cited but also those that play a significant bridging role in filling the network's structural gaps. Those bridging articles are likely to continue to be well referenced in future studies. Structural gaps that have not yet been filled reflect potential research opportunities.

The most influential works are mostly papers that describe conceptual contributions and have formed the theoretical foundation of RI knowledge. As RI is still a fairly new concept the findings show that most the most cited research researches theoretical underpinnings of the concept. The present research frontier has two main interests. First, to disentangle the conceptual overlays among the various innovation typologies to reduce complexity. Second, to devise specific RI practices based on empirical research. The publications found in Table 5.3 give a comprehensive view of current understanding of RI and can be perceive as the fundamental articles describing RI.

The present research front is interested in developing RI practices and thus describing RI in a more firm integrated perspective. The following chapter provides an initial step to satisfy this interest. Through content analysis of relevant publications the drivers and antecedents of RI have been identified and integrated into a framework. It thus aims to fulfil the second research objective of this study.

Chapter 6

Conceptual Framework: Identifying what leads to reverse innovation

"Any fool can learn from his mistakes. The wise man learns from the mistakes of others."

— Otto von Bismarck

Chapter overview

This chapter introduces a conceptual framework of most relevant antecedents, drivers and consequences of RI and how these influence the RI process.

> The structure of this chapter is as follows. The first section, Section 6.1 introduces the motive for such a framework. Section 6.2 discusses the process of how influencing factors were identified and structured in the framework. Subsequently, Section 6.5 presents the framework and describes the RI process and it antecedents, drivers and consequences.

6.1 Introduction

The previous chapter highlighted through bibliometric and content analysis that RI literature derives from a mixture of researchers from different backgrounds. It also indicated that although some collaboration exists a lack of communication and accord among the research domains creates opacities regarding the explanation and usage of the RI concept.

From an industrial/technical perspective, where the term originated, RI is described as either a strategy or a phenomenon where innovation flows from an EM to a DM *within the organisational boundaries of a MNC*. From this perspective the innovation can be managed and the conceptual and theoretical underpinnings described earlier in this thesis hold. For instance the reversal can take place in any stage of the innovation process (Von Zedtwitz et al., 2015) as the ownership of the innovation remains the same and sustainable value is created.

However when reviewing the papers from the healthcare industry RI is described as a process where knowledge is transferred in a reverse way, between EM healthcare systems and DM healthcare systems. For instance Harris, Dadwal, and S B Syed, 2020, p. 1 described the concept as way for "*health systems to recognise current and advocate for future strengthened knowledge flow between the global south and global north*". Exemplifying that within the healthcare domain RI is perceived as a knowledge flow between EMs and DMs *without organisational or institutional boundaries*. Therefore, it describes a process where ideas are taken or shared between an EM and DM but the intellectual property of that idea or innovation is unclear. RI from a healthcare perspective thus describes more a process of shared global learning where knowledge flows from an EM to a DM. This conceptual difference is visualised in Figure 6.1.

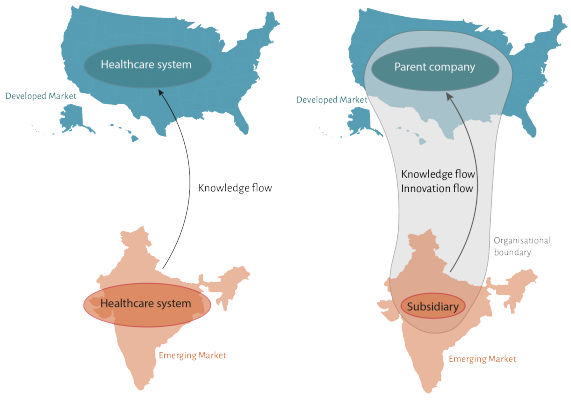


FIGURE 6.1: Conceptual difference of RI among different research domains

The distinction poses various theoretical and managerial questions. As from the healthcare perspective the reversal of flow in other innovation stages proposed by Von Zedtwitz et al., 2015 is probably limited. Furthermore, the entire notion of diffusion theory is lost. Does this definition also enhance global inequality and sustainability issues? Is RI in healthcare even a strategic business decision for accessing new constrained markets? As this was the initial goal of RI (Immelt, Vijay Govindarajan, and Chris Trimble, 2009; Vijay Govindarajan, Kopalle, and Danneels, 2011). In section 7.1, I will further discuss and reflect on these issues.

The key findings of previous analysis showed that apart from a conceptual difference between the research domains, *within* the industrial/technical perspective, a conceptual conflict is present. RI is described as either a *strategy* or a *phenomenon*, posing the question whether RI is intentional or not. This corresponds to Furue and Washida, 2014 conference paper where two types of RI were defined based on the intention of the innovation. A RI that is strategically planned (the MNC selects and targets EMs to set up R&D infrastructure to allow for the development of innovations and then spread to DMs) is named an inductive RI (IRI) (Furue and Washida, 2014) and can thus be seen as a *strategy*. RI that occurs unexpectedly is a coincidental RI (CRI) (Furue and Washida, 2014) and can therefore viewed as a *phenomenon*. Coincidental thus means that a firm does not innovate for a market with the intention of reversing that innovation.

In order to asses whether RI can be induced, identifying and understanding what leads to RI is useful and essential for further development. Moreover, findings from content analysis of previous papers indicate that their is limited knowledge on how to actually achieve RI. When these were described they led to to the impression to be not inclusive — as they were based on singular case studies or companies — or they failed to indicate at what time and how in the RI process these conditions and circumstances were important. Furthermore the conceptual frameworks that were found (See (Hadengue, Marcellis-Warin, Zedtwitz, et al., 2017; Zhu, Zou, and H. Xu, 2017; Suresh Malodia, Shaphali Gupta, and Anand Kumar Jaiswal, 2019)) did not indicate how the RI process actually works but merely stated influencing factors.

Therefore a clear mapping of empirical findings and the relations among influencing factors is necessary to (a) provide sound managerial advice, and (b) create a holistic approach to RI. Therefore this chapter presents a conceptual framework to address the identified issues.

6.2 Development of the conceptual framework

To identify the factors influencing RI and develop a conceptual framework a combination of quantitative and qualitative analysis was used with the specific objectives to [1] investigate RI practices, [2] identify and construct the attributes that aid RI, and [3] develop a conceptual framework that describes the RI and its drivers and antecedents.

Given the fairly general objective of this framework and broad knowledge surrounding RI a knowledge synthesis and thematic content analysis approach was found to be appropriate. This means the framework was developed through an iterative process to determine trends and patterns of descriptions, their frequency, their relation- ships and structures. The goal was through repeated collection of data, and interpretation of that data to reach '*theoretical saturation*'. Theoretical saturation is obtained when no new knowledge emerges in repeated cases (Sekaran and Bougie, 2016). In this case that meant that no new drivers and antecedents or other influencing factors were found in publications relevant to RI.

Through this approach, qualitative and empirical studies were analysed to combine their insights and findings. Thus this framework was developed based on secondary data and interpretations of mostly case studies. These studies were from various countries and different periods of time. A starting point was analysing publications that already attempted to develop such a framework (eg. (Dellermann, 2017; Hadengue, Marcellis-Warin, Zedtwitz, et al., 2017; Suresh Malodia, Shaphali Gupta, and Anand Kumar Jaiswal, 2019). Similarities were found but most frameworks were found to be based on a sparse amount of case studies. The value of this framework is that it integrates these findings and through co-occurence can estimate if the factors are context dependent or not.

Furthermore, top papers (TC>10) were selected and reviewed to determine publications mentioning various RIs and practices that led to their development. These were commonly found in sections describing managerial implications. All factors that were described in the literature as affecting the development of RIs were collected in Table 6.1.

Subsequently as described in the following Section 6.2.1, the influencing factors were divided into the general categories of drivers, antecedents and consequences. The occurrence of these specific drivers, antecedents and consequences determined whether they were integrated into the framework.

Then Section 6.4.1 describes how these groups were aligned within and throughout categories and assessed at what time they influenced the RI process. Finally, most relevant factors were connected to the RI process steps and an attempt was made to

structure these in a framework that (a) explained the RI concept, (b) did not contradict current theories and findings, and (c) was comprehensive yet parsimonious.

6.2.1 Classifying the factors

The literature describes a vast amount of factors influencing RI, of which some are distinct and some are similar. Therefore, classifying the factors into main categories based on their characteristics was essential to reduce complexity. Various terms are used, but literature commonly describes two forms of influencing factors for RI; ***Drivers***, (e.g. (Borini, Miranda Oliveira, et al., 2012)) and ***Antecedents***, (e.g. (Giannetti and Rubera, 2019)). The terminology or justification of these definitions is often withheld and is used for similar factors.

Therefore the following operational definitions are used. An '*Antecedent*' is defined as something existing or happening before, especially as the cause or origin of something existing or happening later (Walter, 2008). A '*driver*' is defined as something that makes other things progress, develop, or grow stronger (Walter, 2008).

After analysis of the identified factors and as these definitions have subtle differences, I define two categories of antecedents: **market** and **organisational** antecedents. *Market antecedents* describe external circumstances that cause or can cause RI. These circumstances are thus not influenced by any organisational practices.

Any factors describing intellectual capital or organisational characteristics are *Organisational antecedents* of RI as these are internal reasons and aspects which promote RI (Vijay Govindarajan, Kopalle, and Danneels, 2011). These are most of interest for this research. Intellectual capital covers all intangible resources associated with an organisation, and that contribute to the transfer of an organisation's value proposition (Edvinsson and Malone, 1997). Further refinement on structuring these factors was achieved by combining structures of (Janda, Schuhmacher, and Kuester, 2018; Reinhardt, Gurtner, and Griffin, 2018; Zhu, Zou, and H. Xu, 2017; Dellermann, 2017).

Drivers are factors that influence the *development* and *reverse transfer* of innovations from emerging subsidiaries to the parent company (Borini, Miranda Oliveira, et al., 2012). Factors that have a positive influence are names **drivers** and factors with negative influence are referred to as **restraints** in the conceptual framework. Restraints are not absolute restrictions but describe energetic biases that force RIs towards various restrictions. Table 6.1 depicts all performance influencing factors for RI that have been identified through this literature review. It is important to note that the conceptual framework adopts the conceptual findings of previous chapter. This means that RI occurs within a clearly defined organisational boundary and ownership of the idea is clear and does not vary.

These antecedents and drivers lead to consequences and have been structured into either *organisational consequences* or *market consequences*. Consequences can be either positive or negative and thus are labelled as **risks** or **rewards** in the conceptual framework.

The following sections introduce all identified organisational antecedents and drivers. Market antecedents like market saturation, innovation inefficiency etc. are not described in these sections as these have been discussed extensively in Section 2.4 and the introductory chapter.

6.3 Organisational antecedents of RI

A variety of characterisations of the institutional environments related to RI have been studied in the literature. A significant amount of the publications focused on the organisational aspects that led to successful RI. This section identifies the most relevant organisational antecedents based on occurrence in the literature.

6.3.1 Organisational Characteristics

Organisational Structure

For successful RI, Borini, Costa, and Oliveira Junior, 2016 argue that the organisational structure for the reversal of flow ought to be well planned and structured. This organisational structuring promotes organisational integration (communication), essential to reduce institutional distance which works as a barrier for innovation (Borini, Miranda Oliveira, et al., 2012; Borini, Costa, and Oliveira Junior, 2016). Organisational integration between the parent and subsidiary creates support from the parent company which is vital for RI (Borini, Miranda Oliveira, et al., 2012). Furthermore, strong integration leads to greater autonomy for innovation and strategic alignment of the MNC. A higher degree of autonomy leads to increased efficiency of RI and thus increased chances of success (Borini, Costa, and Oliveira Junior, 2016; Hadengue, Marcellis-Warin, and Warin, 2017).

TABLE 6.1: Antecedents and drivers for Reverse Innovation identified through content analysis

Form	Context	Type	Influencing Factors	Sources	Captured under
Organisational Antecedents	**Organisational characteristics**	Structure	- Organisational structure needs to be well planned and structured	Borini, Costa, and Oliveira Junior, 2016; Hadengue, Marcellis-Warin, Zedtwitz, et al., 2017	Clean Slate Strategy
			- Global Market screening units: for early identification of reverse potential and possible markets	Janda, Schuhmacher, and Kuester, 2018; Tournois, 2016; Dellermann, 2017; Tournois, 2016; Suresh Malodia, Shaphali Gupta, and Anand Kumar Jaiswal, 2019	Local growth teams
			- Rotate key developed market personnel through emerging market R&D units and vice versa	Hadengue, Marcellis-Warin, Zedtwitz, et al., 2017	High degree of integration
			- End to end localisation	Nivedita Agarwal and Alexander Brem, 2018; Reinhardt, Gurtner, and Griffin, 2018; N. Xu and Y. Xu, 2016; Tournois, 2016	Local growth teams
			- Give subsidiary high degree of autonomy	Borini, Costa, and Oliveira Junior, 2016; Reinhardt, Gurtner, and Griffin, 2018; Hadengue, Marcellis-Warin, and Warin, 2017	High degree of autonomy
		Strategy	- Adopt a corporate strategy that includes emerging economies as potential contributors for innovation	Corsi and Di Minin, 2014; N. Xu and Y. Xu, 2016; Tournois, 2016; Dellermann, 2017; Borini, Miranda Oliveira, et al., 2012; Reinhardt, Gurtner, and Griffin, 2018; M. Zeschky, Widenmayer, and Gassmann, 2014; Hadengue, Marcellis-Warin, Zedtwitz, et al., 2017	R&D internationalisation strategy
	Intellectual Capital	Human Capital	- Internal, interface and external capabilities to develop low-cost product and process innovations	M. Zeschky, Widenmayer, and Gassmann, 2014; N. Xu and Y. Xu, 2016; Nivedita Agarwal and Alexander Brem, 2018; Reinhardt, Gurtner, and Griffin, 2018; Dellermann, 2017	Clean slate strategy
			- Innovation and product champion with influence in emerging or constrained market	Corsi and Di Minin, 2014	-
			- Open and flexible innovation mindset	Janda, Schuhmacher, and Kuester, 2018; N. Xu and Y. Xu, 2016; Hadengue, Marcellis-Warin, Zedtwitz, et al., 2017	Entrepreneurial orientation and clean slate strategy
			- High degree of diversity throughout organisation	Corsi and Di Minin, 2014; Reinhardt, Gurtner, and Griffin, 2018; Janda, Schuhmacher, and Kuester, 2018; Giannetti and Rubera, 2019	Local growth teams
			- Legal and Regulatory Know-how	Janda, Schuhmacher, and Kuester, 2018; Hadengue, Marcellis-Warin, Zedtwitz, et al., 2017	-
		Relational Capital	- Lobby Management	Janda, Schuhmacher, and Kuester, 2018; Hadengue, Marcellis-Warin, Zedtwitz, et al., 2017; Reinhardt, Gurtner, and Griffin, 2018	Local collaboration
			- Access creation: enabling access to the innovation for low-end consumers	Dellermann, 2017; Reinhardt, Gurtner, and Griffin, 2018	Local collaboration
		Structural capital	- Innovation culture and commitment: Creating and maintaining an organisational environment supporting low-end innovation	Borini, Costa, and Oliveira Junior, 2016; Hadengue, Marcellis-Warin, Zedtwitz, et al., 2017; Reinhardt, Gurtner, and Griffin, 2018	Clean slate strategy and entrepreneurial orientation
			-Low fear of cannibalisation	Zhu, Zou, and H. Xu, 2017; Janda, Schuhmacher, and Kuester, 2018	Low resistance to change
			- Entrepreneurial orientation of the company	Borini, Miranda Oliveira, et al., 2012; Tournois, 2016	Entrepreneurial orientation
			- Strong Integration and communication between parent and subsidiaries to reduce uncertainty form institutional distance	Borini, Miranda Oliveira, et al., 2012; Borini, Costa, and Oliveira Junior, 2016; N. Xu and Y. Xu, 2016; Reinhardt, Gurtner, and Griffin, 2018; Janda, Schuhmacher, and Kuester, 2018	High degree of integration
Drivers	**Product**		- low degree of perceived adaptation	Zhu, Zou, and H. Xu, 2017; Suresh Malodia, Shaphali Gupta, and Anand Kumar Jaiswal, 2019	Small adaptations to adress new needs
			- Cultural Specificity	Zhu, Zou, and H. Xu, 2017	High degree of usability
			- Super Value	Suresh Malodia, Shaphali Gupta, and Anand Kumar Jaiswal, 2019; Vijay Govindarajan, Kopalle, and Danneels, 2011 etc.	Super Value
			- Product is best introduced with accompanying new business model adapted to local demands	Suresh Malodia, Shaphali Gupta, and Anand Kumar Jaiswal, 2019; Dellermann, 2017 etc.	Business model innovation
			- Similarity to existing products	Zhu, Zou, and H. Xu, 2017; Tournois, 2016	Low degree of complexity
			- Product Adaptation Ability	Zhu, Zou, and H. Xu, 2017; Dellermann, 2017; Hadengue, Marcellis-Warin, Zedtwitz, et al., 2017; Janda, Schuhmacher, and Kuester, 2018; Reinhardt, Gurtner, and Griffin, 2018; Tournois, 2016	Low degree of complexity
	Market		- Existing products market dominance	Zhu, Zou, and H. Xu, 2017	-
	Organisation		- Subsidiary's experience of a longer period of existence abroad	Borini, Miranda Oliveira, et al., 2012	High degree of integration

Borini, Costa, and Oliveira Junior explain that the role of integration is not merely a mechanism to align the innovation process of a subsidiary with the parent. Integration is an important factor that enables and provides innovation processing abilities to the subsidiary (Borini, Costa, and Oliveira Junior, 2016). Integration is thus a necessity for an *end-to-end localisation* process to overcome the specific environmental determinism of EMs which is also a key influencing factor (Nivedita Agarwal and Alexander Brem, 2018; Reinhardt, Gurtner, and Griffin, 2018; Tournois, 2016). N. Xu and Y. Xu, 2016 support this notion of the importance of end-to-end localisation and propose that a diversified international coupling mechanism is an important support for technology localisation (N. Xu and Y. Xu, 2016).

Janda, Schuhmacher, and Kuester, 2018 expand the structural antecedents for successful RI by addressing the need for *global market screening units* or *local growth teams* - specific business units that scan the company's full global product portfolio for synergies. Janda, Schuhmacher, and Kuester, 2018 has defined three categories of drivers: structural, cultural, and resource-related, which have been adopted in Table 6.1.

Another structural antecedent which has been identified is the positive influence of *rotating key DM personnel through EM R&D units and vice versa* (Hadengue, Marcellis-Warin, Zedtwitz, et al., 2017). This is a structural antecedent to overcome corporate culture challenges and thus an antecedent to increase integration (Hadengue, Marcellis-Warin, Zedtwitz, et al., 2017).

