MBA Master's Thesis

The Emergence of Green Bonds as

Innovative Financial Instruments:

A Bibliometrics Analysis from 2008 to 2020
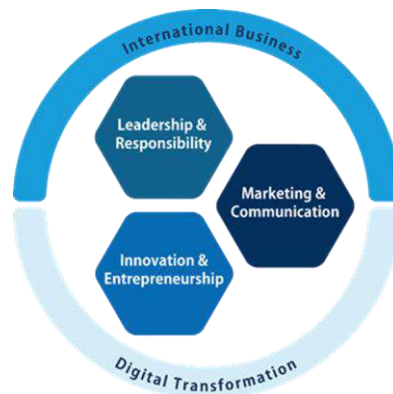
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Abstract

Introduced in 2008 Green Bonds have developed into becoming important innovative financial instruments that can help mitigate against climate change. This thesis illustrates a qualitative and quantitative exploration of peer-reviewed research on Green Bonds via a bibliometric analysis. This dual methodological approach was applied to a set of 98 articles published from 2008 until May of 2020. These articles were extracted from the Scopus-Elsevier database that offers compatible file formats that can be inserted into various software programs. The software utilized in this study was the statistical computing and graphics programming language R. Articles were first analysed through a qualitative filtration process that determined the most frequently cited controversial topics in Green Bond studies. This resulted in generating eight different metrics or variables that have been extensively debated upon by authors in Green Bond research and include: Credibility, Sustainable Development Goals, Psychology, Performance, Bond Sector, International Regulations, Company Focus and Digital Transformation. This research applied the bibliometric interface software-package Biblioshiny. It used 20 of its parameters to generate a robust analytical technique that aids in the understanding of trends and gaps around the sphere of Green Bonds through bibliometric algorithmic applications. A chronological division into three distinctive eras was done to demonstrate the development of the published articles on Green Bonds across time. Finally, a dynamic template designed to individually analyse each journal article was generated to help future scholars comprehend this new research discipline that has seen very little academic publishing in the last years.

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Abbreviation:	Name:
ABS	Asset-Backed Security
ACMF	ASEAN Capital Market Forum
ASEAN	Association of South East Asian Nations
BSB	Bayerische Staatsbibliothek
CBI	Climate Bond Initiative
CBS	Climate Bond Standards
CM(s)	Controversial Metric(s)
CSRC	China Securities Regulatory Commission
CV	Corporate Volunteering
DOI	Digital Object Identifier
DTL	Distributed Ledger Technology
DTSA	Dutch State Treasury Agency
EDF	Eletricite de France
EIB	European Investment Bank
ESG	Environmental Social Governance
EU	European Union
EU GBS	European Union Green Bond Standards
FinTech	Financial Technology
GB(s)	Green Bond(s)
GBDT	Green Bonds Dashboard Template
GBP	Green Bond Principles
GBR	Green Bond Rating
GBS	Green Bonds Standards
IBRD	International Bank for Reconstruction and Development
ICMA	International Capital Maret Association
IPCC	Intergovernmental Panel on Climate Change
MBS	Mortgage-Backed Security
MDB	Multilateral development banks
MOEJ	Ministry of Environment of Japan
NDRC	National Development and Reform Commission
NGO	Non-governmental organization
OECD	Organization of Economic Co-operation and Development
PBOC	The People's Bank of China
SBP	Social Bond Principles
SDG(s)	Sustainable Development Goal(s)
SEB	Skandinaviska Enskilda Banken
SF	Sustainable Finance
SRI	Sustainable and responsible investing
SSA	Supranational-Sub Sovereign and Agency
TEG	Technical Expert Group
UN	United Nations

1.0 Introduction:

"I used to think if there was reincarnation, I wanted to come back as the president or the pope or a .400 baseball hitter. But now I want to come back as the bond market. You can intimidate everybody" James Carville, lead strategist for President Clinton (Shoenmaker & Schramade, 2019, p. 253).

1.1 Title and Problem Statement:

The Green Bond market ignited with its first Green Bond (GB) being issued by the World Bank (International Bank for Reconstruction and Development (IBRD)) in 2008 with an approximate opening value of USD 440 million dollars (WorldBank, 2015, p. 24). Sustainable Finance (SF) entails the financial perception of how investing and lending interrelate on different aspects such as social background, economic implications and environmental concerns (Shoenmaker & Schramade, 2019, p. 4). Although, the world of SF has been around longer than that of Green Bonds (GBs), they have become innovative and novel instruments of finance that seem to be the hip and favourite security catch for many investors nowadays.

The title chosen for this thesis depicts a fairly new topic that has a substantial amount of published research at the time, nevertheless, material is still quite limited given its early stages of development. Although GBs have been around for more than a decade it wasn't until recently that they really took off. From this writer's knowledge this is the first bibliometrics analysis that emphasizes on the status quo of the GB field in an academic context. This analysis will be created and done through a combination of gathered published materials, a mix of methodological strategies and software programs. Most of GB research will be based on its development and evolution since its creation until the present date. These innovate GBs will be analysed and studied through a bibliometrics analysis. The bibliometrics analysis within this research is a statistical technique that not only examines but also evaluates academic literature where there might be gaps, grey zone areas and/or where certain trends might exist. (Dreesbach-Bundy & Scheck, 2017, p. 1)

As previously mentioned, the first GB was issued by the World Bank in 2008. The logic behind this new financial mechanism was backed up by an increasing demand from Scandinavian pension funds that were looking for fixed earnings which involved sustainable and green projects that would mitigate against climate change.

Furthermore it would capture the significant desirability that was seeing a surge in investor preference for sustainable and responsible investing (SRI) (WorldBank, 2015, p. 24). The World Bank also saw this as a strategical opportunity to present this innovative tool and familiarize established and incoming investors. Substantial effort was also put into raising awareness of how non-developed countries could also participate in fighting climate change.