Strategy

Adopting a corporate strategy that includes emerging economies as potential contributors to innovation is a crucial strategic antecedent for RI (Vijay Govindarajan, Kopalle, and Danneels, 2011; Corsi and Di Minin, 2014; Reinhardt, Gurtner, and Griffin, 2018). Having this perception towards EMs is closely related to integration and localisation. However, I view these as results of adjusting a company-wide strategy. According to Tournois, 2016, companies must view such a strategy not just as a methodological or theoretical stage but as a creative process linked to innovation, which helps to define a new territory within its market.

Both M. B. Zeschky et al., 2014 and N. Xu and Y. Xu, 2016 discuss that for successful RI, the physical design and development of reverse product innovations must be located in a subsidiary based in a resource-constrained environment. I classified this as a strategy which includes EMs as potential contributors. Their contribution further clarifies what roles the Parent and the subsidiary need to adopt to generate RI. The Parent should adopt innovation processes that lead to exploitation, wheres subsidiaries should aim for exploitation. Through knowledge transfer the organisation becomes ambidextrous. That helps the company to be innovative and adaptable in EMs, while still relying on more conventional, established business methods in DMs. This reduces uncertainty and risks inherent to innovation.

6.3.2 Intellectual Capital

Intellectual Capital can be split into three elements: human capital, structural capital, and relational capital (Edvinsson and Malone, 1997).

Human Capital

The capability of an organisation's human capital is of decisive importance according to Reinhardt, Gurtner, and Griffin, 2018. The capability to develop low-end or frugal product and process innovations is a key antecedent for RI and is frequently cited (M. Zeschky, Widenmayer, and Gassmann, 2014; Nivedita Agarwal and Alexander Brem, 2018; Suresh Malodia, Shaphali Gupta, and Anand Kumar Jaiswal, 2019). Reinhardt, Gurtner, and Griffin explain the conceptualisation of this capability as a (first-order dynamic) capability that reflects a company's ability to deploy resources reliably to design , develop and market new products that create value for and capture value from constrained customers. M. Zeschky, Widenmayer, and Gassmann, 2014 identify that RI demands different organisational capabilities depending on the type of innovation being reversed. This follows the conceptual contribution of M. B. Zeschky et al., 2014.

Reinhardt, Gurtner, and Griffin, 2018 agree with this notion but show that firms need a specific and interdependent capability set for general low-cost innovation and expand on the specific capabilities needed. However, these are predominantly organisational capabilities like capability to develop and maintain an organisational environment that supports low-end innovation.

Having innovation and product champions with influence in both subsidiary and at the parent company is also an antecedent for RI (Corsi and Di Minin, 2014). Important is these champions recognise the opportunities and possibilities of innovation in EMs and DMs and thus have a high absorptive capacity.

To leverage these capabilities an open and flexible mindset towards innovation is an important antecedent for RI (Janda, Schuhmacher, and Kuester, 2018; Hadengue, Marcellis-Warin, Zedtwitz, et al., 2017). This mindset promotes employees to be open to innovations from EMs and enables them to assess their potential for DMs objectively (Janda, Schuhmacher, and Kuester, 2018). Therefore, one can say that this mindset increases an organisation's absorptive capacity in EMs, an important capability for sustained competitive advantage (Cohen and Levinthal, 1990).

Enabling RI requires a high degree of diversity throughout the organisation (Corsi and Di Minin, 2014; Suresh Malodia, Shaphali Gupta, and Anand Kumar Jaiswal, 2019; Giannetti and Rubera, 2019). Corsi and Di Minin, 2014 state that compiling a global team is crucial for successful RI. Diversity drives cross-country knowledge gathering, assessing cultural constraints and affects the performance and speed at which new products are launched in different countries (Corsi and Di Minin, 2014; Giannetti and Rubera, 2019).

Variations in the legal and regulatory structures between EMs and DMs can serve as a strong barrier to innovation transfer across markets (Janda, Schuhmacher, and Kuester, 2018; Hadengue, Marcellis-Warin, Zedtwitz, et al., 2017). This issue was especially prevalent in literature related to health care products. Therefore, having human capital that has experience and knowledge in these areas can be crucial for RI and thus forms an antecedent for RI.

Relational Capital

Janda, Schuhmacher, and Kuester, 2018 address that the widespread concern of competitors, politicians and the establishment of the disruptive power of RI creates barriers. To overcome these barriers, organisations should be able to manage these concerns and therefore utilise lobby management and networking (Janda, Schuhmacher, and Kuester, 2018; Hadengue, Marcellis-Warin, Zedtwitz, et al., 2017; Reinhardt, Gurtner, and Griffin, 2018).

Creating distribution access is paramount for RI (Dellermann, 2017; Reinhardt, Gurtner, and Griffin, 2018). Reaching the vast amount of potential EM customers enables RI (Reinhardt, Gurtner, and Griffin, 2018). EMs have often no market intermediaries or a well-developed distribution infrastructure creating institutional voids (Reinhardt, Gurtner, and Griffin, 2018). Enabling this access is thus vital for the success of any product in EMs.

Structural Capital

Numerous publications address the importance of creating an innovation culture and commitment towards innovation (Borini, Costa, and Oliveira Junior, 2016; Hadengue, Marcellis-Warin, Zedtwitz, et al., 2017; Reinhardt, Gurtner, and Griffin, 2018). These aspects could impact efficiency and inter-organisational relations, subsequently influencing the RI process (Hadengue, Marcellis-Warin, and Warin, 2017). Reinhardt, Gurtner, and Griffin, 2018, p. 14 state explicitly: "To encourage and support low-end innovation, organisations need to proactively establish an innovation culture of resourcefulness, self-cannibalisation and an emerging customer segment orientation". An issue with this is that a global company culture is hard to achieve, especially when well-established.

Zhu, Zou, and H. Xu, 2017 and Janda, Schuhmacher, and Kuester, 2018 both perceive a low fear of cannibalisation — the erosion of sales of existing products by new offerings (Copulsky, 1976) — an antecedent of RI. However, Zhu, Zou, and H. Xu, 2017 determine this antecedent as an evaluative mechanism of products by management before being launched. Conversely, Janda, Schuhmacher, and Kuester, 2018 determine that it is part of the corporate culture. These notions overlap to an extent because how you evaluate is part of your corporate culture.

Entrepreneurial orientation relates to the positive bias of a company to new business opportunities (Borini, Miranda Oliveira, et al., 2012). This entrepreneurial orientation of a company is considered important for the creation and development of initiatives and competencies in subsidiaries which in turn enable RI (Borini, Miranda Oliveira, et al., 2012; Tournois, 2016). One can argue that this is part of an innovation mindset, however, I view this as a separate necessity for organisational culture. Creating a company culture where innovation is supported is one thing, having the mentality and commitment to exploit these innovations is another and consequently determined as a separate characteristic.

6.4 Drivers for RI

This second category of RI influencing factors has a more direct relationship to the performance of RI. Drivers are factors that influence the *development* and *reverse transfer* of innovations from emerging subsidiaries to the parent company (Borini, Miranda Oliveira, et al., 2012). Two publications accounted for the majority of the identified drivers of RI (Zhu, Zou, and H. Xu, 2017; Giannetti and Rubera, 2019) on which I will elaborate briefly. The perspective of both papers was identifying what factors influenced the launch speed of innovation and what implications this had for the performance of RI. Numerous other publication have described characteristics of innovation that appeal to resource constrained customers like frugal, cost, super-value.

Product Drivers

According to (Zhu, Zou, and H. Xu, 2017), the product characteristics of cultural specificity, similarity to existing products and existing products market dominance determine the ease at which management decides to launch a product in a DM and thus affect RI. These product characteristics define management's perception of effort and resources needed for successful RI (Zhu, Zou, and H. Xu, 2017).

The importance of the ability to adapt an innovation or product prior to launch is an additional influential driver and it has been identified by multiple papers (Zhu, Zou, and H. Xu, 2017; Dellermann, 2017; Hadengue, Marcellis-Warin, Zedtwitz, et al., 2017; Janda, Schuhmacher, and Kuester, 2018; Reinhardt, Gurtner, and Griffin, 2018; Tournois, 2016). The adaptation capability of a product relates to the assessment of effort needed and ease of alteration to specific market needs (Zhu, Zou, and H. Xu, 2017).

Market Drivers

Market dominance is described as the amount of market share or the degree to which an MNC is regarded to be in a leading position in the market (Eliashberg and Robertson, 1988). Zhu, Zou, and H. Xu determine that MNCs with low market dominance only anticipate a minimal risk of lost sales from cannibalisation. They find "The higher the existing product market dominance in the MNC's home market, the higher the management's perceived risk of cannibalisation" (Zhu, Zou, and H. Xu, 2017, p.5). As explained previously, this risk of cannibalisation is an important barrier towards RI. Thus, low market dominance will positively influence RI.

This risk of cannibalisation is a recurring barrier determined by the literature (Corsi and Di Minin, 2014; Hadengue, Marcellis-Warin, Zedtwitz, et al., 2017; Dellermann, 2017; Tournois, 2016). A methodology to restrict this possibility of cannibalisation is to use different distribution channels than usual (Corsi and Di Minin, 2014; Hadengue, Marcellis-Warin, Zedtwitz, et al., 2017).

Organisational Drivers

Additionally, Borini, Miranda Oliveira, et al., 2012 highlight the importance of subsidiary's experience abroad for a longer period. Having experience increases the reversal of innovation. Due to the many complexities that can occur during the innovation process, experience mitigates crucial shortcomings.

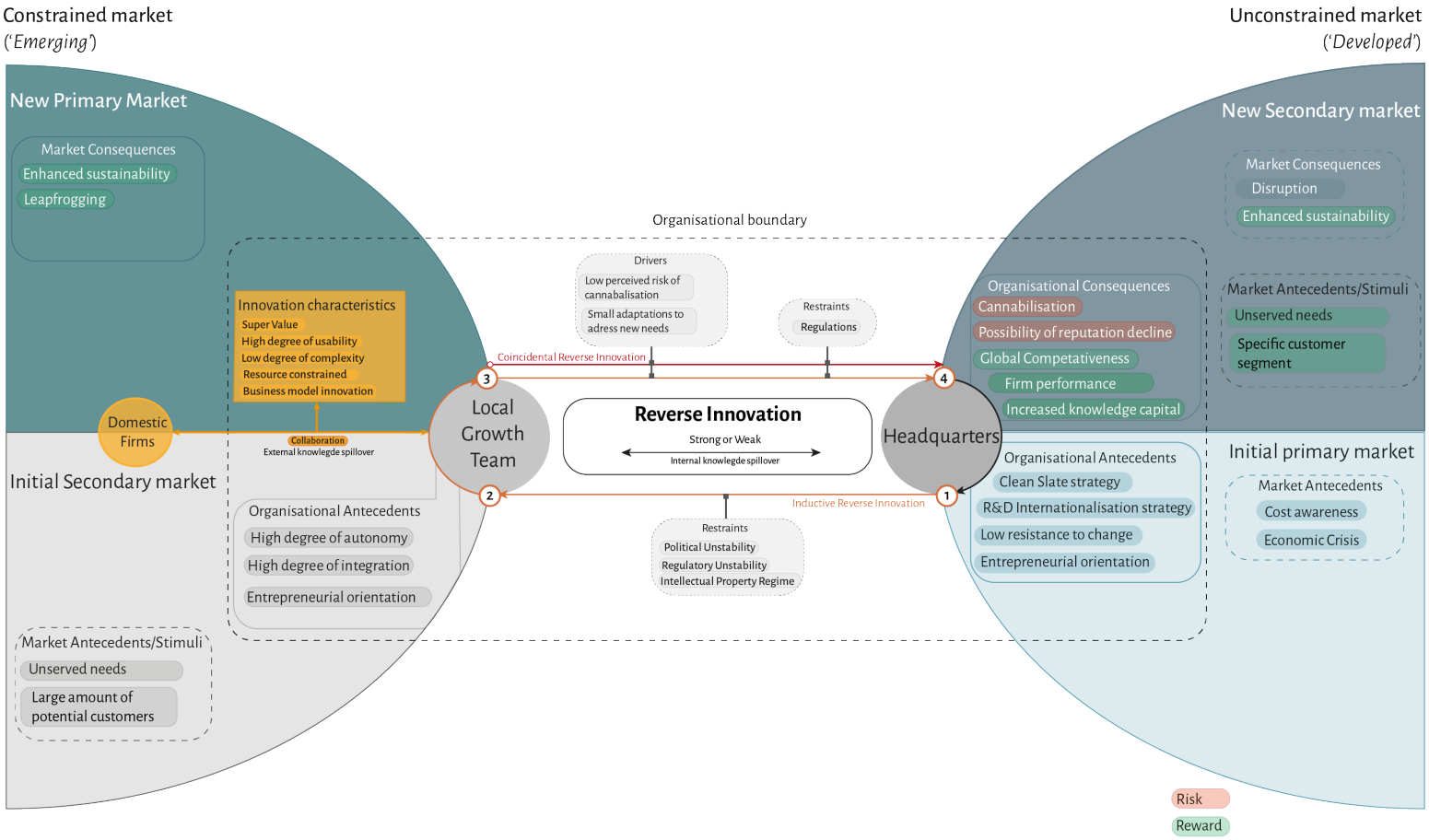
6.4.1 Integrating the drivers and antecedents into a framework

Innovating is not a linear, deterministic model, like it is frequently portrayed. It is well known that the creation and application of innovation is not only influenced by technological and economic considerations but is also determined by societal influences such as the attitudes and expectations of people of what this technology is and should be. The perspective on social shaping emerged from criticising the linear, deterministic vision of how technology evolves. As explained by Williams and Edge, 1996, social shaping, where collective or individual values and expectations shape the creation of technology, is very important for the development of an innovation. This is also of importance in RI.

For this reason, the goal was to structure the identified factors in a non-linear way. Inspiration was obtained from the Technology life cycle (Rosenkopf and Tushman, 1994) and the Socio-cognitive model of Technology Evolution (Garud and Rappa, 1994). These models and frameworks depict innovation development as going through iterative stages described by certain characteristics and interplays between individuals and structures. The interaction between beliefs, artefact characteristics, organisational structures and evaluation routines leads to the creation of innovation and it's adoption.

As the identified factors described similar processes, RI was found to be described best as a process of succeeding steps with specific characteristics. Vijay Govindarajan and Ramamurti, 2011 and Radojević, 2015 were found to describe specific RI innovation steps best. However, these steps did not allow for some of the more recent contributions made by (Von Zedtwitz et al., 2015) and (Furue and Washida, 2014). Therefore, RI steps were formulated that described the RI process and allowed for interplays. These were then aligned with the identified antecedents, drivers and consequences giving the structure of the framework. Meaning that the factors have an interplay with the RI process at a specific step of the innovation process.

This alignment led to Figure 6.2 which is described in the following section. To reduce complexity and for brevity, some have been merged and only key factors which appeared most frequently have been added to the framework.



Inductive Reverse Innovation

1. The actor (any MNC) is attracted by a secondary market stimulus (i.e. untapped market), and strategically decides to offshore full of part of R&D to that market to enter market.
2. The actor innovates specifically for that market through local growth teams with high degree of autonomy and strong collaborations with domestic firms to meet specific secondary market needs. Consequently the initial secondary market becomes the new primary market for the innovation and initial diffusion.
3. The innovation is introduced in the new primary market and subsequently a market in the old primary market is identified for which the innovation characteristics appeal or would appeal through slight adaptations.
4. The introduction of the innovation in the new secondary market creates the 'Reverse Innovation' as the primary and secondary market have exchanged.

Coincidental Reverse Innovation

*The cycle can occur throughout various stages of innovation giving rise to the notions of *strong* an *weak* reverse innovation (See Von Zedtwitz, M., Corsi, S., Søberg, P. V., & Frega, R. (2015). "A typology of reverse innovation".)

FIGURE 6.2: Conceptual Framework

6.5 Conceptual Framework

Figure 6.2 displays the conceptual framework. This section describes all relevant characteristics of the framework. As can be observed RI occurs between a parent and it's subsidiary and clear organisational boundaries are present. The sequential steps guiding the framework were based on Radojević, 2015 and integrate the most occurring factors.

1. The actor (any MNC) is attracted by a secondary market stimulus (i.e. untapped market), and strategically decides to offshore full or part of it's Research and Development practices to that market to enter the market.

2. The actor innovates specifically for that market through local growth teams with a high degree of autonomy and strong collaborations with domestic firms to meet specific secondary market needs. Consequently, the initial secondary market becomes the new primary market for innovation and initial diffusion.

3. The innovation is introduced in the new primary market and subsequently a market in the old primary market is identified for which the innovation characteristics appeal or would appeal through slight adaptations.

4. The introduction of the innovation in the new secondary market creates the 'Reverse Innovation' as the primary and secondary market have exchanged.

It is important to note that this process can theoretically occur multiple times throughout the innovation process as ideation can take place in an EM, then development occurs in the DM and then the innovation returns to the EM for production and the introduction after which the innovation is eventually diffused in the DM. This thus does not contradict the notion of reversal in any innovation stage and thus the notion of strong and weak RI described by Von Zedtwitz et al., 2015.

Initial primary market

RI commonly starts when an actor (any MNC) is attracted by a secondary market stimulus (i.e. an untapped secondary market or segment or a large customer base with unfulfilled needs), and strategically decides to offshore its entire or a part of its R&D practices to that market to enter this market (Vijay Govindarajan and Ramamurti, 2011; Radojević, 2015). This describes the process of inductive innovation as clear strategic intentions are expressed (Furue and Washida, 2014). **Initial primary market antecedents** commonly described which cause this interest are **economic crises** and unstable primary market conditions (Vijay Govindarajan and Chris Trimble, 2012; Leavy, 2011; Hadengue, Marcellis-Warin, Zedtwitz, et al., 2017; Li, Zhang, and Lyles, 2013a). This leads to existing customers becoming more **cost aware**, creating a necessity for alternative products in the initial primary market and companies to look for new innovation capabilities.

RI is also facilitated by various **organisational antecedents of the headquarter**. The most discussed aspect in literature is the mindset of the organisation and the accompanying management strategy. Adopting a corporate strategy that includes emerging economies as potential contributors to innovation is a vital antecedent for RI (Corsi and Di Minin, 2014; Suresh Malodia, Shaphali Gupta, and Anand Kumar Jaiswal, 2019; Reinhardt, Gurtner, and Griffin, 2018). According to Tournois, 2016, companies must view such a strategy not just as a methodological or theoretical stage but as a creative process linked to innovation, which helps to define a new territory within its market. The term that best describes such a strategy is **clean slate** (Suresh Malodia, Shaphali Gupta, and Anand Kumar Jaiswal, 2019; Hadengue, Marcellis-Warin, Zedtwitz, et al., 2017; Vijay Govindarajan and Chris Trimble, 2012; Leavy, 2011). This term is also used to describe strategies for frugal innovation (Hamacher and Rai, 2015; Rosca, Arnold, and Bendul, 2017; R. Khan, 2016).

A Clean slate strategy describes a bottom-up approach to finding a new solution to existing problems. It refers to value innovation theory describing a process where firms have to think from scratch and not be tempted to use existing capabilities (W. Chan Kim and Renée Mauborgne, 1977). Through enabling a clean slate strategy, firms have been found to develop better innovations. Enabling a clean slate strategy is often done by offshoring R&D to the market of origin. Both (M. B. Zeschky et al., 2014) and (N. Xu and Y. Xu, 2016) argue that for successful RI, the physical design and development of reverse product innovations must be located in a subsidiary based in the resource-constrained environment of the initial secondary market. This has been visualised in Figure 6.2.

Numerous publications address the importance of creating an innovation culture and commitment towards innovation (Borini, Costa, and Oliveira Junior, 2016; Hadengue, Marcellis-Warin, Zedtwitz, et al., 2017; Reinhardt, Gurtner, and Griffin, 2018). These aspects could impact efficiency and inter-organisational relations, subsequently influencing the RI process (Hadengue, Marcellis-Warin, and Warin, 2017). An issue with this is that global company culture is hard to achieve, especially when well-established. Furthermore, ambiguities arise when firms target different markets. **Entrepreneurial orientation** relates to the positive bias of a company to new business opportunities (Borini, Miranda Oliveira, et al., 2012). This entrepreneurial orientation of a company

is considered important for the creation and development of initiatives and competencies in subsidiaries which in turn enable RI (Borini, Miranda Oliveira, et al., 2012; Tournois, 2016). Another part of this necessary mindset for RI is a **low resistance to change** (Hadengue, Marcellis-Warin, Zedtwitz, et al., 2017; Vijay Govindarajan and Chris Trimble, 2012; Sarkar, 2011; Drucker, 2014; Vijay Govindarajan and Euchner, 2012). This describes that MNCs should be able to allow for the necessary organisational changes.

When these antecedents are in place, R&D is often partly distributed to subsidiaries or local growth teams. However literature describes a few **RESTRAINTS** that can influence this decision by MNC management. When the initial secondary market is found to be **politically or regulatory unstable** or there are **unclear intellectual property regimes**, the risks are often perceived as too great (Dubiel and Ernst, 2013; Corsi and Di Minin, 2014; Furue and Washida, 2014; Hadengue, Marcellis-Warin, Zedtwitz, et al., 2017)

Initial secondary market

When R&D practices are transferred to the initial secondary market, all reviewed publications have indicated the importance of using local capabilities as **ORGANISATIONAL ANTECEDENTS OF THE LGT**. This is best achieved by setting up Local Growth Teams (LGTs) — separate business units within the organisational structure with own profit and loss responsibilities which are empowered to decide, develop and market innovations for their markets and which can use MNCs resources (Corsi and Di Minin, 2014; Immelt, Vijay Govindarajan, and Chris Trimble, 2009; Suresh Malodia, Shaphali Gupta, and Anand Kumar Jaiswal, 2019; Matthew and S. Prime, 2017; Hadengue, Marcellis-Warin, Zedtwitz, et al., 2017; Vijay Govindarajan and Ramamurti, 2011; Corsi, 2012; Schuster, 2014). These LGTs work well as they have local knowledge and can better identify local market needs and opportunities. Suresh Malodia, Shaphali Gupta, and Anand Kumar Jaiswal, 2019 describes this as an "in-country-for-country" approach with high degrees of internal and external knowledge spillover through strong collaboration with domestic firms and government. Enabling RI requires a high degree of diversity throughout the organisation (Corsi and Di Minin, 2014; Reinhardt, Gurtner, and Griffin, 2018; Janda, Schuhmacher, and Kuester, 2018; Giannetti and Rubera, 2019). Corsi and Di Minin, 2014 state that compiling a global team through LGTs is crucial for successful RI. Diversity drives cross-country knowledge gathering and affects the performance and speed at which new products are launched in different countries Corsi and Di Minin, 2014; Giannetti and Rubera, 2019.

Janda, Schuhmacher, and Kuester, 2018 address that the widespread concern of competitors, politicians and the establishment of the disruptive power of RI creates barriers. To overcome these barriers, organisations should be able to manage these concerns and therefore utilise lobby management and networking Janda, Schuhmacher, and Kuester, 2018; Hadengue, Marcellis-Warin, Zedtwitz, et al., 2017; Reinhardt, Gurtner, and Griffin, 2018.

For successful RI, the organisation for RI ought to be well planned and structured (Borini, Costa, and Oliveira Junior, 2016). This organisational structuring promotes organisational **integration** (communication), essential to reduce institutional distance which works as a barrier for innovation (Borini, Miranda Oliveira, et al., 2012; Borini, Costa, and Oliveira Junior, 2016). Organisational integration is a key factor for RI Borini, Miranda Oliveira, et al., 2012; Borini, Costa, and Oliveira Junior, 2016; N. Xu and Y. Xu, 2016; Reinhardt, Gurtner, and Griffin, 2018; Janda, Schuhmacher, and Kuester, 2018. Integration between the parent and LGT creates support from the parent company and strong integration leads to greater **autonomy** for innovation and strategic alignment. A higher degree of autonomy leads to increased efficiency of RI and creates the clean slate approach (Borini, Costa, and Oliveira Junior, 2016; Hadengue, Marcellis-Warin, Zedtwitz, et al., 2017). Having innovation and product champions with influence in both subsidiary and the parent company has also been shown to enhance RI (Corsi and Di Minin, 2014).

Through these antecedents and collaborations, innovations are developed with specific characteristics. As these innovations are introduced in the same market, the initial secondary market becomes the new primary market.

Innovation characteristics

Literature has done thorough research on the specific characteristics of RI innovations. As indicated in the bibliometric study, various overlaps to other innovation typologies were found. This included frugal characteristics and disruptive technologies. Vijay Govindarajan and Chris Trimble, 2012 described five gaps — infrastructure, sustainability, regulatory, preference and price-performance—which divide constrained market from developed markets and innovations should incorporate these gaps for success. However, it was found that most innovations primarily satisfied the price-performance gap by creating cost-constrained innovations (Hadengue, Marcellis-Warin, Zedtwitz, et al., 2017). After review of listed RIs, it was determined that the compatibility—the degree to which potential consumers feel a new product is consistent with their present needs, values, and practices (Schiffman, Kanuk, and Wisenblit, 2010) — was most important for success in constrained markets. This was enabled by the LGT through extensive market research, a good understanding of the customers and resource-constrained (frugal) design principles (Brem and Wolfram, 2014; M. Zeschky, Widenmayer, and Gassmann, 2011; Agarwal, Brem, and Dwivedi, 2020; Dellermann,

2017). RIs were found to often have reduced complexity (Reinhardt, Gurtner, and Griffin, 2018; Dellermann, 2017) and high relative advantage — the degree to which potential customers perceive a new product as superior to existing substitutes (Schiffman, Kanuk, and Wisenblit, 2010). Important to note is that superiority does not mean that the technology was per se superior. Superiority often indicated the price-performance ratio. This is best described as **super-value**, pointing to substantial value creation at considerably reduced costs (Suresh Malodia, Shaphali Gupta, and Anand Kumar Jaiswal, 2019). For consumer products, trialability and observability were found to be important. This is properly due to the importance of word-of-mouth and in-store experience in EMs (Atsmon, Kuentz, and Seong, 2012).

Because of the higher proportion of first-time consumers, shorter history of brand recognition, a climate of social affirmation and a fragmented media environment, word of mouth plays a greater role and being able to easily explain the advantages of the product is thus beneficial (Atsmon, Kuentz, and Seong, 2012). The in-store experience affects a larger portion of the final purchase preferences in EMs, consumers never miss the hands-on experience if possible and therefore trialability is fairly important (Atsmon, Kuentz, and Seong, 2012).

To capture all properties as well as possible under a single term, **usability** has been used in the framework. Usability is a measurement of how well a single person can use a product/design to effectively, adequately and satisfactorily accomplish a specific purpose in a specific environment (Nielsen, 1994). Business model innovations were also described as enhancing the possibility of successful market introduction in the new primary market (Dellermann, 2017)

New primary market

When an innovation has been introduced and diffused in the new primary market this led to numerous **NEW PRIMARY MARKET CONSEQUENCES**. Often described in the literature was **leapfrogging** (Vijay Govindarajan, Kopalle, and Danneels, 2011; Schnaars, 1994; Klarin, 2019; L. Martin, 2018; Hadengue, Marcellis-Warin, Zedtwitz, et al., 2017). Leapfrogging is the idea that regions with badly defined infrastructure or economic structures will leap forward drastically without intermediate steps by adopting new advanced systems and technologies. Instead of first having fragile or expensive technology, these markets would immediately have superior products and thus 'leapfrogged' stages or technology previously developed by DMs. Various papers have also indicated the **enhanced sustainability** due to RI (Brem and Wolfram, 2014; Hadengue, Marcellis-Warin, Zedtwitz, et al., 2017).

The innovation characteristics can appeal to a market or market segment in the previous primary market. This can either be deliberate or it can occur coincidentally. The entrepreneurial orientation and open and flexible organisational mindset work this time in the opposite direction Janda, Schuhmacher, and Kuester, 2018; N. Xu and Y. Xu, 2016; Hadengue, Marcellis-Warin, Zedtwitz, et al., 2017. This mindset promotes employees to be open to innovations from EMs and enables them to assess their potential for developed markets objectively Janda, Schuhmacher, and Kuester, 2018. As a market is found in the initial primary market the innovation is adapted to the needs of that market and subsequently introduced creating the actual 'reversal' as the initial primary market has become the secondary market and the initial secondary market has become the primary market for that innovation. Thus the innovation has transferred in the opposite direction of what to date still is the norm.

This process can be enhanced by creating *global market screening units* - specific business units that scan the company's full global product portfolio for synergies (Janda, Schuhmacher, and Kuester, 2018). According to Zhu, Zou, and H. Xu, 2017, the product characteristics of cultural specificity, similarity to existing products and existing products market dominance determine the ease at which management decides to launch a product in a DM. These product characteristics define management's perception of effort and resources needed for successful RI Zhu, Zou, and H. Xu, 2017. When the innovation needs **small adaptations to address new needs** and management **perceives a low risk of cannibalisation** few risks are involved in transferring the innovation back to DMs. Zhu, Zou, and H. Xu, 2017 and Janda, Schuhmacher, and Kuester, 2018 both perceive a low fear of cannibalisation as a driver for RI. However, restraining the possibility is varying **regulations** (Hadengue, Marcellis-Warin, Zedtwitz, et al., 2017). These regulations are most prevalent in case studies describing healthcare related innovations. Less strict regulations and unclear innovation processes can result in doubt towards these innovations (Faheem Ahmed et al., 2017).

New secondary market

When the complete reversal of innovation takes place this has various **ORGANISATIONAL CONSEQUENCES**. First, a MNC's global competitiveness is enhanced as it supplies innovative products to a new market (Hadengue, Marcellis-Warin, Zedtwitz, et al., 2017; Immelt, Vijay Govindarajan, and Chris Trimble, 2009; A. K. Gupta et al., 2003; Suresh Malodia, Shaphali Gupta, and Anand Kumar Jaiswal, 2019; Janda, Schuhmacher, and Kuester, 2018). Furthermore, it has extended its knowledge capital as it possesses new innovative approaches and the knowledge to innovate for resource-constrained customers. Risks are also described in the literature. The most common risk is **cannibalisation**. Other risks are the **possibility of reputation decline** (Sartor and Beamish, 2014; Aschmoneit, Janevska, and Tillmar, 2013; Zhu, Zou, and H. Xu, 2017; Tournois, 2016).

New primary market consequences are the possibility of **disruption** (Hadengue, Marcellis-Warin, Zedtwitz, et al., 2017; Janda, Schuhmacher, and Kuester, 2018; Suresh Malodia, Shaphali Gupta, and Anand Kumar Jaiswal, 2019) which can be both positive and negative and **enhanced sustainability** which was described previously.

6.5.1 Differences among markets

When analysing the RIs and their markets of origin it has been found that the antecedents, drivers and consequences do not vary across the various EMs. This is partly due to the lack of depth of the described innovations and their characteristics. But mostly the antecedents align as they describe general managerial characteristics of the RI process and not, for instance, detailed cultural specifications. Other publications in related fields were also found confirming that drivers and antecedents across EMs do not vary (Ernst et al., 2015).

However, when reviewing the innovation context some slight differences were found. As described previously, regulations are specially mentioned in relation the healthcare products. Furthermore, RIs within the healthcare domain is often perceived as having less quality and experience more resistance (Faheem Ahmed et al., 2017; Y. A. Bhatti et al., 2017). This is probably due to the nature of the industry. DM customers want the best healthcare and do not exchange quality for the price.

6.6 Interpretation and Summary of Chapter 6

In this chapter, the third sub-research question was answered, which was: What are the key drivers and antecedents for RI and if applicable, how do these differ based on their emerging market based on content analysis of key publications on RI performance?

The results were obtained by analysing and extending frameworks and findings of previous authors and empirical studies and combining these in a framework based on occurrence.

A categorisation was proposed which sorted factors into organisational antecedents, market antecedents and drivers. Antecedents are factors that cause or lie at the origin of RI while drivers were defined as factors that progressed RI.

Of the organisational antecedents, the most debated factor in the literature is the corporate mentality and the strategic approach that is necessary for RI. Adopting a business approach and structure that incorporates EMs as potential innovation contributors is a critical precedent. Various antecedents were related to this idea and indicated methods to achieve this. For instance, adopting local growth teams, an open innovation approach for the initial secondary market and using high degrees of integration between the parent and the subsidiary. To develop low-end or frugal product and process innovations a high degree of diversity and autonomy is required within these local growth teams.

For the innovations to be successfully adopted in EMs and to appeal to DM segments the innovations often had super value characteristics with high degreed of usability and low degrees of complexity. Often RI necessitated new business models as financial structures are completely different.

For these innovations to transfer to unconstrained market management needed to perceive little risk of cannibalisation and small product adaptations. These can be used as constraints when developing innovation.

These influential factors were combined and structured in a framework and related to specific RI steps. By doing so, practitioners can easily assess their practices to identify what they can do to enhance opportunities of RI. Furthermore, they can propose strategies to deal with these factors. The framework has also adopted recent conceptual contributions like inductive and coincidental RI and strong and weak RI. This effort to combine current scholarly and empirical knowledge can be seen as a step forward towards theory building (Weick, 1995).

Lastly it was found that although scholars have used case studies from different markets and contexts, this had little effect on the described antecedents and drivers.

This chapter has fulfilled the second research objective; to develop a conceptual framework for RI drivers, antecedents and practices that regards the emerging market of origin. The following chapter discusses these findings to a greater context.

Chapter 7

Discussion: Significance of the findings

"Necessity is the mother of invention"

—Unknown

Chapter overview

In the introductory chapter of this thesis two main research problems were described. First, it was noted that in recent years less publications were studying RI and a review of our present knowledge concerning RI was necessary. Second, a lack of knowledge concerning the conditions and circumstances at which RI occurs was found to be present in literature. For this reason a study investigating the theoretical base, shape, relations and concepts of RI in the mirror of scholarly discourse has been performed in this study. This has lead to expected and unexpected results which have been described in previous chapters. This chapter discusses how these findings can be interpreted and reflects on the new identified understandings obtained in this research about RI and its literature.

› The structure of this chapter follows interpretations of this research. Section 7.1 interprets conceptual findings from the bibliometric study. Section 7.2 reflects on the identified influencing factors. Section 7.3 discusses a conceptual finding of the bibliometric analysis and content analysis and argues why RI is a strategy and not a phenomenon. Section 7.4 reflects on an identified paradox of the concept. Section 7.5 provides a personal reflection on RI.

7.1 Towards a singular concept

Complementary understanding 1: Researchers should use the concept of RI only when the specific reverse innovation characteristics are met and not as a term for global learning or knowledge sharing.

A key finding of this study has been the conceptual conflict between how RI is used in the industrial/managerial industry as opposed to the healthcare industry. Important to note is that this does not refer to healthcare products. It does, however, apply to healthcare policies and managerial practices. Within healthcare literature, RI is described more as a bi-directional transfer of ideas and policies from low-income to high-income settings (Ahmed et al., 2017; Y. A. Bhatti et al., 2017).

Ahmed et al., 2017, p. e968 exemplifies this perception of RI in healthcare by describing the concept as: "The West should look to these nations to learn from their methods of implementation, which include more efficient use of equipment and infrastructure, optimised clinical processes and productivity through task-shifting, and unification of all stakeholders under a shared vision to engage in organisational decision-making built on trust".

Although it is a 'reverse transfer of knowledge', I argue that it is not 'reverse innovation'.

For the description of RI in the industrial/managerial industry, the intellectual property of the idea should remain fixed and through its introduction in a market, it becomes an innovation as it provides value to whoever owns the intellectual property of that innovation. This thus indicates that RI should only occur within an organisational boundary or when the ownership of the intellectual property remains constant. Furthermore, the innovation passes through distinct stages and thus follows the common theory of innovation diffusion. Besides, the idea of RI is to access and serve resource-constrained customers to enhance competitive advantage and generate innovation knowledge. This type of innovation approach also aids in sustainability performance and provides value to EM customers. The combination of these constructs defines the foundation of the concept of RI.

For the healthcare definition, these constructs do not hold. There is no economic benefit for EMs when their policy or management ideas are used by DMs. Therefore, ownership of the intellectual property in this use is vague. Also, the intention of RI is not to access new markets or gain competitive advantage. The idea is only to learn from different practices and adopt them. Also as ideas and policies do not pass through innovation stages where reversal can occur this usage does not follow common diffusion theory. Also, conceptual contributions proposed by Von Zedtwitz et al., 2015 and Furue and Washida, 2014 do not hold in the definition of RI in healthcare literature.

Y. A. Bhatti et al., 2017 even defined a process of identifying RI's by scanning EMs for innovations that could possibly reverse. This implies using innovations of EMs for their benefit and not to enter EMs. Although these policies can aid in cost reductions (Harris, Weisberger, et al., 2015; Faheem Ahmed et al., 2017), I question if they add competitive advantage and the idea of protecting against EM competitors.

The ethical issue in my opinion with the usage RI in this manner is that it feeds the capitalistic way of thinking that the term at its core was supposed to challenge. RI is not about the exploitation of EM resources, knowledge or policies to create a more cost-effective system or product for DMs. At its fundamental core, it represents an approach to deliver products that satisfy the basic needs of EM customers through local collaboration which results in positive business outcomes. This has also emerged in the analysis of constructing the conceptual framework. Through this approach, these markets can be entered successfully creating competitive advantage and subsequently the possibility of RI as it transfers to DMS.