This study has been broken down into three eras which will be more thoroughly explained later in this study and will aid readers understand how GBs have progressed. The following is a short summary of the three eras created by the writer: The first era goes between the years of 2008 to 2012. This first era saw multilateral development banks (MDBs) as the sole source for issuing GBs. The second era starts in 2013 and is characterized by the entrance of other issuers such as municipalities, corporations, export/import credit agencies, municipal organisations and country-development banks and how these entities pioneered the issuance of GBs in the financial market (Christa Clapp, May 2016, p. 5). After this period the third and last era entitled "The Green Leap Forward" starts in 2016 and prolongs until May of 2020. This last era is characterized by a historical move in the world of GBs by an aggressive economic giant, the People's Republic of China.

The identified problem of this study is the lack of information and knowledge regarding GBs by the general public. The field of GBs has been a very controversial topic. The focal points of this study will concern the status quo of the GB market. This paper will delve into the grey or problematic areas that this innovative green financial instrument has had to face throughout the past years. A theory and background will be included as an introduction regarding published research on GBs that will build up of how the problem can be addressed. This will be done so through a bibliometric analysis where the author will experiment and see if there are any trends or gaps that can be more clearly identified through this empirical analysis. Software programs will aid in the analysis and visualization of this entire process and results.

1.2 Research Aims and Objectives:

The focal objective of this paper is to analyse the status quo of GB material published from 2008 until May of 2020. The aim is to try to find a statistical correlation or gaps that might exist between peered reviewed scientific journal articles. Distinctive

relevant variables, analytical software and most of all a bibliometric approach will be combined in order to reach this objective. There will be an application of a collection of bibliometric parameters which will provide the reader with the ability to recognize and categorize GB published research compositions, tendencies and volume expansions (Dreesbach-Bundy & Scheck, 2017, p. 1). The variables and tools utilized to reach this study's objective will be portrayed and deeply clarified.

1.3 Thesis Structure:

The thesis structure will be organized into four parts. The first part will include chapter two that consists of a literature review on the development of GBs. It will delve into the theory and background of the GB anatomy and the GB market. The purpose of this section is to provide the reader with the essential and leading knowledge in the field of GBs. As well as how the GB market has brought in controversial topics such as Greenwashing. Additionally, this part will unfold the ever-growing entrance of new entities and how the GB market has developed across time.

The second part consisting of chapters 3.0, 4.0 and 5.0 will encompass the main body of this study which will emphasize on the methodology that has been conceived by the author. A set of 98 peered-reviewed articles from the Scopus-Elsevier database will be included as the intervention group.

The third part, chapter 6.0 will exhibit the data analysis and results from the entire study. It will also introduce an analytical dashboard template that will be the results of methods applied during the analysis of the selected articles in this bibliometric study.

Finally, part number four chapters 7.0 and 8.0 will first develop on a deep discussion of the outcomes. This part will also delineate the limited areas of this research and the possibilities for future research in the field of Green Bonds. A short concise conclusion will mark the end of this paper.

2.0 Literature Review:

2.1 Background and Theory

The following section will provide the reader with the foundations of GBs as innovative financial instruments and an overview of how the GB market started. There will be a short literature analysis on the multiple definitions of GBs and how they differ to other debt mechanisms. The anatomy of the GB and participants involved will be briefly explained.

2.1.1 Sustainable Financial Instruments

There have been significant alterations in world climate which have and are posing some of the most paramount challenges towards the existence and longevity of the human race (UNEP, 2015). Concurrently, there has been a response to counter these threats by organizations and communities around the globe by instilling measures that mitigate against climate change and can thus reach intended climate friendly goals. There are two central movements of change or goal-oriented targets to neutralize the negative effects of global warming and other environmental challenges.

The first is the United Nations (UN) sustainable development goals (SDGs). These SDG's are 17 broad sustainable goals established with 169 targets with the purpose to increase the prosperity of both people and our planet (UNEP, 2015, pp. 1-2). The second initiative established was The Paris Agreement/*L'accord de Paris*. This agreement has targeted a distinct set of aspirational goals so that communities across the planet would work together in order to decrease the threat of climate change by the reduction of green gas emissions and fight against the depletion of natural resources and biodiversity (UNFCCC, 2015, p. 2). Both these initiatives will need sustainable innovative technology and require a change in our habitual standards of living. The transition to a greener and more sustainable society will require trillions of dollars of investment in all areas surrounding these two initiatives. Projects such as green building construction to clean energy production will be needed to fight climate change amongst many of the challenges posed by global warming and the depletion of natural resources.

According to the Organization of Economic Co-operation and Development (OECD) there is a lack of USD 6.9 trillion per year. This amount would be needed year after year until the year 2030 in order cover financial projects such as sustainable

infrastructure, renewable low-carbon emitting energy sources and many more green development ventures that will mitigate against climate change (OECD, 2017a, p. 13). The European Commission has also forecasted needed funds for similar purposes. Such as low carbon emission products, green transport and sustainable water management projects in order to achieve targets that have been established by the European Union (EU) (2017a, p. 13). The magnitude of needed funds in Europe has been estimated to be at over EUR 180 billion euros a year.

As for needed SDG funds, there would be an even greater requirement of sources of capital. Huge sums would need to be injected into this new and greener economic structure to try to meet all 17 SDG goals that were set (HLEG, 2018, p. 2).

Public funds have not been able to reach financial investment quantities that are needed to reach proposed targets. There is a great need for private financial inflows of funds to help meet these goals. An example of transforming economic tools in Europe means that: "A deep re-engineering of the financial system is necessary for investments to become more sustainable and for the system to promote truly sustainable development from an economic, social and environmental perspective. This implies finding ways to integrate sustainability into the EU's regulatory and financial policy framework and to mobilise and orient more private capital flows towards sustainable investment" (TEG(ed.), 2019, p. 11). This gap is not only seen in developed economies such as the EU and North America, but it has also been felt in emerging economies or developing nations. New forms of financial mechanisms such as green bonds must be created in order for developing countries to also be part in developing a greener and cleaner economy (Banga, 2019, p. 17) . One way of promoting the private sector into financing sustainable investments is through GBs as they are predicted to be of essential use in order to fund projects that will help accomplish the goals set by both the Paris Agreement and the UN's SDGs (Cochu et al., 2016, p. 7).