In my opinion, RI in healthcare is used as a buzzword to overcome the perceived quality barriers by traditional institutions towards EM healthcare policies and methods. This has also been acknowledged in previous literature (Matthew Harris, Emily Weisberger, et al., 2016). I argue that using EM policies and approaches in healthcare is a form of exploitation as EMs have devised these approaches based on necessity (Prabhu, 2017). Furthermore, the use of the term might be the issue which hampers the adoption of EM healthcare policies in DMs. RI is often narrated in the context of resource constraints. The term, therefore, might enhance the perception of lesser quality by adopters in the new secondary market which was identified in this study as a barrier for RI in healthcare.

Therefore I consider it important that future research adopts the term accordingly and a singular concept is used for RI. I propose the following checklist for RI to prevent conceptual confusion in the future:

Reverse Innovation	Reverse knowledge transfer
✅ The reversal occurs within clearly defined organisational boundaries and the intellectual property of that innovation remains clear	⛔ The reversal occurs across organisational boundaries and systems without regard for intellectual property.
✅ The reversal provides value creation for both secondary and primary market	⛔ The reversal does not necessarily provide value creation for both secondary and primary market
✅ The 'reversal' describes a process where the innovation is diffused in the primary and secondary market according to diffusion theory	⛔ The idea is implemented or simply adopted without regard for diffusion theory

Table 7.1: Future research conceptual checklist

On the outset, this looks to be contradictory to the notion of open innovation. Open innovation spans organisational boundaries and this study has shown that it has been of increasing interest in RI literature. However, when the work of Chesbrough, 2003 was analysed this proved not to be the case. Open Innovation is defined as the use of deliberate inflows and outflows of **knowledge** through the organisation boundary to accelerate **internal innovation**, and expand the markets for external use of innovation (Chesbrough, 2003). Thus knowledge is transferred through the organisational boundary but not the innovation itself. The recent interest in open innovation is not in contradiction with the proposed characteristics. It actually only exemplifies that local market knowledge is of crucial importance for proper RI practices. This market knowledge can be obtained through local growth teams. However, it can also be obtained through open innovation.

To summarise, the term 'reverse innovation' should not be adopted by scholars who describe different processes. This only creates further confusion on a concept that is already highly related to various other innovation types and processes.

7.2 No lack of knowledge, but a lack of integration

Complementary understanding 2: There is no lack of knowledge on the practices that lead to RI. However, there is a lack of knowledge about how these should be structured and integrated into a strategy.

Section 1.2, Research Problem described that there was a lack of knowledge concerning the factors and circumstances at which RI occurs and that there is no clarity on how they differ among markets. As previously argued, RI does not occur but it is induced through specific decision-making.

But in all fairness when reflecting on the findings of the content analysis one cannot state that there is a lack of knowledge concerning these factors. Numerous publications described in varying degrees the factors that influence RI performance and how organisations were structured for successful RI. However, what did miss in the literature is the organisation of these factors into categories and comparison with other studies. Most publications reported findings for their specific contexts but did not make the effort to compare and evaluate these with previous publications. This means that scholars have been focused on reporting what they observed but do not generalise their findings into a broader context. Also when empirical studies do not reflect or compare with previous studies on practices, knowledge progresses slowly.

The framework and structure of the influencing factors were meant to synthesis and integrate current knowledge on RI practices and endeavours. It can be seen as a benchmark which has structured current knowledge and through comparison and occurrence most relevant factors were identified. The framework can, therefore, be used by practitioners to analyse and objectively assess their innovation practices and how they should organise for a RI endeavour. The framework is in that sense a 'best-practice' describing a standard way in which companies have successfully developed RIs. Section 8.3 elaborates further on the contributions of this study.

Through the content analysis, one of the identified conceptual conflicts could also be answered. Namely, whether RI is a strategy or a phenomenon. Although the bibliometric study and content analysis seem separate, they actually partly evolved out of each other in order to answer this conceptual conflict.

7.3 Strategy or phenomenon

Complementary understanding 3: RI is an umbrella strategy as it originates in constraints and leadership creates a certain vision for the company by defining strategic boundaries and targets which enables others to respond accordingly with their own strategies and practices.

The bibliometric analysis in the study indicated a conceptual conflict. The literature describes RI as either a strategy or a phenomenon. After content analysis and analysing influential factors, it was found that RI is more a strategy than a phenomenon. RI never happens 'out of the blue' and in the literature a clear pattern can be identified in the stream of decisions leading to RI. This 'pattern in a stream of decisions' is described by Mintzberg and Waters, 1985 as a strategy.

The main step to complete the RI process and thus go 'reverse', is to transfer the innovation from a constrained market to an unconstrained market. This necessitates the introduction of an innovation. This is a deliberate choice made by a MNC and often involves analysing the perceived risk of cannibalisation and how much effort must be put into adapting an innovation to meet specific market needs. Therefore, RI tends to be better described as a strategy than as a phenomenon.

According to Mintzberg and Waters, 1985 the degree of intention defines whether a strategy is *deliberate* or *emergent*. This variation better describes the variations in intention found in literature than phenomenon or strategy. This also corresponds to the work of Furue and Washida, 2014 who described a RI typology based on this strategic intention.

Although this predefined intention varies across the reported case studies. In general, a decision is made at a certain moment in time to either innovate in a constrained market or transfer an innovation. Of the various strategies proposed by Mintzberg and Waters, 1985, I find that an '*umbrella strategy*' captures the pattern of decisions leading to RI best. An umbrella strategy originates in constraints and leadership creates a certain vision for the company by defining strategic boundaries and targets, which enables other actors to respond accordingly with their own strategies and practices (Mintzberg and Waters, 1985).

This correlates to RI as the parent company often creates a vision to offshore R&D to EMs as it experiences increasing constraints and issues in the DM. Within this description of a strategy, the subsidiaries are still able to develop own strategies and innovation practices. This umbrella strategy therefore also captures some aspects of the necessary organisational and entrepreneurial mindset necessary for RI. Furthermore, it allows for the necessary autonomy and integration, which were found to be key organisational antecedents of RI.

7.4 Internal Paradox of the concept

Complementary understanding 4: Due to the nature of the concept, the concept of RI will eventually become outdated.

The introduction of this thesis also analysed that in recent years there have been fewer publications discussing RI. I argue that due to the nature of the concept this is eventually bound to happen and perhaps already takes place. Frugal innovation and other innovations address the study of innovation under constraints, while RI better addresses the study of innovation diffusion between constrained and developed markets (Y. Bhatti et al., 2018). Thus constrained thinking creates innovations and RI transfers these ideas across the divided markets.

As RI describes an approach to innovate successfully for EMs and subsequently DMs, innovation capabilities of these markets will increasingly overlap. This will eventually result in a narrower divide between these markets. Apart from these capabilities, RI needs a demand from constrained and from advanced countries. As these demands will steadily become similar the enabling circumstances of RI will disappear.

Innovations will also start to diffuse and spread more equally in both directions, resulting in the concept eventually becoming outdated as MNCs continuously operate and diffuse in EMs and DMs. Thus the paradox inherent to the concept is that as MNCs become better at RI, the term becomes less relevant as the gaps described by Vijay Govindarajan, Kopalle, and Danneels, 2011 disappear. One can only speculate when this will happen and there is still a vast amount of knowledge to be gained from studying RI.

7.5 Personal reflection on the significance of reverse innovation

Radically rethinking our innovation practices is something that will ensue in the near future. Innovation of the future is not going to be about adding new and more expensive features. Innovation practices will be about providing the greatest amount of value for the least amount of money and using as little resources as possible.

The proverb "Necessity is the mother of invention" holds true since necessity has been pushing innovation over the decades. Something that is becoming even more apparent during the current pandemic. To satisfy immediate demand, COVID-19 has led to ultra-fast innovation and business transitions. Organisations have quickly accepted digitisation and remote working to continue their work. Firms looked at available technologies and developed innovations to address new demands and even developed medical devices. The constraints that were faced were met and overcome.

This urgent demand for innovativeness meant businesses needed to use their resources to develop and be open to collaborations and new practices. The result? Dyson manufactured ventilators, distilleries made hand sanitizers, the TU delft innovated breathing apparatus and the fashion industry manufactured face masks.

These innovations and changes allowed businesses to step forward through re-purposing. Instead of the typical innovation principle of just employing the latest and greatest technology which will generate a need by merely existing, firms addressed real-world needs through rethinking standards.

I find that innovation is often misunderstood as being synonymous with 'high-tech'. This is why innovations are often met with a burst of early adopters who want the newest technology but eventually fail in the longterm. An innovation can be new, quick and work well, but if it doesn't solve a problem, it only enters the short-lived consumer segments at the top of the BoP.

Current innovation strategies operate on the idea of 'People don't know what they want until you show it to them'. I find this highly misinterpreted, global consumers cannot dictate what they want but they can and do make clear what they need. This need just happens to be addressed by doing the opposite of present innovation strategies.

I find it an innovators job to address actual, real-world needs and bridge the gap between solving known problems with innovations. However, these needs and this necessity for innovation is hard to find in DMs. But, it is this necessity that creates the changes that need to happen and which will lead to a competitive advantage in the future.

To learn to deal with this necessity and to address actual needs, RI provides tremendous potential. In doing so problems are solved and new customers are created. By having knowledge and experience in resource-constrained environments companies harness themselves for future uncertainties.

RI provides an approach where establishing real value lies at the centre of the innovation strategy. It will, therefore, be invaluable for the future of innovation and for the future of firms.

Chapter 8

Conclusions and Recommendations: Reflecting this research

"The electric light did not come from the continuous improvement of candles"

—Oren Harari

Chapter overview

In this final Chapter the results of this research and the general conclusions are discussed.

› The structure of this chapter is as follows. The first section, Section 8.1 provides the answers to the sub-questions of this study. Section 8.2 provides the answer to the main research question. Subsequently, Section 8.3 discusses the scientific contributions of this study. The managerial relevance is discussed in Section 8.3.2. Section 8.4 discusses the limitations of this study on which Section 8.5 provides suggestions for future research. As this report is part of an official examination its relevance with Management of Technology is described in Section 8.6 .

8.1 Answers to Sub-Questions

The answers to the sub-questions which were proposed in Section 1.3 are provided in this section. First, the question is introduced, followed by a synthesis of key points derived from the research. With stagnating developed markets and a vast amount of unserved potential customers in emerging markets, Multi-National Enterprises have an increasing interest in developing successful innovations for Emerging Markets. Furthermore, holding a dominant position in developed markets can no longer be taken for granted as competitors from emerging markets arise. But as the types of products, contexts, demands and business models in emerging markets are fundamentally different, MNCs are radically challenged. To date, the concept of RI remains unclear and has numerous overlaps with other innovation types. Furthermore, the practices that lead to RI have not been evaluated or integrated to determine a best-practice approach.

The main objective of this thesis was to determine how the research landscape of RI has structurally evolved and to present a conceptual framework that integrated key drivers, antecedent and practices. To achieve this, bibliometric analysis techniques and content analysis have been used to analyse, structure and integrate current knowledge on RI. The first question was:

Sub-question 1: What are the key journals, influential institutions, most productive scholars, impactful and trending articles in RI research based on bibliometric analysis?

In this study, a bibliometric analysis of RI research was conducted analysing 208 articles identified from the ISI Web of Science and Scopus databases. With the aid of bibliometric and bibliometric-visualisation tools, this question was answered. First, a merging procedure was coded and both data files were combined into a single readable data file. The bibliometric software that was used in this study were VOSviewer and Bibliometrix R-package.

Globalisation and Health, Research Technology management and Journal of Cleaner production are the leading journals for RI (see table 4.2). The most contributing countries were the U.S.A., the U.K. and Germany (see fig. 4.3). These were found to correspond to the countries of the most influential institutions. These were Imperial College London, University of St. Gallen and Dartmouth College.

M. Harris, V. Govindarajan and Y. Bhatti are the most impactful authors within RI literature. These top three authors belong to the research interests of the conceptual development of RI (Govindarajan), RI for healthcare (Harris) and the relations between frugal and RI (Bhatti) (see table 5.1).

Immelt, Vijay Govindarajan, and Chris Trimble, 2009, Vijay Govindarajan, Kopalle, and Danneels, 2011 and M. B. Zeschky et al., 2014 were the most impactful papers for RI based on global citations (see table 5.3). These articles were found to lay the theoretical foundation of RI.

Vijay Govindarajan and Ramamurti, 2011, M. Zeschky, Widenmayer, and Gassmann, 2014 and Agnihotri, 2015a are the articles that have been cited most consistently and highly within the field (see Table 5.2). Vijay Govindarajan and Ramamurti, 2011 was identified as the first article structuring the theoretical underpinnings of RI and the definition of RI described in this paper was found to be the most cited. M. Zeschky, Widenmayer, and Gassmann, 2014 is the most influential and highly cited publication describing how MNCs should organise for RI and Agnihotri, 2015a researched four types of low-cost innovations in emerging markets: Jugaad, Frugal, Value and RI.

The top trending articles in the three recent years were Pisoni, Michelini, and Martignoni, 2018, Agarwal, Grottke, et al., 2017 and Mokter Hossain, 2018. These articles were reviews of resource-constrained innovation typologies and thus indicate that the recent trend has been to clarify the various innovation typologies and their connections.

Sub-question 2: What are the structural associations among RI literature, and how do they relate based on bibliometric visualisation analysis?

In this thesis, a bibliometric visualisation analysis was used to map the conceptual, intellectual and social structure of the RI field and their associations. Based on this analysis, some conclusions can be drawn. First of all, the initial expectation that the RI field is structured around the different related innovation typologies or markets of origin turns out to be too simplistic and somewhat incorrect. As identified by the concept co-occurrence maps for the periods of 2009-2014, 2015-2019 and 2009-2019, the conceptual structure of RI can be divided into three main domains which relate to the conceptual development of RI, the sustainable dimension of RI and RI for healthcare (see Figure 5.3).

Moreover, these sub-fields turn out to be fairly separate. Where the sustainable dimension of RI connects the conceptual development field and RI for healthcare field.

The conceptual development field is, as the name states, primarily concerned with advancing our understanding of RI by providing both empirical and conceptual research. It contains research that was related to the industrial/managerial domain. All papers that laid the foundation for RI were found in this sub-field. Within the conceptual development domain three perspectives towards the concept have been found: *business*, *product* and *market*. The concept of RI thus composes of three interrelated elements which in combination provide the concept of RI.

Within this *conceptual industrial domain* RI is a conflated term describing mostly frugal product innovations that have a disruptive nature when they transfer from EMs to DMs. In this industrial domain, a conceptual conflict was found. RI was described as a phenomenon and as a strategy highlighting the conceptual issue of whether RI can be induced via a strategy or whether it remains an observable event.

The RI for healthcare field proved to be a major field with numerous publications describing RI. The analysis of the frequency with which researchers use specific concepts in their publications has revealed that the healthcare domain describes RI as a process of reverse transfer of knowledge and ideas focused around organisation and management. As this is a different usage of the concept described in the conceptual development field, this research has concluded that there is conceptual conflict in the way RI is described in the two sub-fields.

As these sub-fields were displayed quite separate in the various methods of bibliometric mapping, it was found that both research sub-fields work separate from each other and define different meanings and practices for RI which reduced the conceptual clarity of RI. This is the first research that has identified this issue.

It was concluded, that the definition of RI used in the conceptual development field was the correct usage of the term. This study has proposed solutions and clear boundaries for RI to prevent future confusion. Key characteristics of RI are therefore that ownership of the intellectual property remains constant and that the reversal of the innovation takes place within organisational boundaries.

As described, this bibliometric analysis resulted in two unexpected conceptual conflicts. As the following research question necessitated further content analysis, the goal was to also address whether RI is a strategy or a phenomenon through the identification of the influencing factors and circumstances that led to RI.

Sub-question 3: What are the key drivers and antecedents for RI and if applicable, how do these differ based on their emerging market based on content analysis of key publications on RI performance?

In Chapter 6 a content analysis was undertaken to identify factors that influence RI. These were categorised in drivers, antecedents and consequences. The drivers and antecedents can be found in Table 6.1. This is the first study that has summarised and integrated findings of previous studies under one framework and structure. To construct the framework the RI process was described in 4 steps which would describe a complete RI cycle. Based on the occurrence of the factors and at what step they influenced the RI process, the framework was constructed. This attempt to group all the RI drivers, antecedents and practices led to to the conceptual framework found in Figure 6.2. It was also found that drivers and antecedent do not differ based on their emerging market. The framework thus provides a best-practice approach to RI which does not conflict with conceptual contributions proposed in recent years.

Through this content analysis, RI was found to have clear patterns in the decisions that led to RI. For this reason, it has been concluded that RI is a strategy and not a phenomenon. Thus redressing the first conceptual conflict.

8.2 Answer to Main Research Question

Main Research Question

Based on bibliometric analysis, how has the research landscape of RI structurally evolved and based on key publications on RI performance, how can RI drivers, antecedent and practices be integrated into a conceptual framework?

By integrating the findings of previous sub-questions, the answer to this main question is obtained. To avoid repetition a short summary is provided. This thesis has demonstrated how the RI field has evolved over time from an unstructured field to three distinct sub-fields. These sub-fields are concept [1] Conceptual development of RI, [2] The sustainable dimension of RI, and [3] RI for healthcare. It has been concluded that sub-field [1] and [3] show little similarities based on their conceptual, intellectual and social structure.

Through content analysis, various definitions of RI have been identified and conceptual differences highlighted. Concomitantly, all used concepts to varying degrees provide overlapping characteristics of RI. These characteristics have been found to occur in subsequent stages which collectively describe the concept of RI. The antecedents, drivers and consequences have been aligned with these sequential steps. Thus instead of trying to capture RI in a single definition, this research has proposed that RI should be described as a course of interrelated steps. For this reason, Radojević, 2015 sequential steps were adapted and used to structure the identified antecedents, drivers and consequences accordingly into one conceptual framework. Through the adoption of this structure, the drivers, antecedents and consequences could be related to the RI step they influenced. This study has found that an organisations structure and mindset are vital for RI. By creating local growth teams with high degrees of autonomy and integration firms have greater chances of developing RI.

8.3 Research Contributions

This work had specific managerial and scientific objectives, which were outlined out in Section 1.3. Since the entire research has been presented, a more detailed breakdown can be provided on the various ways in which this research adds academic or managerial value. Therefore the scientific contributions and managerial contributions are described.

8.3.1 Scientific contributions

Scientific contributions are described as the added scientific value of a researcher's findings (Markov, Ivanova, and Velychko, 2013). The most objective measure to analyse scientific contribution and impact is through citations, which lies at the basis of this research. However, the following subjective scientific contributions are discussed.

Scientific contribution 1: This research has provided initial bibliometric information on the RI field

This study has contributed to science as it is the first bibliometric study in this field which identifies and structures the scientific field of RI. By providing key journals, influential institutions, most productive scholars and impactful and trending articles a comprehensive analysis of the field has been obtained. This means that this research provides a comprehensive perspective

towards the current state of the art. It can thus be seen as starting point for future studies on the topic. Through the identified research trends and gaps, scholars can quickly asses what gaps they want to fill and what publications are of importance to read. Also scholars can use this study by only reading papers that are relevant for their research. For instance by reading papers specific to one research stream.

The bibliometric visualisation will be of value to experienced and inexperienced researchers alike. For less experienced scholars, this literary visualisation using an open-source software method gives a description of intricate networks in RI literature in one glance. It displays important sources and research communities. This study is useful for experienced researchers to save time and energy in interpreting the large variety of articles. It contributes by collecting all relevant information, and makes it possible to represent the complex patterns created by the vast volume of data consisting of many publications.

The value of bibliometric studies for literature reviews is that they are objective and reproducible, meaning that the data collection techniques and analytic procedures in this study would produce the same findings if they were repeated by some one else. Few literature reviews have this quality and mostly provide subjective notions on the scientific field. This research has thus contributed by providing objective data which was further subjectively analysed to discuss some of the findings.

Scientific contribution 2: This research has identified and clarified conceptual conflicts in RI literature

No previous studies were found that described that RI is used in different ways in literature. This research has therefore contributed by identifying and clarifying these conceptual conflicts across the sub-fields found in RI literature. It has thus aided in the disentanglement of the concept and provided clarification into what a RI constitutes. Describing RI as a process that occurs within an organisational boundary and as a process where the intellectual property of an innovation must remain constant. As a conceptual conflict was present one can assume that scholars across the disciplines do not understand the defining characteristics of RI. Therefore, this study has contributed to science by defining more characteristics of RI that were previously uncertain or unknown.

Scientific contribution 3: This research consolidated RI practices into a single framework on which future research can elaborate

This research has contributed by presenting the RI influencing factors into an integrated framework which explains the concept and at what stage, specific antecedents and drivers are important. Such frameworks that reviewed current practices and knowledge are not present in current literature. This framework provides a basis on which future conceptual and empirical studies can elaborate and iterate. This can eventually lead to future theory building (Weick, 1995) which can enhance our understanding of the concept. Furthermore it provides scholars with a framework that includes the most relevant knowledge on RI practices to date, which makes an easy starting point for future studies.

In an attempt of proposing a conceptual framework for RI with a comprehensive view, the contribution of this thesis, to some extent, has relied on extending the conceptual frameworks and findings of previous authors and empirical studies by combining them. While these frameworks were found to be contextual and described the innovation process in a linear fashion (Dellermann, 2017; Suresh Malodia, Shaphali Gupta, and Anand Kumar Jaiswal, 2019; Von Zedtwitz et al., 2015), the one proposed in this thesis is more in line with conceptual contributions of recent years and comprehensive. Comprehensive in the sense that first, no publications have clearly structured the factors in distinct categories with clear definitions. Through this proposed categorisation scholars can structure their findings adequately and add on previous findings easier. This structure has also created a 'checklist' which managers and scholars can use to assess their innovation practices or evaluate their findings. This will mitigate to some extent the risks that are inherent to innovation with the aim of assuring practitioners.

Scientific contribution 4: This research provides a merging method/code which successfully combines literature from different databases for bibliometric analysis

No literature or software has been found which enables scholars to combine data from different bibliographic databases. Recent studies have shown that the coverage of these databases differs substantially (Visser, Jan van Eck, and Waltman, 2019). Therefore, if scholars want comprehensive bibliometric studies combining data and removing duplicates is of importance. This study has developed such a method with the aid of CWTS Leiden and proven that this merging procedure provides reliable results. Throughout this study, every map was compared to maps of the single data files and merged files proved to provide more information on the intellectual, conceptual and social structure of the scientific field. In that sense, this thesis has contributed by developing a method through which data of ISI Web of Science and Scopus can be merged and formatted for bibliometric software. Specifically for VOSviewer and Bibliometrix R-package.

Scientific contribution 5: This research has showcased how bibliometric tools can be used to analyse and give insights into a research field

Managing research data or reviewing literature is a massive task for many scholars. This task is often tedious and costs valuable research time. However, keeping track of relevant research and understanding a fast-evolving field will assist researchers to identify research gaps, conflicts and assist in improving knowledge across different fields.

Therefore complementing traditional approaches with bibliometric tools will enable scholars to quickly find patterns in a large amount of literature across different periods in time and display these patterns in an intuitive manner. However, to date, little studies have shown the possibilities of these tools and how they enable to quickly report on a scientific field and more importantly highlight conflicts and research gaps.

This study has contributed by showing the possibilities of bibliometric tools and how researchers can use them to structure a field. The advantage of this method of literature review is that is is an objective one. Through translating data into useful visual formats, scholars will be able to establish information based on objective evidence, improve decision-making and conduct meaningful studies. The methods outlined in this thesis may be extended to the study of other fields.

8.3.2 Managerial relevance and contribution

The main managerial contributions of this research were the identification of the drivers, antecedents and consequences that have been most occurring in publications describing RI practices. This can be used as a tool for decision-making in business. The research thus provides a comprehensive overview which can be used by practitioners for the development of RI initiatives. By structuring and summarising factors into a framework businesses are able to determine what changes need to be made in their organisation and innovation approach. Without having to read the vast amount of papers on RI.

This framework also maps the relations within and across the numerous factors and the succeeding steps of the RI process. Therefore, this framework helps practitioners to arrange the relations and factors in an aggregated way and make sense of them in order to act accordingly. It was found that certain factors were of influence in certain steps (e.g. adaptation perception), while others needed to be present throughout the innovation process (e.g. entrepreneurial mindset). Therefore, managers can quickly assess in what step their innovation process is and use scholarly knowledge to adjust accordingly. Also, external effects that directly influence the process have not been adequately described in the literature. This framework can thus aid managers in identifying factors that are non-obvious and it could help in making strategic decisions. For example, from the start aiming to develop an innovation that can be easily adapted for introduction in DMs. Or using market instability to decide to start innovating for different markets. In addition, establishing reliable relations of all drivers and antecedents to RI performance will help practitioners to focus on these factors objectively. It is hard to assess own innovation practices, but by directly comparing it to the framework, gaps and possibilities for improvement can be objectively and easily identified. Through understanding which uncertainties and challenges are directly related to RI, practitioners may try to encourage or provide essential processes to solve such issues.

The foregoing points show that the content of this research can be of great value to companies that want to develop RI initiatives or assess their practices in EMs. As being aware of influencing factors and proper practices serves as a crucial step towards this goal.

8.4 Limitations of the study

Limitation 1

First, the publications that were used for bibliometric analysis were obtained only from Scopus and ISI Web of Science . Other bibliographic databases were not used in this study. This has was partly due to Scopus and ISI Web of Science providing proper coverage but also as these databases provided data formats that could be merged and analysed through the bibliometric software. Since RI had such a strong subfield concerned with healthcare, PubMed could have been used. However, according to Elsevier, Scopus has notable duplicated coverage of the literature offered by PubMed. However, there may be additional publications of importance in PubMed, Microsoft Academic or Dimensions that have not been covered in this study. Also, the search terms in this study were quite narrow. Perhaps future studies could extend the search terms and also include terms like "trickle-up" innovation or "reverse knowledge transfer".

Limitation 2

Another limitation of this study is the possibility of a loss of data during the merging and formatting procedure. When the data was merged duplicates were extracted from the data-set. Although these duplicates were checked, any information that the removed publication had was been lost. Furthermore, when publications are analysed though Bibliometrix, a conversion tool is used to structure all the publications in a manner that is understandable for Bibliometrix. To ensure reliability the maps were constantly checked with other data (dimensions) to reduce the possibility of errors. However, some errors could have occurred during the conversion process.

Limitation 3

To visualise the bibliometric data, parameters were used. To determine proper parameters a balance needed to be found between clear structural associations and too much information in the maps, this was achieved through iteration. But even the smallest of changes to the parameters could change the maps. For that reason, there is a possibility of experimenter bias as I determined when maps were decent. In respect to the content analysis, due to the nature of a thesis, I was the only one who judged the publications. Although the relevancy of antecedents, drivers and consequences were based on occurrence, my judgement played a role in this thesis and can thus have affected the results (Brewerton and Millward, 2001).

Limitation 4

The framework proposed in this study has not been validated. Meaning that only secondary data was used to develop it and no additional research was done to demonstrate or support the truth or value of it. Multiple studies reported that the difficulty in developing strategies or practices for RI is that successful companies are not willing to share their 'tricks of the trade'. This means that numerous studies were carried out later than when the innovation process occurred. The value of secondary data is that is less obtrusive, which is valuable in analysing strategies. However, this often means that researchers are not involved and cannot change variables to see effects.

Limitation 5

The studies that proposed conceptual frameworks provided 'degrees of influence' for the factors they found in their case studies (e.g. (Suresh Malodia, Shaphali Gupta, and Anand Kumar Jaiswal, 2019; Dellermann, 2017; Hadengue, Marcellis-Warin, Zedtwitz, et al., 2017). Meaning that they were able through statistic analysis to analyse the influence of certain factors on the RI process specific for their case studies. As the framework proposed in this study combined and summarised these factors, the degree of their influence was lost. However, the framework has utilised these to assess at what innovation step they portrayed their influencing power.

Limitation 6

Another limitation of this study is that the scope was towards MNCs from primarily developed markets. This was partly intentional but also partly unintentional. Very few studies were found that described practices and influential factors for emerging MNCs. Furthermore, most publications only described successful innovations that were introduced into markets. Therefore a limitation of the framework is that it does not integrate or discuss any negative practices that lead to unsuccessful RI.

8.5 Recommendations for Future Research

Suggestion for future research regarding Limitation 1

Future research may conduct a bibliometric analysis that develops separate maps of RI related literature or try to combine the data from more databases to provide more comprehensiveness. Also, researches can use broader terms to find relevant publications. Especially as some researchers have declared to not like the term. Future studies that analyse the field with Microsoft academics could also provide valuable insights as this relatively new database has been found to cover a vast amount of publications.

Suggestion for future research regarding Limitation 2

The merging procedure currently only integrates data from ISI Web of Science and Scopus as these have quite similar data organising structures. However, to enable the benefits that bibliometric studies provide procedures should be developed that can integrate all databases and remove duplicates. Current bibliometric software is becoming increasingly user friendly, however,

obtaining data for the input in these programs is still a tedious task. For this study relative, few publications were used as input. However, when fields are analysed that have great amounts of publications, current data collection methods are not suitable.

Suggestion for future research regarding Limitation 3

In future studies, the interpretation dependency describes in limitation 3 could be minimised by using multiple scholars (Duriau, Reger, and Pfarrer, 2007). Multiple scholars, especially with experience can aid in reducing subjectivity and biases.

Suggestion for future research regarding Limitation 4

RI is still fairly uncommon and literature often uses the same examples to describe it. This indicates that well defined and empirically tested strategies and practices are not present. Furthermore, the enabling environment for RI is fairly specific and strategies could identify how these environments can be created. Future research should aim to develop RI according to the various influencing factors that have been identified. By empirically verifying these antecedents, RI practices could be devised and tested. This will aid the theory-building (Weick, 1995) and validate the framework described in this thesis.

Suggestion for future research regarding Limitation 5

To further validate the framework, future research can conduct studies that only focus on the relationships among drivers, antecedents and consequences. This would provide their importance and their degree of influence. This would provide practitioners with information on what factors described in the framework proposed in this study are of most importance and influence the RI process most.

Suggestion for future research regarding Limitation 6

RI is often described concerning EMs and DMs. However, few studies analyse a reversal of flow from a secondary EM to a primary EM. For instance from Vietnam to China. In these situations, the customer demands and needs are expected to be more similar than from India to the U.S.A. As these demands are similar, the enabling environment is easier achieved and thus would imply more reversals. This is an interesting direction for future research as perhaps the antecedents, drivers and consequences described in this thesis would change. Besides, not all companies have created successful innovations, for example, the TATA Nano car. However, no research has described scientifically what practices resulted in failure and what general learnings can be obtained from these case studies in regards to strategy.

This work is also based on a qualitative method of analysis and presents findings which can be further collated and diversified to various contexts. Future research may focus on specific industries instead of markets and different degrees of innovativeness. It will also be useful to address the effect on innovation capability in terms of type (product, process, service.) and degree (incremental or radical).

Additional Suggestion: Balancing autonomy and integration of the LGT/subsidiaries

In the framework, local growth teams need both high degrees of autonomy and high degrees of integration. This poses various managerial difficulties as this duality is difficult to achieve. Future studies could enhance current knowledge on how to achieve this or relate it to theory on ambidextrous organisations.

Additional Suggestion: Sustainable performance related to RI

Various publications have indicated that RI enhances the sustainability performance of the firm and that it leads to positive outcomes for markets. However, as described in Section 2.4 MNCs can also have negative influences on the markets they enter dependent on the way they enter these market. In RI literature these negative effects have not been described. Thus research which elaborates on the positive en negative effects of RI could indicate how firms should enter and approach these markets to create maximal benefits.

8.6 Mandatory discussion of research relevance for completion of MSc. Thesis

This master thesis is conform the learning objectives and criteria of the Management of Technology Master of Science program as it relates to exploring and comprehending how firms can use technology to design and develop products and services that contribute to improving outcomes.

This thesis has combined the academic disciplines of business, engineering and technology into one research activity, making it multidisciplinary in nature. Furthermore, by combining literature and business information to logically reason a framework for RI an analytical component is present. Another analytical component in this study was learning how to execute a bibliometric analysis from scratch and devise relevant results from this data. As coding was necessary for this study new knowledge on coding was obtained and how to perform extensive literature reviews. As this work is also focused on the technological domain and technological innovations, all criteria for a Management of Technology thesis have been considered.

The insight that has be gained during this study can be used to develop a more informed global innovation strategy and more specifically how to develop a RI initiative.

Scientific Relevance

The study of reverse innovation is regarded as an emergent field. This master thesis, therefore, is relevant to the existing scientific literature in a few ways. First, it has identified future research opportunities for scholars. This to further establish RI in scholarly discourse and as a stand-alone innovation typology. Second, by determining the internal and external relations to other research streams, more effective research can be done as a clear narrative on the current field has been presented. Furthermore, this study has provided a summary of the field, structurally and content-wise. Thus for any businesses attempting a RI initiative, this study will provide information on what to read and who to approach without having to read large quantities of publications.

Societal Relevance

This study has done research in a topic that provides various positive societal outcomes. To start it has researched a innovation approach that aims at including currently excluded people at the bottom of the economic pyramid. Furthermore the innovation approach studied in this research leads to increased sustainable performance. For these reasons this study has societal relevance as society could benefit from reverse innovation practices. This study was aimed at increasing our current understanding on reverse innovation practices in order to aid the development of future reverse innovation initiatives.

Relevance to Management of Technology

The following three criteria were established by the TU Delft as criteria for a Management of Technology (MoT) MSc. Thesis, and the topic of this thesis is aligned with these criteria in the following manner:

1. The work reports on a scientific study in a technological context.
   This study has used the scientific methodology of bibliometric analysis and content analysis to study emerging market innovation practices in the technical domain.
2. The work shows an understanding of technology as a corporate resource or is done from a corporate perspective.
   This study has showed how proper innovation practices in emerging markets can be linked to sustained competitive advantage. Innovation lies at the heart of a companies resources. By establishing drivers, antecedents and consequences of revers innovation this topic has provided a firm integrated perspective towards RI.
3. Students use scientific methods and techniques to analyse a problem as put forward in the Management of Technology curriculum.
   The curriculum of Management of Technology has been applied liberally throughout this research. Courses utilised for knowledge and methodology in this thesis are the following:

Table 8.1: Management of Technology courses used for this thesis

Course	Related Concepts
MOT1435 Technology, Strategy & Entrepreneurship	Organisational approaches towards various types of innovations and innovation diffusion
MOT2312 Research Methods	Methodologies for conducting research
MOT2004 Preparation for the Master Thesis	Introduction to RI and identification of research problem
SPM9239 Responsible Innovation	Corporate social responsibility

Appendix A

Annotated Bibliography for bibliographic coupling

TABLE A.1: Annotated Bibliography of top coupled papers

[Back to cross referenced location: section 5.2: Bibliographic Coupling: identifying research streams]

Citation	Year	Title	Type	Aim/ main topic	Research Stream
Vijay Govindarajan, Kopalle, and Danneels, 2011	2011	"The effects of mainstream and emerging customer orientations on radical and disruptive innovations"	Journal Article	First article structuring the various theoretical underpinnings of RI	Conceptual development of RI
Sarkar, 2011	2011	"Moving forward by going in reverse: emerging trends in global innovation and knowledge strategies"	Journal Article	Describes the reason why RI is important and can occur in the global marketplace	Conceptual development of RI
Borini, Miranda Oliveira, et al., 2012	2012	"The reverse transfer of innovation of foreign subsidiaries of Brazilian multinationals"	Journal Article	This study aims to understand what factors enable emerging multinational subsidiaries to create technologies that the parent company uses. It focuses on what factors drive reverse innovation.	Conceptual development of RI
Li, Zhang, and Lyles, 2013b	2013	"Knowledge Spillovers, Search, and Creation in China's Emerging Market"	Journal Article	This article discusses that knowledge spillovers, search, and creation in an emerging market are a dynamic and reciprocal process with knowledge flowing between and among foreign and domestic firms	Conceptual development of RI
Sartor and Beamish, 2014	2014	"Offshoring innovation to emerging markets: Organizational control and informal institutional distance"	Journal Article	This article uses the definition of organisational control to examine how discrepancies in the informal structures that exist in the home and host countries affect the strategy (or organisational control decision) to set up for the offshoring of innovation of multinational enterprises (MNE) with respect to subsidiaries.	Conceptual development of RI
M. Zeschky, Widenmayer, and Gassmann, 2014	2014	"Organising for reverse innovation in Western MNCs: the role of frugal product innovation capabilities"	Journal Article	This article investigates how MNCs of the healthcare and electronics industries can organise their international R&D practices for RI.	Conceptual development of RI
Chittoor and Aulakh, 2015	2015	"Organizational Landscape in India: Historical Development, Multiplicity of Forms and Implications for Practice and Research"	Journal Article	Discusses the plurality of organisational forms that dominate the Indian economy, their evolution in the period after economic liberalisation in 1991, and their attempts to catch-up and participate in global markets	Conceptual development of RI
Subramaniam, Ernst, and Dubiel, 2015	2015	*From the special issue editors: Innovations for and from emerging markets*	Journal Article	Describes product and market characteristics and the value of innovating for and within Ems	Conceptual development of RI
Von Zedtwitz et al., 2015	2015	"A typology of reverse innovation"	Journal Article	This article adopts a linear innovation model with the four successive stages of concept ideation, product development, primary target market introduction and subsequent secondary market introduction to expand the definition of RI beyond its market-introduction context allowing for the reversals of the flow of innovation in other stages.	Conceptual development of RI
Herrerias, Cuadros, and Luo, 2016	2016	"Foreign versus indigenous innovation and energy intensity: Further research across Chinese regions"	Journal Article	The aim of this work is to analyse the role played by both foreign and indigenous innovation on energy intensity as well as the possible interactions between them across 30 Chinese regions	Conceptual development of RI
Mokter Hossain, Simula, and Halme, 2016	2016	"Can frugal go global? Diffusion patterns of frugal innovations"	Journal Article	Analyses the diffusion patterns of frugal innovation and identifies four main diffusion patterns of frugal innovations	Conceptual reviews of EM innovations and frugal innovation
R. Khan, 2016	2016	"How Frugal Innovation Promotes Social Sustainability"	Journal Article	Discusses how frugal innovation aids in social sustainability.	Conceptual reviews of EM innovations and frugal innovation
Agarwal, Grottke, et al., 2017	2017	"A systematic literature review of constraint-based innovations: State of the art and future perspectives"	Journal Article	Provides a systematic review of all constrained-based innovations in order to asses similarities, differences and presents future research topics to further disentangle the field.	Conceptual reviews of EM innovations and frugal innovation
Hossain, 2017	2017	"Mapping the frugal innovation phenomenon"	Journal Article	Uses content analysis and bibliometric analysis to map the frugal innovation phenomenon	Conceptual reviews of EM innovations and frugal innovation