2.1.2 Historical Background

The initial process to issue a green bond began back in July 2007. The concept of a GB was first forged by The European Investment Bank (EIB). The EIB established a vision of allocating funds in order to issue bonds worth 600 million euros which were at the time named Climate Awareness Bonds, financial instruments which would focus on environmentally sustainable initiatives such as renewable and efficient clean energy

projects (Deschryver & de Mariz, 2020, p. 3). Afterwards the World Bank finally released the very first GB in 2008. After its launch, the GB market made very little economic progress in its preliminary years but then gained momentum sparked by wider interest from investors. Until 2012 multilateral development banks were the only genuine issuers of GBs (Rosembuj & Bottio, 2016, p. 1).

Corporate Green Bonds came into play in November 2013. The first totalling SEK 1.3 billion were issued by Vasakronan, the largest real estate business in Sweden through an alliance with Scandinavian Individual Bank known as SEB (Skandinaviska Enskilda Banken) (Deschryver & de Mariz, 2020, p. 3). Then came the Commonwealth of Massachusetts, who gave birth to the very first Municipal Green Bond during June 2013. The Green Municipal Bond was issued for a whopping USD 100 million, amassing this sum was of no problem since the state quickly received financial offers from 183 investors totalling over USD 130 million (Cherney, 2013, p. 1). This municipal bond was so successful that it led the New York City Comptroller to propose a plan to issue the very first environmentally friendly financed green bond by an American city worth USD 30 billion set to be released by the year 2018 (Zanki, 2014).

In 2014 another crucial evolutionary step marked an important new change in the GB market. This was when the Green Bonds Principles were introduced by the International Capital Market Association (ICMA). These can be seen as the initial guidelines of current GB labels that exist today (ICMA, 2014, pp. 1-2). Around the same time the Climate Bonds Standards (CBS) released by the Climate Bond Initiative (CBI) were also another major advancement that added material to the framework of the GB market guidelines. More on these types of frameworks and standards will be furthered explained during section Governing Framework and Structure of GBs later in this study.

In 2016, Poland become the first nation to issue a country GB or what is known as a state sovereign GB or supranational GB (Park, 2019, p. 601). Corporate GBs have also become a popular mechanism for collecting funds. The giant Apple published its first GB as a counter reply to the Paris Agreement summit of 2015. The economic value of the Apple GBs were estimated at an outstanding USD 1.5 billion which made it the biggest corporate GB ever issued by an American firm (Volcovici, 2017). The German chemical giant BASF SE also released a massive GB in 2020. The sustainable bond

had a value of EUR 1 billion with a yearly coupon rate of 0.25% on a seven-year period (BASF, 2020). The GB market has seen quite an increase in size during the last decade. Figures published by the CBI have demonstrated that global issuance of GB surpassed USD 167 billion in 2018. During this same year China issued more than USD 30 billion in GBs making up around 18.5% of total global issuance, which ranked them second at the top of the table after the United States (Zhou & Cui, 2019, p. 2).

In the introduction the author mentioned a three-era scenario for the 12-year life span of the GB market from 2008 until the present year which can be seen on the next page in Figure 1. It illustrates some of the main highlights of each era in a timeline. During section 3.0 of this paper more on these eras will be discussed, as they will play important roles as variables for the data analysis section of this study.

Figure 1: Green Bond Timeline (Authors creation through AdobeSpark)
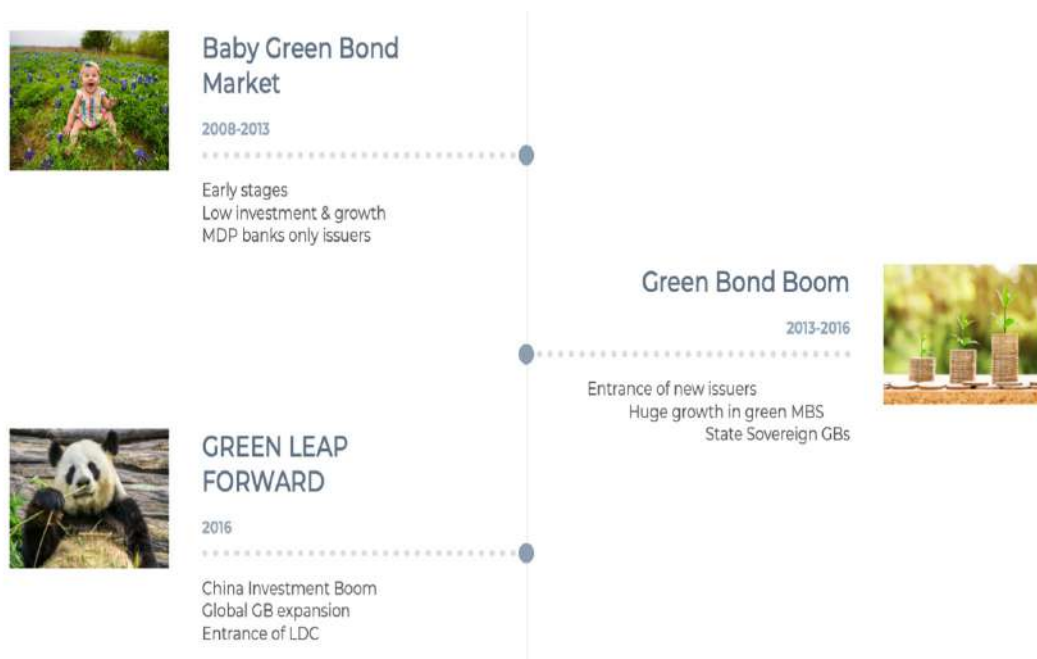
2.1.3 Definitions

Throughout the literature investigation of this study there were several definitions found for what constitutes a GB. Some papers stated very popular definitions which came from highly-numerically cited academic sources, as for others gave definitions in relation to their specific discipline of study. Supplementary, there were many studies that also stated official definitions from either The Green Bond Principles (GBP) or the CBS. Some authors described a GB in their own way, mainly to describe a special function regarding their proceeds and/or their main purpose of combating climate

change. A GB can be said to be collateral debt who's marginal gains are invested into climatic or environmentally friendly ventures (Hachenberg & Schiereck, 2018, p. 372). The term GB can be said to imply that proceeds gained will be invested into eco-friendly projects (Mercer, 2015, p. 52) within different green fields such as water management, clean energy, bioenergy, sustainable agriculture, renewables and green-transport (Campiglio, 2016, p. 221).

One important feature that readers must acknowledge throughout this study is the overlap that exists among many terms that define the various types of green financial instruments. For example, Green, Social or Sustainable Bonds may have very few differences between them. Nevertheless, this may cause an overlap effect with one type of bond covering target funding of other(s) types of bonds that their specified label would usually delimit them to. This may cause a certain extent of confusion of what the exact coverage extent of a specified type of bond may be. One thing that they do all share is that these development bonds are generated by debt and have commonalities in the ways in which proceeds are to be solely re-invested into adequate environmental and social endeavours or a mix of these two (ICMA, 2020b, p. 6). The ICMA latest March 2020 Guidance Handbook also states that the three definitions of Green, Sustainable and Social bonds are all defined or work as mechanisms that are delimited to identical capital markets and financial guidelines that other listed economic securities also follow.

The GBP introduced by ICMA define a GB as "any type of bond instrument where the proceeds will be exclusively applied to finance or re-finance, in part or in full, new and/or existing eligible Green Projects and which are aligned with the four core components of the GBP" (ICMA, 2018a, pp. 1-2). More on the four components will be discussed during the section of Governing Framework and Structure of GBs later in this paper.

Much of published literature sometimes denotes a GB as environmental or climate bonds. There is much confusion within these precise definitions but ultimately what it is important to understand is that climate bonds are included within the sphere of GBs, and not their equal (Laskowska, 2018a, p. 54). As for the CBS, Version 3.0 defines a GB, Green Loan or Green Debt Instrument as "a bond, loan or other debt instrument where the proceeds will be exclusively applied to finance or re-finance, in part or in

full, new and/or existing eligible green projects, and which is aligned with the four core components of the GBP or the Green Loan Principles. A Green Bond, Green Loan or Green Debt Instrument should not be considered fungible or interchangeable with bonds, loans or other debt instruments which are not aligned with those four core components" (CBI, 2019, p. 8). As can be seen both these last definitions are almost identical, this is due to the fact the last version and all previous versions of the CBS have taken into consideration to a great extent the standards and definitions set by the previously established and more illustrious GBP.

Other literature was found with a main narrative focus on the key differences of a GB against a regular bond or what is also known as a vanilla bond. It is important to note that there are significant differences among these two types of bonds.

2.1.4 Green Bond Vs Vanilla Bonds

A regular or conventional bond is a long-term agreement were the party acting as a debtor approves and schedules future payments which correspond to the actual principal of the debt plus any interest generated, all within a certain period lapse, to any given bondholder (Besley & Brigham, 2013, p. 29). A very popular documented understanding is that regular or conventional bond has three variables that greatly influence the bond price or its value; first, the essential features of the bond, second, the risk free rate, and finally, the probability that the bond will fail in which case that entity or business will not be able to repay the obliged debts it owes (Merton, 1974, p. 449).

Although very limited research has been published and mainly only done so by investment banks or similar entities of the like. They have demonstrated several differences between a GB and a regular bond starting with pricing performance (Hachenberg & Schiereck, 2018). Some regular bonds have been utilized to compare them against analogous GBs in order to see if regular bonds trade at a reduced or intensified fee, this can be seen through examples that have found certain trading strategy differences among many studies (Ridley, Chan, & Edwards, 2016). Index dissimilarities have also been studied to compare green and vanilla bonds (Preclaw & Bakshi, 2015, p. 5), but there is a lack of proper statistical data analysis amongst the entire pool of GBs. As well there seems to be an evaluation effect that most studies seem to have their own format or method, making it even harder to compare and appreciate gaps, similarities or obtain profound and meaningful comparisons (Bloomberg, 2017; Karpf & Mandel,

2017; Zerbib, 2017). Piva et al. have assessed data showing that both in mean-variance spanning examinations and in mean-variance frontier investigations there is data indicating that GBs have tested negative towards an investor's diversification of future prospect gains (2017, pp. 6-7). Various analyses have been made and concluded that GBs have a very small chance of actually giving any diversification benefits that aren't exploited by their regular counterparts, conventional bonds. The outcome is that there is no clear connection of an increase in demand for GBs from all types of investors caused by investing in GBs as a source of portfolio diversification (Piva et al., 2017, pp. 6-7). Therefor there must be other variables that have caused this increase effect in the demand of GBs in the financial market. There are cases were big investors such as pension funds and insurances businesses have been influenced by environmental social governance (ESG) strategies and have thus seen an increase in demand for GBs, predominantly because of reputational benefits (Piva et al., 2017, pp. 6-7). Piva et al. were able to do a matching analysis by coupling 112 GBs to comparable Vanilla Bonds. In their study there was an examination of the scale and importance of differences in yields that concluded that there was only a small difference of 6 basis points in most cases in favour of GBs. One anomaly that was highly noted was that that the differences vastly depended on the actual market segment that was being studied. This on top of other variables such as how many bonds were issued, their specific credit rating and further eclectic bond characteristics (Piva et al., 2017, pp. 46-47).

From an issuer's point of view, GBs can diversify your basket of ownership, increase one's portfolio size, significantly reduce your cost of capital and increase the duration of proprietorship, in comparison to regular bonds (Tang & Zhang, 2018, p. 4). There are certain tendencies that imply that GB's have certain vulnerabilities. These weaknesses consist of how much information is actually released and how clear that information is bestowed. Likewise, there are immediate costs because of the necessity for extra personnel and extra certification attached to generating a GB and finally the volatility danger of hindering one's reputational risk can also be rendered as disadvantages of GBs (Tang & Zhang, 2018, p. 4).