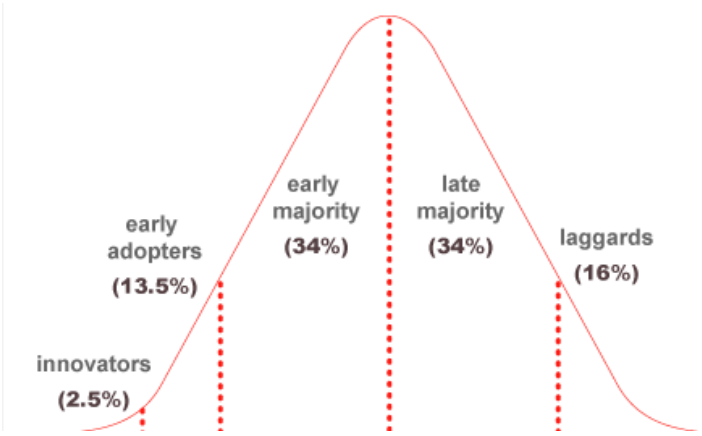
Mokter Hossain, 2018	2018	"Frugal innovation: A review and research agenda"	Journal Article	A systematic review of the frugal innovation literature in order to understand the main sources, theories, and overlapping concepts, as well as the input, success factors, impeding factors, and output of frugal innovations (FIs)	Conceptual reviews of EM innovations and frugal innovation
Pisoni, Michelini, and Martignoni, 2018	2018	*Frugal approach to innovation: State of the art and future perspectives*	Journal Article	Systematic literature review of 113 contributions published on frugal innovation to identify different typologies of innovations and evolution of the frugal innovation concept	Conceptual reviews of EM innovations and frugal innovation
Hang, J. Chen, and Subramian, 2010	2010	"Developing Disruptive Products for Emerging Economies: Lessons from Asian Cases"	Journal Article	This study analyses four innovative firms in Asia that became multinational companies on the back of disruptive products developed specifically to address the needs of consumers in emerging economies.	Conceptual and organisational reviews of RI and relations to other typologies (disruptive, open innovation
Talaga, 2010	2010	"The future of pharmaceutical R and D: Somewhere between open and reverse innovation?"	Journal Article	Discusses the role of RI and open innovation for the the development of better future pharmaceutical R&D practices.	Conceptual and organisational reviews of RI and relations to other typologies (disruptive, open innovation
M. B. Zeschky et al., 2014	2014	"From cost to frugal and reverse innovation: Mapping the field and implications for global competitiveness"	Journal Article	The paper analyses the various types of resource-constrained innovations—cost, good-enough, frugal and reverse innovation— and conceptualises the variations between them. It explores the implications for a strategy that offers a structure for managers to systematically examine their own approaches to resource-constrained innovation.	Conceptual and organisational reviews of RI and relations to other typologies (disruptive, open innovation
Corsi and Di Minin, 2014	2014	"Disruptive Innovation … in Reverse: Adding a Geographical Dimension to Disruptive Innovation Theory"	Journal Article	Describes RI as being a subset within the disruptive innovation theory	Conceptual and organisational reviews of RI and relations to other typologies (disruptive, open innovation
Winterhalter, M. B. Zeschky, and Gassmann, 2016	2016	"Managing dual business models in emerging markets: an ambidexterity perspective"	Journal Article	This study draws from ambidexterity literature and finds that through implementation of a low-cost business model and premium-business model in separation provide proper ambidextrous organisations for EM innovation.	Conceptual and organisational reviews of RI and relations to other typologies (disruptive, open innovation
Hadengue, Marcellis-Warin, Zedtwitz, et al., 2017	2017	"Avoiding the Pitfalls of Reverse Innovation: Lessons Learned from EssilorOne company's experiences suggest how the specific challenges of reverse innovation may be anticipated and overcome."	Journal Article	Comprehensive systematic literature review of RI analysing innovation types which can transfer into RIs and provides a conceptual framework for RI	Conceptual and organisational reviews of RI and relations to other typologies (disruptive, open innovation
Winterhalter, M. B. Zeschky, Neumann, et al., 2017	2017	"Business Models for Frugal Innovation in Emerging Markets: The Case of the Medical Device and Laboratory Equipment Industry"	Journal Article	Investigates various business models that foster frugal innovation within the health care domain	Conceptual and organisational reviews of RI and relations to other typologies (disruptive, open innovation
Dubé et al., 2014	2014	"Convergent innovation for sustainable economic growth and affordable universal health care: Innovating the way we innovate"	Journal Article	This paper introduces convergent innovation (CI) as a form of meta-innovation-an innovation in the way we innovate. It discusses how this can lead to enhance sustainable performance and better health care practices	Frugal Innovation and sustainable innovation development
Agnihotri, 2015a	2015	"Low-cost innovation in emerging markets"	Journal Article	Defines four types of low-cost innovations in emerging markets: jugaad, frugal, value and reverse. Their features, their similarities and their differences are described.	Frugal Innovation and sustainable innovation development
Judge, Hölttä-Otto, and Winter V, 2015	2015	"Developing world users as lead users: A case study in engineering reverse innovation"	Journal Article	Publications analyses RI innovation through a case study of a wheelchair	Frugal Innovation and sustainable innovation development
Inigo and Albareda, 2016	2016	"Understanding sustainable innovation as a complex adaptive system: a systemic approach to the firm"	Journal Article	Analyses sustainable innovation and identifies 5 components	Frugal Innovation and sustainable innovation development
Knorringa et al., 2016	2016	*Frugal Innovation and Development: Aides or Adversaries?*	Journal Article	Publication explores the sustainability dimension of frugal innovation and argues that an empirical approach is needed to asses where and when frugal innovation fosters inclusive development.	Frugal Innovation and sustainable innovation development
Prabhu, 2017	2017	"Frugal innovation: Doing more with less for more"	Journal Article	The paper introduces the notion of frugal innovation — creating quicker, safer, and cheaper solutions for more people using limited resources — and explores approaches and examples of such change already happening in core sectors such as manufacturing, food, automotive, and energy in emerging and developed economies	Frugal Innovation and sustainable innovation development
Rosca, Arnold, and Bendul, 2017	2017	"Business models for sustainable innovation - an empirical analysis of frugal products and services"	Journal Article	Analyses the relationship between frugal and RI and their sustainability performance and describes business models for sustainable development	Frugal Innovation and sustainable innovation development

Shamsuzzoha B Syed, Viva Dadwal, and G. Martin, 2013	2013	"Reverse innovation in global health systems: towards global innovation flow"	Journal Article	Proposed that for better global health care knowledge must be shared among developing and emerging countries.	RI for healthcare applications
Binagwaho et al., 2013	2013	"Shared learning in an interconnected world: Innovations to advance global health equity"	Journal Article	In this paper examples are presented of Rwanda's programmatic, technological and research-based innovations and offer reflections on how the global health community could leverage innovative partnerships for shared learning and improved health outcomes through RI across all countries	RI for healthcare applications
Johnson et al., 2013	2013	"Learning from the Brazilian Community Health Worker Model in North Wales"	Journal Article	Health officials in many countries are looking for ways to expand coverage of health services by increasing the recruitment of health workers in the Population. In this article the reason for the UK to benefit from the scaled-up primary care approach of Brazil's Community Health Work is explained, beginning with a pilot project through North Wales	RI for healthcare applications
Busse, Aboneh, and Tefera, 2014	2014	"Learning from developing countries in strengthening health systems: An evaluation of personal and professional impact among global health volunteers at Addis Ababa University's Tikur Anbessa specialized hospital (Ethiopia)"	Journal Article	This article analyses what kinds of effects global collaborations have on developing-country health volunteers, and how to advance this emerging body of knowledge. Furthermore, it aims to improve the knowledge of methods and indicators for assessing reverse innovation.	RI for healthcare applications
Crisp, 2014	2014	"Mutual learning and reverse innovation-where next?"	Journal Article	Describes how mutual learning in health care systems can aid global progression of RI.	RI for healthcare applications
Harris, Weisberger, et al., 2015	2015	"'They hear "Africa" and they think that there can't be any good services' - perceived context in cross-national learning: A qualitative study of the barriers to Reverse Innovation"	Journal Article	Describes that a barrier to RI is the perception that it lacks quality	RI for healthcare applications
Snowdon et al., 2015	2015	"Reverse innovation: an opportunity for strengthening health systems"	Journal Article	The goal of this study was to explore whether a challenge to reverse innovation based on competition could mobilise and encourage current and future leaders to identify and lead potential reverse innovation projects that address health system challenges in Canada	RI for healthcare applications
Matthew Harris, Emily Weisberger, et al., 2016	2016	"That's not how the learning works - the paradox of Reverse Innovation: a qualitative study"	Journal Article	Discusses the term RI for healtch care	RI for healthcare applications
Tran and Ravaud, 2016	2016	"Frugal innovation in medicine for low resource settings"	Journal Article	This article discusses the different types of frugal innovations and RIs, illustrated with examples from the literature, and argue for the need to give voice to this neglected type of innovation in medicine.	RI for healthcare applications
Rodriguez and Montalvo, 2007	2017	"Innovation Policies From the European Union: Methods for Classification"	Journal Article	This study focuses on taxonomic and topological methods of innovation policies in the European institutional context.	RI for healthcare applications
Matthew Harris, Macinko, et al., 2017	2017	"Measuring the bias against low-income country research: An Implicit Association Test"	Journal Article	This study analyses if the source of a product influences the perception of that product in evidence-based medicine and decision-making.	RI for healthcare applications
Matthew Harris, Marti, et al., 2017	2017	"Explicit bias toward high-income- country research: A randomized, blinded, crossover experiment of English clinicians"	Journal Article	Describes that unconscious biases of research from lower income countries impacts the acceptance of research, practices and knowledge in health care.	RI for healthcare applications

Appendix B

Background innovation theories

Diffusion of Innovation model (E. M. Rogers, 1962)



Note. Reprinted from www.provenmodels.com

FIGURE B.1: Diffusion of Innovation model

Through his work on how farmers implement agricultural technologies, Everett M. Rogers is generally regarded as the founder of the "Diffusion of Innovation" theory. His book, Diffusion of innovation in 1962, earned him academic fame and remains even now the second most cited book in the social sciences (E. M. Rogers, 1962).

Diffusion is described as the communication mechanism by which the market embraces a new concept or product. While the diffusion rate is described as the pace at which new idea spread from one customer to the next. Compared to diffusion, *adoption* describes an individual's psychological decision-making processes, rather than that of the collective market.

Rogers found that a pattern of diffusion in a social system fits an S-Curve in which the adoption of an innovation starts slowly, followed by rapid adoption and concludes in decreasing adoption as the innovation matures or new technologies develop. He also stated that users were implementing new technical innovations at various times and speeds. Rogers used these varying adoption rates to differentiate between various stages in the diffusion cycle. Rogers also used the degree to which an individual is relatively earlier in adopting new ideas than other members in a social system to distinguished five groups of adopters as ideal types:

Innovators

'Innovators' are the first 2.5% of adopters. Innovators are entrepreneurial and skilled, have numerous sources of knowledge, and show a greater risk-taking tendency. They are inspired by the possibility of becoming a change agent. They are willing to accept initial issues that may follow from new goods or services and are prepared to address these problems by proposing solutions.

Early adopters

The next 13.5% of users are 'early adopters'. They are influential, educated, social figures. They are the visionaries looking to embrace and use emerging technologies to achieve some competitive advantage. They are attracted by high-risk, high-reward and are not very price-sensitive.

Early majority

The 'early majority' comprises the next 34% of adopters. They are conscious and guided by evolutionary shifts, rather than searching for revolutionary changes to achieve productivity enhancements in their businesses. They have three principles when implementing new technology:

1. *'When it's time to move, let 's move it together.'* This principle determines why adoption in the diffusion cycle rises so rapidly.
2. *'If we select a company that will take us to the new paradigm, let's all select the same one.'* This principle describes the success of firms.
3. *'Once the process starts, the faster we get it done, the better.'* This principle shows why the stage of transition happens fast.

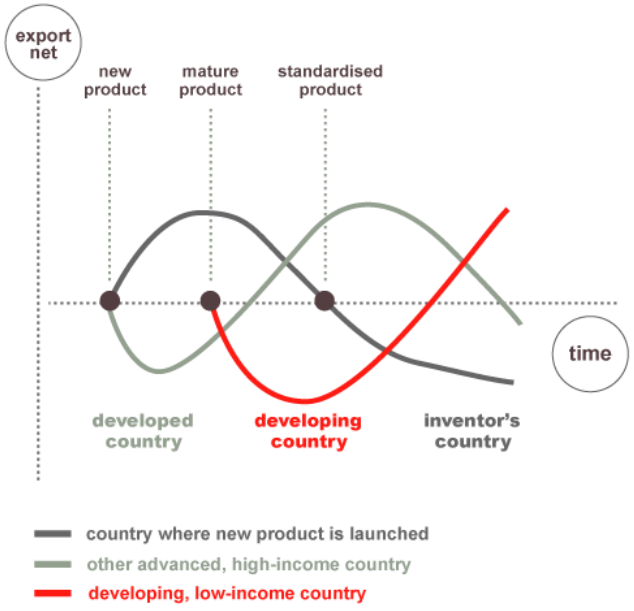
Late majority

The next 34% of adopters is the 'Late majority'. They are sceptical, conservative, and of lower socioeconomic status. They are very price-sensitive and adopt innovations that are known to be widespread. They are prompted to buy innovations only to remain with the market and often rely on a single, reliable expert to help them make sense of technology.

Laggards

The last 16% of users are defined as 'Laggards'. Laggards are technology sceptics who just want to uphold the status quo. They do not consider that technology can improve efficiency and are likely to withhold from purchasing new technologies.

International product life cycle (IPLC) (Vernon, 1966)



Note. Reprinted from www.provenmodels.com

FIGURE B.2: International product life cycle (IPLC) model

Raymond Vernon published a model in 1966 which determined organizational trends of internationalisation. He tried to look at how U.S. firms developed into MNCs during a time when those firms dominated global trade.

The international trade cycle of the IPLC is composed of three stages:

New product

The IPLC starts when a company in a DM decides to take advantage of a technologigy by introducing a new , innovative product it in its home market. Such a market is more likely to start in a DM as more high-income buyers can purchase and are willing to experiment with new, innovative goods. Besides, there is easier access to the capital markets to finance the development of new products. Development is often more likely to start locally to reduce risk and uncertainty.

At the end of this stage, exports to other industrial countries may occur which helps the firm to increase revenue and increase the descent of the product experience curve. Many DMs have customers with identical tastes and incomes that make exporting the easiest first step in an attempt to internationalise.

Maturing product

Exports to DM continue to grow over time making it economically feasible and even politically appropriate to start local production. The design and production process of the innovation becomes more and more stable. Foreign direct investment (FDI) in production plants leads to lower unit costs due to lower labor costs and lower transportation costs. Offshore production facilities are intended to serve local markets which replace exports from the home market of the organisation. Competition from local firms starts in these DMs.

Standardised product

The main markets become saturated during this period. The primary comparative advantage of the innovator has diminished. The organization is beginning to concentrate on cutting production costs rather than introducing new product functionality. As a result the innovation and its development are being increasingly standardized. This allows for greater economies of scale and increases the efficiency of the production operations. Capital will start to replace labor. Production facilities will relocate to countries with lower incomes to counter price competition and trade barriers, or simply to meet local demand. As in DMs, local rivals will be given first-hand access to information and can start copying and selling the similar innovations.

This model thus describes the cycle of innovations and how they rise and fall through time. It is to date one of the fundamental theories on innovation.

[Back to cross referenced location: Section 2.2: Conceptual development of Reverse Innovation]

Appendix C

Fundamental Innovation Types

In general, innovation can be either a new product, process, service or business model that applies new or existing technology in a new or existing market. Most innovations belong to numerous types and the categories often overlay.

Product, process or service

Presumably, the easiest way to classify innovations is by product/service classification. The principal difference between product and service innovations is that products are tangible while services are not.

€ Business Model

Another way to distinguish innovation is to analyse the business model it uses. Innovations can either use new business models or an existing business model in a new market.

Technology

Innovations can either use new or existing technology. Innovations are often categorised by their technological innovativeness, however innovations do not have to concern technology.

Market

Apart from technology, innovation can be classified depending on the market it targets and the impact it has. Innovation can either *sustain* a MNCs position in an existing market, *disrupt* an existing market, or *create a new market*.

The most popular method to characterise innovation is to analyse it on two dimensions: **novelty** and the **impact** it has. This implies that novelty is related to *products, services and processes* and impact is based on the *market* it effects (Kovacs et al., 2019).

Novelty is interpreted as indicating the advancement of an innovation compared to the state-of-the-art at the moment of creation. Impact points to market outcomes that develop over time. Therefore, novelty can be assessed as soon as an innovation is being developed, whereas the impact of an innovation can be determined after a substantial time period.

A fundamental typology of innovation is based on these two dimensions. Incremental and radical usually refer to the technology of an innovation and sustaining or disruptive to the impact it has on the market. This creates a matrix describing the four main types, visualised in fig. C.1. However, these types have no strict boundaries and often overlap. Although not common, a product can be incrementally disruptive where small incremental changes eventually lead to market disruption.