There are other arguments that can set apart green and regular bonds, a key one is how fast GBs can grow their investor base at a much faster pace. This is because GB issuance draws in a broader range of media exposure and is highly sought after by impact investors in order to keep up with their green investment obligations (Tang & Zhang,

2018, p. 18). Tang & Zhang's concluding analysis points out to the fact that amidst their findings current GB shareholders clearly obtain positive value from GB issuance (2018, p. 18). Wisniewski and Zielinski have associated that the greatest benefit of a GB compared to a regular bond is the marketing perspective benefits that are reaped by investors because the effects of GBs show decisive progress towards socially responsible projects. More benefits from the part of issuers and underwriters can also be reflected in how there is an image amelioration outcome in their ESG policies (Wiśniewski & Zieliński, 2019, p. 89). Another common term for regular bonds is also brown bonds. There has been limited research suggesting that GBs have not only possessed higher yields but that they are also coupled with better liquidity and tend to be more stable by having less volatility when comparing them to brown bonds (Partridge & Medda, 2020, p. 4). Partridge & Medda found that within their analysis of Green Municipal Bonds, GBs have been demonstrated to be very competitive pricewise compared to their brown counterparts in the primary market. Nevertheless they have also enjoyed a higher price increase after their issuance in the secondary market (Partridge & Medda, 2020, pp. 18-19). More research and data are required to really do a deep analysis of the differences of GBs vs regular bonds. This is a tricky analysis since the market of GBs is quite new and underdeveloped which makes many studies partially inconclusive.

2.1.5 Types of Green Bonds

The GBP state that there are four types of GBs but also affirms that future GB types might arise, and will be consequently included in future reports issued within the GBP (2018a, p. 6). The following are types of GBs with a short explanation:

Standard Green Use of Proceeds Bond

This type of bond is a regular recourse to issuers' commitment requirements and goes in line with the GBP (ICMA, 2018a, p. 6).

Green Revenue Bond

This a non-recourse to issuer commitment requirement follows and is also affiliated with the GBP. To which the bond's credit disclosure is to be secured by an injection of cash flows from revenue earnt. Revenue is amassed mostly through diverse fees and

taxes. The utilization of earnings being generated might or might not be linked to green projects (ICMA, 2018a, p. 6).

Green Project Bond

Like the previous two bonds, a Green Project Bond is also aligned with the GBP. It can be used for a solitary project or an assortment of projects. In this case the investor is directly affected by the risk entitled to any type of project that possesses or does not possess possible recourse to the issuing entity (ICMA, 2018a, p. 6).

Green Securitised Bond

This type of bond is indemnified by a single or multiple green project(s). These types of bonds include ABS (Asset-Backed Security), MBS (Mortgage-Backed Security), and Covered Bonds and are amongst the most common forms of bonds which are in line with the GBP, although other types could also be classified as a Green Securitised Bond. Finally, the main supply of cash flows is usually generated by the assets in play (ICMA, 2018a, p. 6).

Apart from the GBP other authors have built their own schemes for classifying GBs. The following descriptions of other types of GBs have been a combination of academic work done by Laskowska, Caldecott and the OECD in which there are different types of GBs that are based on their research assessments of GBs (Caldecott, 2010, p. 55; Laskowska, 2018a; OECD, 2017b):

Corporate Bond

This type of GB is very common type of bond which is utilized as a debt mechanism by corporations (Laskowska, 2018a, p. 55). One of the first Green Corporate Bonds was issued by Unilever with a value of £250 million with the purpose of substantially cutting the use of water, disposable waste and greenhouse gases emitted by their factory operations all by 50% (Daneshkhu & Bolger, 2014).

Sovereign Bond

This type of bond is issued by the government of any nation state. Previously mentioned; Poland became the first to issue such a type of bond (Laskowska, 2018a, p. 55).

Supranational, Sub-Sovereign and Agency (SSA) Bond

These are very common GBs which are issued by financial entities such as the World Bank or the European Investment Bank (Laskowska, 2018a, p. 55).

Financial Sector Bond

This is a very similar bond compared to a corporate bond but in this case the bond is issued by a financial entity with the only absolute purpose of procuring funds intended for green endeavours (Laskowska, 2018a, p. 55).

The GB market is quite immature and lacks a lot of clear data to make firm assumptions or even forecast of upcoming changes within and around its structure. This is mostly due to the fact that the first issuance of a GB wasn't that long ago. There have been different labels or names given to a wide variety of GBs as this previous section has demonstrated. One must be clear that new types of GBs may emerge, change or go through an evolution phase, which is why it is important to keep an open mind with new and incoming GB types in the near future. Now this study will go into some of the key entities involved in the GB world.

2.1.6 Green Bond Participants

This section will briefly sum up some of the main entities involved in the green bond market. These concise descriptions of issuers, investors, underwriters, external reviewers, index providers and other market intermediaries include most stakeholders involved but it is not limited to new incomers or other labelling names of published or upcoming material regarding participants in the GB world.

Issuers

An issuer of a GB can be best described as a body who has the power to label a GB whose proceeds are invested into projects that fight global climate change or aid the environment (Cochu et al., 2016, p. 25; Flammer, 2018, p. 1). According to the GBP's ICMA Handbook, any entity wanting to issue a GB is liable towards any applicable law or standard. Any individual issuer in the debt capital market is allowed to issue a Green, Social or Sustainable Bond, as long as they follow the rules and standards set up by the GBP or the Social Bond Principles (SBP) (ICMA, 2020b, p. 6). This handbook also links a wide list of guidelines which can be further scrutinised online called the Principles Resource Centre which posts an extensive catalogue of all issuers that

have already publicly broadcasted their evaluation reports produced by an external party. It also means that they have filled out a market information template which gives bond issuers permission to publicly acknowledge their intent to strictly follow the guidelines of the GBP (ICMA, 2020b, p. 6).

According to the CBS, in order for issuers to receive the CBS certification mark they must first acknowledge and be in line with the GBP. By doing so, an issuer wanting to certify a GB can do so in their own accord. This gives issuers the opportunity to prove to the public that their bond complies with the established scientific standards for climate consciousness and sound procedural measures thru administration transparency and by demonstrating where investment proceeds are directed or redirected (CBI, 2019, p. 4).

Concurring with the EU Green Bonds Standards (EU GBS), Eckhart et al. imply that at the moment there is no real financial incentive for issuers wanting to distribute GBs in comparison to conventional bonds. This is due to the assumption that there aren't many studies demonstrating the pricing benefits of a GB (Eckhardt, Pierrat, & Van Roosebeke, 2019, p. 5). Additionally, the EU-GBS state that issuers then have to face higher fees that are produced by GBs, due to the external reviewer costs and rigorous reporting undertakings (Eu-GBS, 2019, p. 15). A 2019 EU-GBS report also confirms that issuers usually tend to avoid issuing GBs because of the attached risk of losing one's reputation, if standards aren't met or that by easing regulations there might be a loss of formerly attained certifications and diminish one's reputation (2019, p. 15).

In Laskowska's studies some of the benefits of GB issuers are explored. They include points that imply that there are public relations or marketing benefits that issuers can harness and use as advantageous tools to capture more market share (2018a, pp. 60-61). Currently. there seems to be a growing tendency by buyers towards involving themselves in green or sustainable investments. Although we have learnt that there is still not enough evidence that clearly depicts GB's financial benefits for buyers. More so there does tends to be a maturing approach of awareness concerning the green educational knowledge side, by customers' perspective of the environmental aspirations of any issuing entity. In past decades bondholders have had a tendency to invest in long and secure loans which could make green bonds a perfect instrument because they tend to finance long term sustainable projects (Wachter, 2003, p. 331)

By having trustworthy issuers interested in financing green or sustainable projects which usually mature in more than a decade, investors can perceive the progressive impact that GBs may have. This can provide issuers with a better relationship landscape with new or old clients wanting to invest in GBs. Banga's research states that usually there are at least three players involved when issuing a bond, which of course includes the issuer, an impartial reviewer and an underwriter (Banga, 2019, p. 7). Banga's explanation of how the procedures work when issuing a GB can be seen in Figure 2.

Figure 2: Process for Issuing a Certified GB (Adapter from: (Banga, 2019, p. 9))
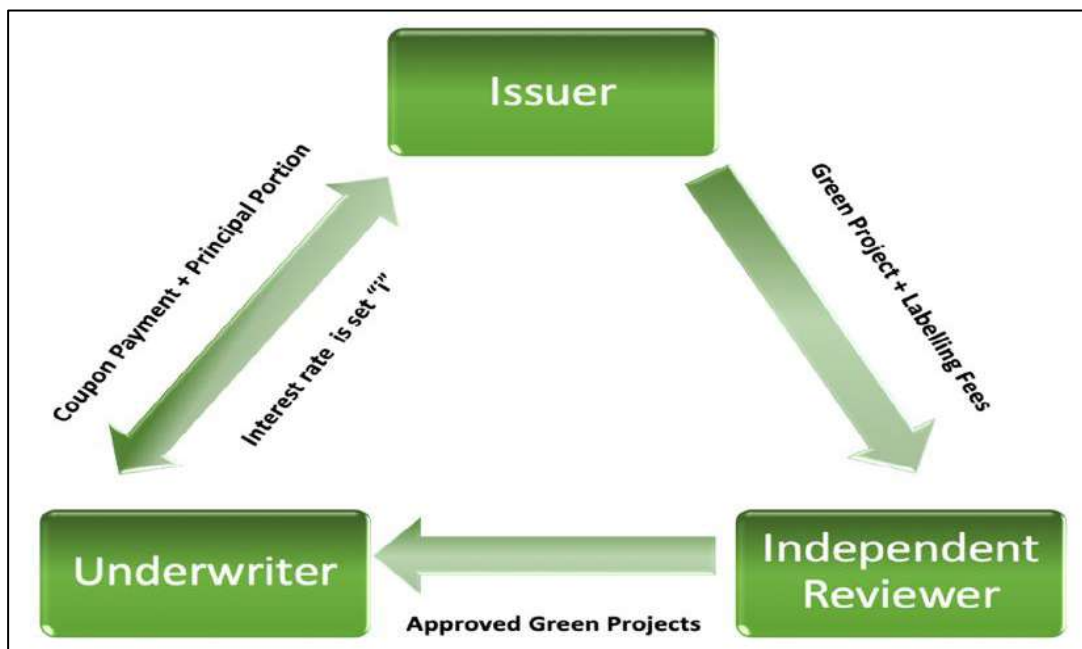
Investors

There are numerous advantages that can be seen from the perspective of an investor towards GBs. A main one can be the fulfilment that GBs provide their buyers regarding demand for ESG ventures while still being a competitive and profitable source of investment (Katori, 2018, p. 3). Here investor have similar options of risk and earnings that can be very similar to conventional bonds. Studies have forecasted that regular investors that may not be involved with the purchase of regular bonds have shown a high demand for GBs (Katori, 2018, p. 3). Katori's research has demonstrated that investors of GBs like to retain newly purchased GBs for longer extents of time and as so they can be seen as committed and stable bondholders (2018, p. 3). One key measure for buyers to invest in GBs is the certification which goes hand in hand as a

screening mechanism. This decreases the research workload by investors having to do independent appraisals or commit to due diligence costs on any particular GB (CBI, 2019, p. 4).

Empirical evidence has demonstrated that investor's awareness regarding environmental and social ventures has been a fundamental phenomenon in the wake of an altering GB market (Kaminker, 2018, p. 14). There seems to be a higher demand not just for data that demonstrates to investors of how GBs can diminish risk fluctuations within their portfolios. More so, how investor's strongly wary if their investments can actually really help and improve society as a whole with accurately projected specified profits (Kaminker, 2018, p. 14). This implies that there are really solid concerns from the side of investors not only to achieve personal profits but to actually see social change. These have been fundamental psychological and financial avenues, by which issuers have in the past and can in the future target and influence investors purchasing decision for GBs.

Underwriters

These entities are the ones responsible of managing the civic issuance and circulation of most GBs. They operate tightly with issuers in order to value and determine the exact offering price of a GB (Cochu et al., 2016, p. 25). Cochu et al, present in their studies some of the main underwriters in terms of size for the year 2015 which include Bank of America Merril Lynch, Credit Agricole, HSBC, J.P. Morgan, HSBC, CITI, Morgan Stanley, SEB and Barclays (2016, p. 25). Underwriters can benefit from the GBP which have been a helpful source that can influence market movements when release dates are close by, thus easing transactional procedures.