Incremental Innovation

Incremental innovation entails making small, gradual and continuous changes to add or sustain value to existing products, services and processes. This can be as simple as adding a new feature to an existing product or developing a line extension. As the matrix illustrates, incremental innovation relies on existing technology and an existing business model and as such has no large impact on the market. This makes these types of innovation low risk.

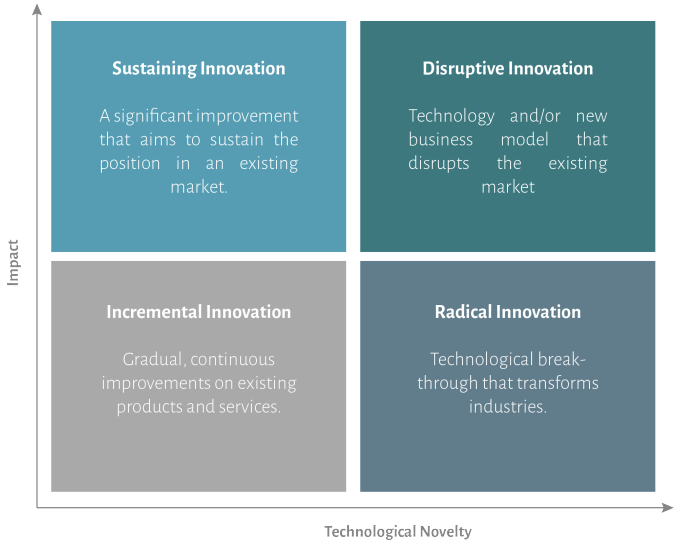


FIGURE C.1: Innovation typology matrix (Kylliäinen, 2019)

Incremental innovation can assist MNCs to remain competitive and have expected revenue streams. Incremental innovations usually attract higher paying customers as the key to success is knowing the primary customer needs and how innovations can be adapted to better meet these needs.

Examples of incremental innovations are widespread. Adding more and sharper/better blades to shaving products are a prime example.

Breakthrough Innovation

The following type of innovation — breakthrough innovation — is rarer compared to incremental innovation. Breakthrough innovation is challenging as it requires the introduction of **either** a new technology **or** a new business model. Although not present in the matrix, as it is more a middle way between two extremes, it is discussed often in literature.

Breakthrough innovation requires higher investments in terms of capital, time and resources and is therefore high-risk. Yet, the rewards can be greater too as the product or service often presents significantly better value to consumers than the existent market offering.

Radical Innovation

Radical innovation involves presenting a revolutionary technology **and** a new business model simultaneously (Leifer et al., 2000). Radical innovations derive from the creation of new knowledge and the commercialisation of entirely new ideas or products (Hopp et al., 2018). Radical innovation is not straightforward. Similar to breakthrough innovation, it needs an unconventional approach to R&D and requires significant business transformations and investments. However, when done successfully it can be transformational; altering the shape of an existing market, making competition obsolete, or creating a new market entirely. Radical innovation has strong similarities to disruptive innovation(Hopp et al., 2018). But radical innovations differ in that they use in principal a revolutionary technology. Ase these innovations are so "radically" different than what is known, they often encounter a lot of resistance.

Examples of radical innovation in history have been electricity, the internet and more recently blockchain technology and artificial intelligence (ARK Investment Management LLC, 2019)

Disruptive Innovation

One of the most consistent patterns in business has been the inability of leading companies to maintain their dominant position as technologies and markets change. According to Bower and Clayton M Christensen, 1995, the fundamental reason why companies can successfully retain current customers but are unable to produce products that customers of the future demand, lies in one of the most popular management convictions. They stay close to their customers.

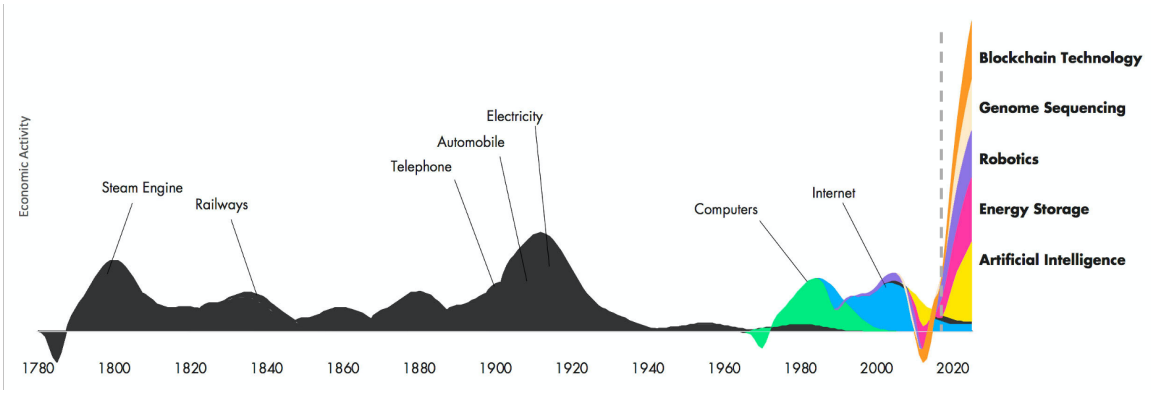


FIGURE C.2: Examples of radical innovations (ARK Investment Management LLC, 2019)

This approach of giving customers the product performance they seek has historically led to a pattern where these same companies are hurt by a technology their customers led them to disregard. Companies are often so deeply invested in meeting the need of established customers and fending off competitors that it is difficult and illogical to develop innovations that do not meet mainstream customers needs but only appeal to small or emerging market customers. According to Bower and Clayton M Christensen, 1995, the well organised and established firms have devised their business processes to eliminate the proposed products and technologies that do *not* address current customer demands. However, this leaves them vulnerable to disruptive innovations.

In business theory, a *disruptive innovation* (DI) is an innovation that generates a new market and value network and disrupts an existing market and value network, ultimately displacing established market-leading companies and products.

The technological characteristics of these disruptive innovations are often not radically new or complex, but they possess two main characteristics (Bower and Clayton M Christensen, 1995):

- They present a different package of performance attributes which are not valued by existing customers
- The performance attributes that are valued improve at such a rapid rate that the technology invades the established market.

Disruption can occur in two ways. First, entrants may target customer segments which are over-looked with an innovation deemed inferior by the incumbent firm but subsequently move up-market as their product through incremental/sustaining innovation improves (Hopp et al., 2018).

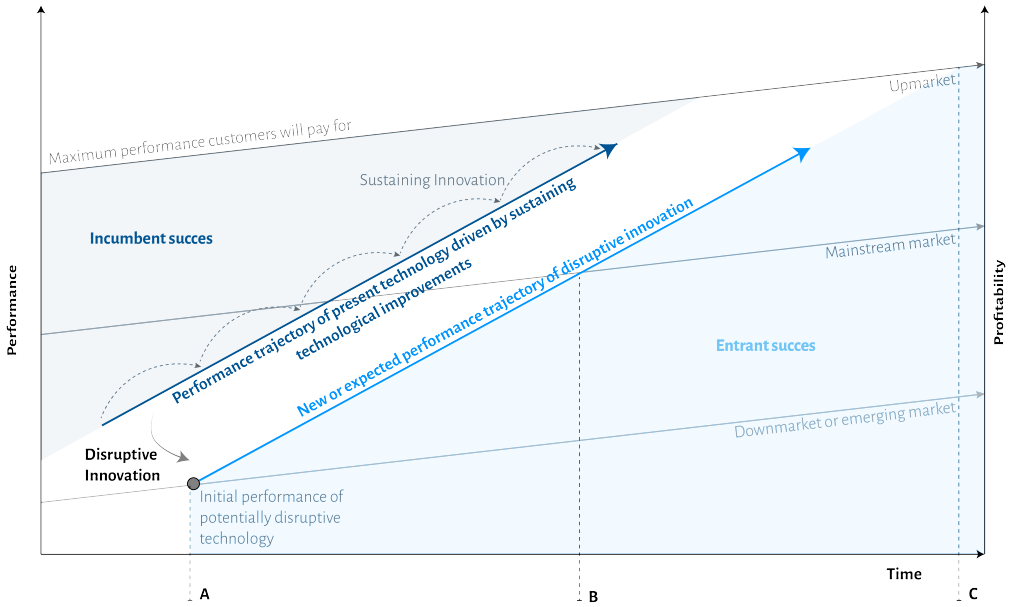
Second, entrants may create markets where no market is present by turning non-consumers into consumers. Disruption is thus not only about technology but it is created through a combination of novel technologies and a new business model (Hopp et al., 2018).

An example of disruptive innovation is the video streaming service Netflix. Video streaming caught the entertainment industry completely by surprise, quickly ascending from the low end of the market as a low-cost alternative watching movies to ultimately disrupting the entire entertainment industry, ending video rental companies and how movies are produced. Like numerous disrupters, Netflix through a combination of a new technology and business model initially captured a small, niche market of movie fanatics who didn't care for the newest film releases and did not mind waiting for their movies to be delivered. Netflix was initially fairly slow and didn't offer a compelling new product. But as it grew into a better service it gained more mainstream customers eventually disrupting the market and ending incumbents like video stores and cable networks.

A fundamental difference compared to radical innovation is thus the initial downmarket where the innovation is introduced before it grows into a disruptive innovation.

Sustaining Innovation

Sustaining innovation is somewhat similar to incremental innovation as it describes slight alterations to products which become better with every iteration. The improved version targets more demanding and high-end customers with better performance and characteristics. However, the difference is that it aims at sustaining the current **business model** in the existing premium market segments (Bower and Clayton M Christensen, 1995). It therefore improves and grows existing value networks through incremental changes in the product.



(a) Adapted from Bower and Clayton M Christensen, 1995

FIGURE C.3: Disruptive innovation model

The continuous iterations of the iPhone are examples of sustaining innovations. Aimed at sustaining the position of Apple in the market by consistently trying to add more value to the products aiming at more profitable premium segments.

[Back to cross referenced location: section 2.3: Reverse innovation related innovation types]

Appendix D

Bibliometric databases comparison

Table D.1: Advantages and disadvantages of using particular bibliometric databases

Software	Advantages	Disadvantages
ISI Web of Science	· Includes several databases · Support almost all databases · Almost everything is possible when coupled with other software	· Not user friendly · Requires extensive training to operate
Scopus	· Easy to use · Offers extensive citation analysis	· Only usable with Web of Science database · Visualisation feature is limited · Cannot process more than 500 records at a time
Dimensions	· Many visualisation options · Easy for co-citation, co-word, co-author network analysis	· Not suitable for only citation analysis · Clusters may be confusing
Google Scholar	· Eases the keyword/knowledge based clustering	· Clustering may fail if no burst is present in a cluster
Microsoft Academic	· Offers built in graphics and algorithms · Powerful for visualisation	· Data needs to be prepared accordingly

[Back to cross referenced location: section 3.2.2: Bibliographic Databases]

Appendix E

Bibliometric analysis software comparison

TABLE E.1: Advantages and disadvantages of using particular bibliometric analysis software

Software	Advantages	Disadvantages
Bibexcel	· Offers many features · Support almost all databases · Almost everything is possible when coupled with other software	· Not user friendly · Requires extensive training to operate
HistCite	· Easy to use · Offers extensive citation analysis	· Only usable with Web of Science database · Visualisation feature is limited · Cannot process more than 500 records at a time
VosViewer	· Many visualisation options · Easy for co-citation, co-word, co-author network analysis	· Not suitable for only citation analysis · Clusters may be confusing
CiteSpace	· Eases the keyword/knowledge based clustering	· Clustering may fail if no burst is present in a cluster
Gephi	· Offers built in graphics and algorithms · Powerful for visualisation	· Data needs to be prepared accordingly
CitNetExplorer	· Offers built in graphics and algorithms · Powerful for visualisation	· Data needs to be prepared accordingly
RStudio Bibliometrix	· Offers many features and visualisations · Supports almost all databases · Provides most analysis tools	· Requires programming knowledge · Requires training to operate

Note. Own analysis

Tools	Thematic network	Author network	Reference network	Other networks	Evolution	Performance	Burst detection	Spectrogram	Geospatial	Visualization
General bibliometric and performance analysis										
CRExplorer								X		Spectrogram
ScientoPyUI					X	X				Timeline graph, bar graph, evolution graph and word cloud
Publish or Perish						X				
Science mapping analysis tools										
Bibexcel	X	X	X	X		X			X	External software
BiblioShiny	X	X	X	X	X	X	X	X	X	Network, three-fields plot, wordcloud, tree map, historiograph, strategic diagram, evolution map and world map
BiblioMaps	X	X	X	X		X			X	Network
CiteSpace	X	X	X	X		X	X		X	Tree ring, geospatial map
CitNetExplorer			X							Network
SciMAT	X	X	X	X	X	X				Strategic diagram, cluster network, overlapping map, evolution map
Sci² Tool	X	X	X	X			X		X	Temporal, geospatial map, topical, network
VOSviewer	X	X	X	X		X				Network, overlay, density
Libraries										
Bibliometrix	X	X	X	X	X	X	X	X	X	Network, three-fields plot, wordcloud, tree map, historiograph, strategic diagram, evolution map and world map
BiblioTools	X	X	X	X		X			X	Network
Citan						X				Bars, box plots and pie chart
Metaknowledge	X	X	X	X			X	X		Timeline graph, spectrogram and network
scientoText		X				X				
ScientoPy					X	X				Timeline graph, bar graph, evolution graph and word cloud
Some tools were excluded since they do not incorporate any feature. Excluded: *Publish or Perish*										

FIGURE E.1: Results of the review of bibliometric analysis and visualisation tools

Note. Adapted from (Moral-Muñoz et al., 2020, p.15)

[Back to cross referenced location: section 3.5: Adopted Visualisation Software]

Appendix F

RStudio Code

```
> setwd("~/Desktop/Data")
> getwd()
[1] "/Users/bastijhof/Desktop/Data"
> s<-readFiles("scopus.bib")

From version 3.0.0, the function readFiles has been dropped.
Please use the function 'convert2df' to import and convert your export files
> S<-convert2df("scopus.bib", dbsource = "scopus",format = "bibtex")

Converting your scopus collection into a bibliographic dataframe

Done!


Generating affiliation field tag AU_UN from C1:  Done!

> W<-convert2df("savedrec.bib", dbsource = "isi", format = "bibtex")

Converting your isi collection into a bibliographic dataframe

Error in file(con, "r") : cannot open the connection
> W<-convert2df("savedrecs.bib", dbsource = "isi", format = "bibtex")

Converting your isi collection into a bibliographic dataframe

Done!


Generating affiliation field tag AU_UN from C1:  Done!

> Database<-mergeDbSources(S, W, remove.duplicated = TRUE)

duplicated documents have been removed
> dim(Database)
[1] 208  32
> library(openxlsx)
> write.xlsx(Database, file = "Database.xlsx")
>
> library(bibliometrix)
To cite bibliometrix in publications, please use:


http:\\www.bibliometrix.org


To start with the shiny web-interface, please digit:
biblioshiny()

> biblioshiny()
Loading required package: shiny

Listening on http://127.0.0.1:6734
Loading required package: rio
The following rio suggested packages are not installed: 'csvy', 'feather', 'fst', 'hexView', 'readODS', 'rmatio'
```

```
Use 'install_formats()' to install them
Loading required package: DT

Attaching package: 'DT'

The following objects are masked from 'package:shiny':

    dataTableOutput, renderDataTable

Loading required package: ggplot2
Loading required package: shinycssloaders
Loading required package: shinythemes
Loading required package: wordcloud2
Loading required package: colourpicker

Attaching package: 'colourpicker'

The following object is masked from 'package:shiny':

    runExample

Loading required package: treemap
Loading required package: ggmap
Google's Terms of Service: https://cloud.google.com/maps-platform/terms/.
Please cite ggmap if you use it! See citation("ggmap") for details.
Loading required package: maps
Loading required package: visNetwork
Loading required package: plotly

Attaching package: 'plotly'

The following object is masked from 'package:ggmap':

    wind

The following object is masked from 'package:ggplot2':

    last_plot

The following object is masked from 'package:rio':

    export

The following object is masked from 'package:stats':

    filter

The following object is masked from 'package:graphics':

    layout


Converting your scopus collection into a bibliographic dataframe

Done!


Generating affiliation field tag AU_UN from C1:  Done!

Warning: 'group_by_()' is deprecated as of dplyr 0.7.0.
Please use 'group_by()' instead.
See vignette('programming') for more help
This warning is displayed once every 8 hours.
Call 'lifecycle::last_warnings()' to see where this warning was generated.
'summarise()' ungrouping output (override with '.groups' argument)

Converting your dimensions collection into a bibliographic dataframe

Warning: Error in $<-.data.frame: replacement has 0 rows, data has 1818
  157: stop
  156: $<-.data.frame
```

```
 154: postprocessingDim
 153: dimensions2df
 152: convert2df
 148: eventReactiveHandler [/Library/Frameworks/R.framework/Versions/4.0/Resources/library/bibliometrix/biblioshiny/server.R#184]
 104: DATAloading
 103: exprFunc [/Library/Frameworks/R.framework/Versions/4.0/Resources/library/bibliometrix/biblioshiny/server.R#246]
 102: widgetFunc
 101: func
  88: origRenderFunc
  87: renderFunc
  83: origRenderFunc
  82: output$contents
   2: runApp
   1: biblioshiny
```

Converting your dimensions collection into a bibliographic dataframe

```
Warning: Error in $<-.data.frame: replacement has 0 rows, data has 1818
 157: stop
 156: $<-.data.frame
 154: postprocessingDim
 153: dimensions2df
 152: convert2df
 148: eventReactiveHandler [/Library/Frameworks/R.framework/Versions/4.0/Resources/library/bibliometrix/biblioshiny/server.R#184]
 104: DATAloading
 103: exprFunc [/Library/Frameworks/R.framework/Versions/4.0/Resources/library/bibliometrix/biblioshiny/server.R#246]
 102: widgetFunc
 101: func
  88: origRenderFunc
  87: renderFunc
  83: origRenderFunc
  82: output$contents
   2: runApp
   1: biblioshiny
```

Converting your dimensions collection into a bibliographic dataframe

Done!

Converting your dimensions collection into a bibliographic dataframe

Done!

Warning: Removed 10 rows containing missing values (position_stack).

Converting your scopus collection into a bibliographic dataframe

Done!

Generating affiliation field tag AU_UN from C1: Done!