External Reviewers

External reviewers are in charge of individually revising that any given GB coincides and follows the procedures and rules that have been set up as market standards (Cochu et al., 2016, pp. 25-26). There are areas where reviewers interact with other participants in the GB market. They are an essential middleman between an issuer and investors. According to Cochu et al., external reviewers provide the necessary guarantees to investors that their investments qualify as green financial instruments (Cochu et al., 2016, p. 26). The GBP act as guiding measures for issuers who can use any

assessment done by an external reviewer in a public manner. Nevertheless this is only possible if these assessments have been proven to follow guidelines and standards set by the GBP (Cochu et al., 2016, p. 26). Cochu et., al confirm that external reviewers are free to disclose any relevant features of an issuer's GB (2016, p. 26). There are four main areas that external reviewers can act as consulting entities and provide certain services. The first consist of providing a consultant review, this incorporates secondary opinions (Cochu et al., 2016, p. 26). Some of the most famous second opinion contributors in the market are; Oekom, Cicero, DNV GL, SustainAnalytics and Vigeo. Verification is another service that can be provided by external reviewers such as auditors. The main difference between certification and verification is that verification mainly is indented for internal alignment of standards or that have been already set by a GB issuer (Cochu et al., 2016, p. 26). The third area of service is certification, in which case an issuer may have its GB, associated form or any use of proceeds verified and in alignment with an exterior GB valuation benchmark (Cochu et al., 2016, p. 26). This third-party review option is quite a demanding task since it analyses and compares GB criteria that is pertinent to any given project. It also demonstrates how it meticulously selects any given project and strategically publishes progressive reports that gather data figures which measure climate or social change (Cochu et al., 2016, p. 26). The CBS which this study will later elaborate more on, in the section of Governing Framework and Structure of Green Bonds can be said to be an official certifier.

Rating is the final area were third party external reviewers such as rating agents or expert researchers in a given field can provide quantitative or qualitative analysis and present measurable rating evaluations (Cochu et al., 2016, p. 26). S&P Global Ratings and Moody's Investor Services are two rating providers that are well known in the GB market.

Other Market Intermediaries

These mostly include stock exchanges. They have been essential in their ability to act as central platforms were trading can be exercised by green and sustainable conscious debt securities (Cochu et al., 2016, p. 26). The Luxembourg Stock exchange is an example were green securities have been seen in action.

Index Providers

These types of providers tend to be mostly credit assessment organizations whom co-operate with other entities that have the undertaking to produce indexes that aid investors with competent analysis results that demonstrate how well a GB has performed (Cochu et al., 2016, p. 26). There are many indices such as the S&P Green Bond Index and the Bank of America Merril Lynch, as well as eastern indices such as the China Climate-Aligned Bond Index.

2.2 Governing Framework and Structure of Green Bonds

This next section will elaborate on the regulatory infrastructure of GBs. The first section will cover the GBP by ICMA while the second will emphasize on the CBS by the CBI. These two schemes have already been mentioned previously but throughout this section there will be a deeper exploration to help understand the complexity and controversy attached to these two regulatory systems. Since the inception of the first GB, the market has been known to lack straightforward and well-defined public guidelines (Park, 2019, pp. 604-605). Katori mentions in his research that the GB market possesses three main issuing bodies, the first two are the already mentioned schemes; GBP and CBS, nevertheless he includes a third called the Green Bond Rating (GBR) (2018, p. 1). There seems to be a lack of consistent international regulatory norms that can be bilaterally defined and recognized on universal level (OECD, 2017b, pp. 6-8). After having looked at these three popular regulatory frameworks there will be a short summary on other international or supra-national regulatory structures.

There are some international frameworks that not every investor will consider official, authentic or even valid. During the last section Governing Frameworks, section 2.4.4 will include some of the powerful international regulatory bodies that have been growing throughout the last couple of years. It will include China's regulatory structure perspective that according to Wang and Zhang became the largest GB market nation issuer on the planet in 2016 (2017, p. 16). There will be a reinstatement of international controversy which will be furthered studied both in the Assessment and Methodological sections of this paper. Making the limited issuing countries of GB frameworks important variables in the bibliometrics analysis branch of this study.

2.2.1 The Green Bond Principles

One of the most important mechanism in the GB market was the creation of the GBP by the ICMA in January of 2014 (Ehlers & Packer, 2017, p. 90). There have been numerous versions released of the GBP, almost one per year until its final version which was released in June of 2018. It has become undoubtably known that these principles have become one of the main pillars of the GB market's governing body. Previous to the launch of the GBP the GB market was mainly regulated by World Bank system who had also launched the first GB in 2008 (Ramstad, 2019, p. 27).

Philosophy

Procedural guidelines can be said to be the backbone when creating a company's specific process mechanisms that any particular business can use in order to create its very idiosyncratic operating model (Zaring, 2006, p. 294). The GBP are a set of voluntary process guidelines that were developed and released by private financial organisations under the patronage of the ICMA (ICMA, 2015, p. 1). There is a wide array of specifics that the GBP include throughout their guidelines which have been rereleased on various occasion. One of the most important factors about the GBP is that proceeds must be utilized for sustainable environmental purposes. Suitability of any project must be defined with a clear and detailed planning process. Transparency is also crucial when there is a need to track and locate more information of where proceeds have gone to. Finally, there must also be a systematic annual release of the use of proceeds that are clearly depicted (Ehlers & Packer, 2016, p. 3).

At the moment the GBP do not specifically delineate which form of venture or project is suitable to be characterized as a green. Nevertheless, they do guide issuers and other parties involved with the most relevant, in-house established standards that can help determine what can be actually entitled to qualify as a green project, thus enabling future stakeholders a type of guiding manual that can be utilized for creating future ventures (OECD, 2017a, p. 8). The GB market has clearly established a functioning mechanism that improves the way in which the debt system can monetarily supply green sustainable investments such as environmental projects. The GBP are a source of reliable standards that act as a framework that suggests comprehensibility, reliability and systematic coverage (ICMA, 2018a, p. 2). These guidelines provided by the GBP are meant be utilized by all parties involved throughout the lifetime of a GB.