Converting your dimensions collection into a bibliographic dataframe

```
Warning: Error in $<-.data.frame: replacement has 0 rows, data has 208
 157: stop
 156: $<-.data.frame
 154: postprocessingDim
 153: dimensions2df
 152: convert2df
 148: eventReactiveHandler [/Library/Frameworks/R.framework/Versions/4.0/Resources/library/bibliometrix/biblioshiny/server.R#184]
 104: DATAloading
 103: exprFunc [/Library/Frameworks/R.framework/Versions/4.0/Resources/library/bibliometrix/biblioshiny/server.R#246]
 102: widgetFunc
 101: func
  88: origRenderFunc
  87: renderFunc
  83: origRenderFunc
  82: output$contents
```

```
  2: runApp
  1: biblioshiny

Converting your scopus collection into a bibliographic dataframe

Done!


Generating affiliation field tag AU_UN from C1:  Done!
```

[Back to cross referenced location: section 4.1: Data Collection]

Appendix G

Thesaurus file

Label	Replaced by
developed country	Developed market
Developed countries	Developed market
Frugal innovations	frugal innovation
frugal	frugal innovation
World Health	health care
Health service	health care
care	health care
health	health care
Healthcare	health care
health systems	health care
health-care	health care
Global health	health care
Health care system	health care
Medicine	Health Care
Health	health care
Delivery of health care	health care delivery
Reverse innovations	reverse innovation
reverse-innovation	reverse innovation
J reverse innovation	reverse innovation
Organization	Organization and management
Disruptive innovations	Disruptive innovation
globalization	globalisation
multitnational-corporations	MNC
mnc	MNC
enterprises	MNC
multinationals	MNC
subsidiaries	MNC subsidiaries
mnc subsidiaries	MNC subsidiaries
foreign subsidiaries	MNC subsidiaries
base	bottom of the pyramid (BOP)
bottom	bottom of the pyramid (BOP)
bottom of the pyramid	bottom of the pyramid (BOP)
research-and-development	R&D
strategies	Strategy
of-the-art	state-of-the-art
Market	Emerging Markets
emerging economies	emerging markets
emerging market	emerging markets
emerging countries	emerging markets
Developing world	developing countries
Developing country	developing countries

Label	Replaced by
Management	organization and management
Journal	
Article	
Procedures	
Humans	
Note	
Research	
Economics	
Engineering research	
Learning	
Human	
Priority journal	
Use	
Place	
understanding	
Paper	
Area	
Implication	
Company firm	
Case	
case study	
Order	
Role	
Lesson	
Interest	
Topic	
Knowledge	
Delivery	
Originality Value	
Type	
Interview	
Scopuscom	
Example	
Study	
Analysis	
Model	
Literature	
Idea	
Data	
Insight	
Author	

Note. Blank spaces in the table indicate that these items were excluded and deemed as providing not any information concerning associations in the literature

[Back to cross referenced location: Section 4.1.2: Thesaurus Preparation]

Appendix H

Bibliometric data tables

Table H.1: Explanation of key parameters

Metrics	Description
Betweenness centrality	To what degree the node forms part of paths connecting an arbitrary pair of centrality nodes in the network (L. C. Freeman, 1977)
H-index	An index which quantifies the scientific research performance of a scholar. It seeks to provide a robust single-number metric of a researcher's impact, balancing consistency with quantity (Hirsch, 2005)
G-index	aims to enhance on the H-index by providing more weight to highly-cited articles (Egghe, 2006)
Full counting	Full counting assigns each unit of analysis (author,document,keyword etc.) one credit, e.g., five authors equals five credits (Waltman and Eck, 2015)
Fractional counting	Accredits a fraction of one credit to each author (Waltman and Eck, 2015)

Table H.2: Most relevant countries by corresponding author

Country	Articles	Percentage	Freq	SCP	MCP	MCP Ratio
USA	23	21.50%	0.20175	12	11	0.478
United Kingdom	18	16.82%	0.15789	16	2	0.111
Germany	9	8.41%	0.07895	8	1	0.111
Canada	8	7.48%	0.07018	6	2	0.25
Brazil	6	5.61%	0.05263	6	0	0
China	5	4.67%	0.04386	5	0	0
Finland	5	4.67%	0.04386	5	0	0
France	5	4.67%	0.04386	5	0	0
Australia	4	3.74%	0.03509	2	2	0.5
Switzerland	4	3.74%	0.03509	3	1	0.25
Belgium	3	2.80%	0.02632	3	0	0
Singapore	3	2.80%	0.02632	3	0	0
Argentina	2	1.87%	0.01754	1	1	0.5
India	2	1.87%	0.01754	2	0	0
Italy	2	1.87%	0.01754	2	0	0
Netherlands	2	1.87%	0.01754	2	0	0
Spain	2	1.87%	0.01754	1	1	0.5
Sweden	2	1.87%	0.01754	2	0	0
Colombia	1	0.93%	0.00877	0	1	1
Cyprus	1	0.93%	0.00877	1	0	0
Total	**107**					

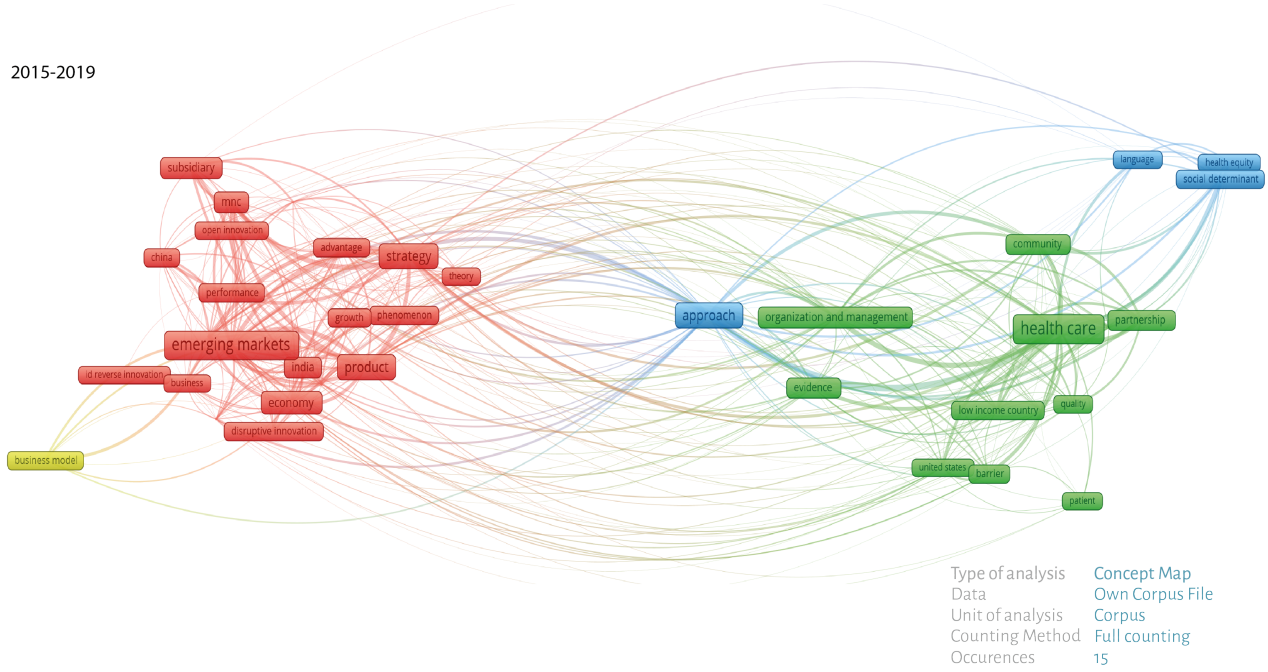
[Back to cross referenced location: chapter 5: Bibliometric Analysis Results: Current state of the scientific field]

Table H.3: Betweenness Values

Node	Betweenness centrality
Vijay Govindarajan, Kopalle, and Danneels, 2011	21.37795549
Immelt, Vijay Govindarajan, and Chris Trimble, 2009	16.02444414
M. B. Zeschky et al., 2014	15.06198925
M. Zeschky, Widenmayer, and Gassmann, 2011	13.60432644
Radjou, Prabhu, and Ahuja, 2012	10.94825795
Von Zedtwitz et al., 2015	7.608576219
M. Zeschky, Widenmayer, and Gassmann, 2014	7.291828253
Stuart L Hart and Clayton M Christensen, 2002	7.253580599
Hang, J. Chen, and Subramian, 2010	6.002185106

Appendix I

Bibliometric data figures



(a) *Concept map of RI literature from 2015 to 2019 with a keyword occurrence of 15 to be included in the map. Constructed with VOSviewer .*

FIGURE I.1: Concept Map 2015 - 2019

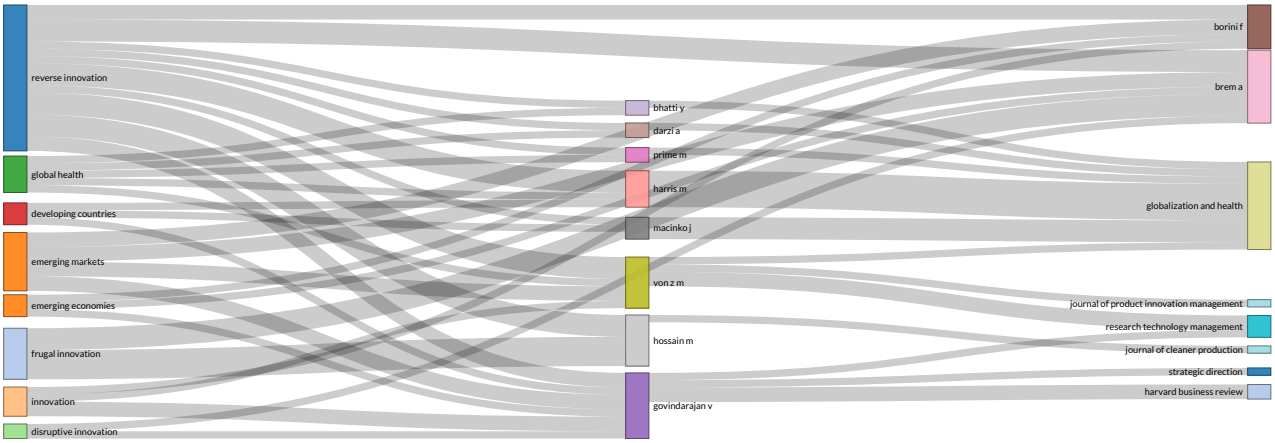
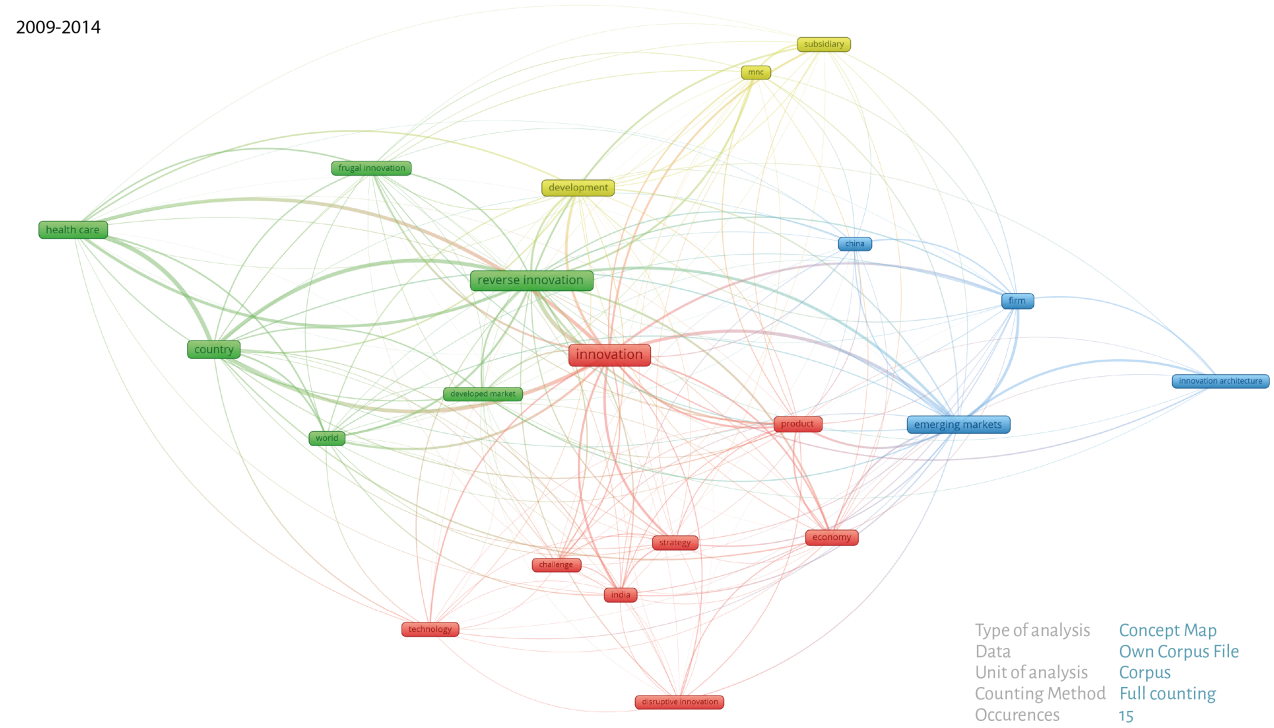
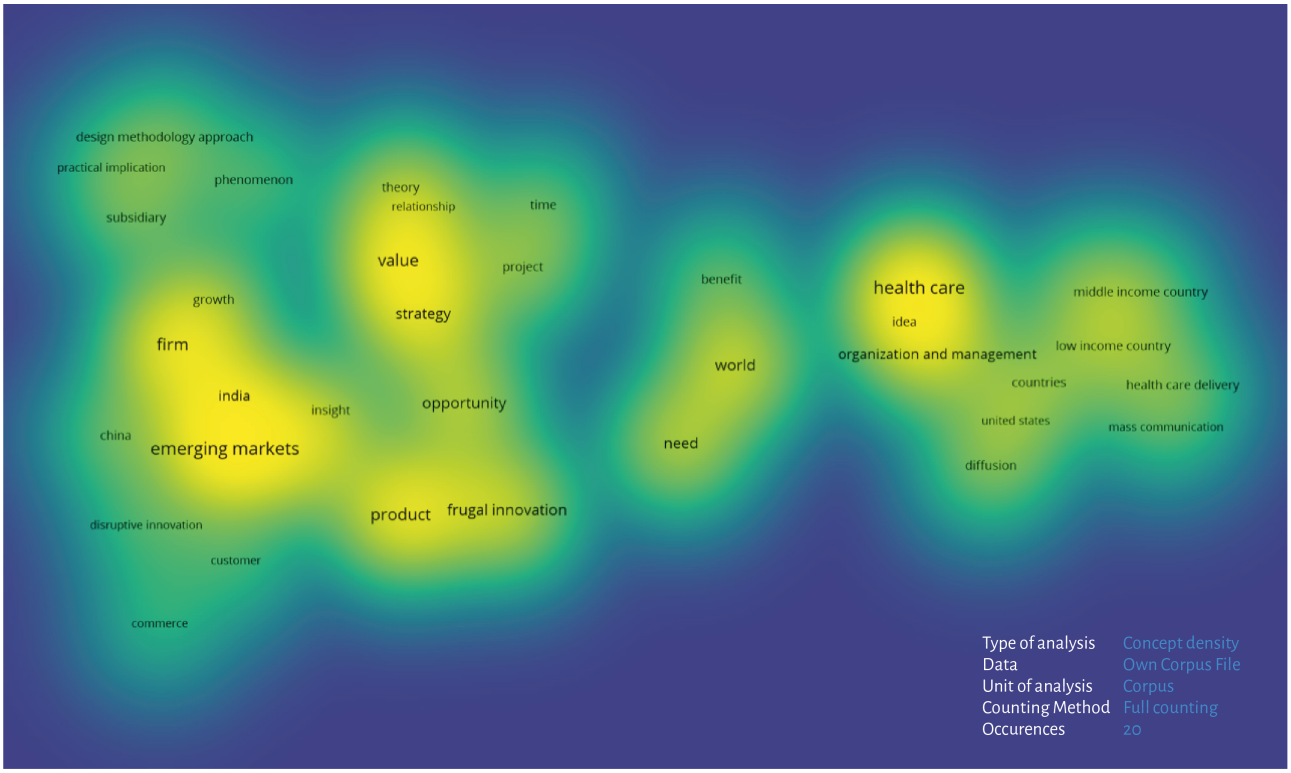


FIGURE I.2: Three Fields plot: relations among keywords (left), authors (middle) and sources (right) for RI literature



(a) *Concept map of RI literature from 2009 to 2014 with a keyword occurrence of 15 to be included in the map. Constructed with VOSviewer .*

FIGURE I.3: Concept Map 2009 - 2014



(a) *Concept map of complete RI literature with a keyword occurrence of 20 to be included in the map. Constructed with VOSviewer .*

FIGURE I.4: Concept Map

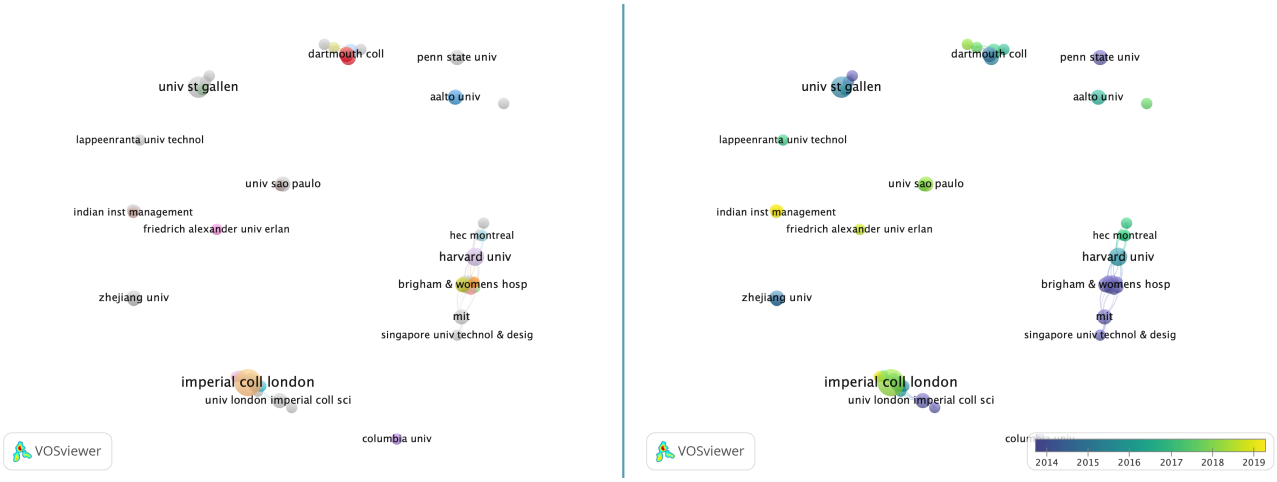


FIGURE I.5: Collaboration network Institutions

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