They aid in cross data formula that grants data sharing which in essence helps assign and raise capital needed for improving or establishing new environmentally friendly endeavours (2018a, p. 2). Another of the main purposes of the GBP is to concentrate on how new proceeds are employed and collaborate with issuers not only wanting to create from scratch but also the ability to transform their business format into much more eco-friendly undertakings. The GBP act as a consultant force that incorporates impactful endorsements from governing members and participants of the GBP and the SBP which can altogether be classified as The Principles (ICMA, 2018a, p. 2). These principles are managed by an executive committee which is in charge of providing the public with yearly reports on how they have influenced and helped to promote and grow the GB spectrum (2018a, p. 2).

The GBP are meant to be employed by stakeholders involved in the GB market that will ease transactional procedures and shorten issuing times. They are an essential source that guide issuers on how a GB must be launched in order to instil trustworthiness, while helping buyers access transparent and reliable information where their proceeds will be safely invested (ICMA, 2018a, p. 3).

Components

The following section will emphasize on what are the main four components that make up the GBP and how they play an essential role in its functioning structure. Every one of the four components convey a different array of best conducts that issuers can use. An example can be at the initial stage of a GB when emphasis is focused on marketing effort and sale of the bond, which would go in hand with the first two components, use of proceeds and process evaluation & selection (Park, 2019, p. 22). As for the final two components, management of proceeds and reporting, Park makes a connection of how funds gained from the sale of the bond can be utilized and how they should be reported (2019, p. 22).

The following are the four components with a brief description:

1. **Use of proceeds:**

This is the very heart of a GB since it clarifies exactly how funds are to be invested and depicts all the legal procedures that go hand in hand in order to ensure a safe and secure methodology (ICMA, 2018a, p. 2). The GBP state that all green ventures ought

to have a comprehensible and well defined purpose of how funds are to be environmentally favourable and if possible a quantifiable method should be provided by the issuer (2018a, p. 2). When it comes to refinancing a certain project issuers should also compare what proportions were originally funded by other means of debt and how much was added by GB issuance funds. There are many eligible environmental conscious areas that have been categorized and included in the GBP that serve as intended goals where GB can cause a positive impact effect. These categories include projects within the spheres of, "renewable energy, energy efficiency, pollution prevention & control, environmental sustainable management of living natural resources and land use, terrestrial and aquatic biodiversity conservation, clean transportation, sustainable water & waste water management, climate change and adaptation, eco-efficient &/or circular economy adapted products, production technologies & processes, and green buildings", these are amongst the most common areas of eligibility for GB projects (ICMA, 2018a, p. 3).

2. Process for Project Evaluation and Selection:

This component stresses on how transmission of information should be done with investors. Starting with how environmental sustainability goals are to be met. As well as how issuers should regulate whether or not a project suits an appropriate category of all the ones mentioned in component number one and explain other applicable norms or conditions that describe possible risks involved in any related green project being funded (ICMA, 2018a, p. 3). As always transparency of projects involved are of extreme importance throughout this stage.

3. Management of Proceeds:

All net proceeds must be properly ascribed to a secondary account, then transferred to an allotted portfolio where they can also be traced directly by the issuer (ICMA, 2018a, p. 4). The GBP also state that as long as proceeds are still due, the remaining proceeds need to be frequently assessed in order to see balances proceeds that were used for a given period or project. This is done so that absolute transparency can be transferred to investors by allowing them to be periodically informed of were unused proceeds are, and were they are meant to be invested in the future (2018a, p. 4). This component also advices on using external or third-party verification means in sequence to guarantee even more transparency.

4. Reporting:

Katori stresses that financial institutions should utilize external entities that will instil corroboration practices over all four components of the GBP guidelines and that they are accurately being followed (2018, p. 4). The GBP clearly state that all information regarding any project should be meticulously described and that an impact analysis should also be released on an annual basis (ICMA, 2018a, p. 4). This fourth component stresses highly on transparency and how funds from proceeds should be properly reported. This with the purpose of obtaining measurable quantitative results and assessing what quantifiable impact green projects from a selected amount of funds have on the environment and societies were investments are being made.

External Review

Another important area of the GBP is the external review process. There are highly recommended options advocated by GBP when issuers plan to issue a GB and how they should do so while appointing an external evaluation contractor. The principles suggest that external reviewers provide verification assurance that the four components are being followed. There are several means and ranks by which an external party can do a GB analysis on behalf of GB issuers (ICMA, 2018a, p. 5). The GBP incite that autonomous reviewers provide statistical eco-friendly characteristics. Different providers can develop their own frameworks given their own niche field of expertise. The GBP suggest that external reviewers can be grouped in four main groups of service providers: secondary party opinions, independent verifiers, certification issuers and GB scoring or rating (2018a, p. 5). External reviewers can provide one or more of these service at the same time, grouped or individually.

All relevant credentials that might be relevant for any given project should be provided by external reviewers. The principles highlight that even though all suggestions are mere recommendations the guidelines that have been created are done so in good faith. This is so that best practices are followed along with clear communication standards of information conveyance from external reviewers towards GB issuers, underwriters, buyers and any other entities involved (2018a, pp. 5-6).

2.2.2 Climate Bonds Standards

The CBS were emitted by the CBI an organization that focuses on providing non for-profit investor-services and guidelines in the GB market. The CBI started issuing its

standards and certification formats back in 2010 for all project entities involved in wanting to make a positive impact on the environment and climate change (CBI, 2019, p. 3). The CBS focus on providing recommendations that reassure a speedy process in the creation of GB investments with the purpose of expanding influence and aiding to reach the aspirations of the Paris Climate Agreement (CBI, 2019, p. 3).

There have been several versions of the CBS. One of the most cited releases by academic authors has been version 2.0. For up to date purposes most of the literature review of the CBS will be based on the CBS version 3.0 released in December 2019.

The purpose of having a certification scheme is to promote a set of guidelines. Plus a measurement of evaluation that reconfirms that standards are being followed and provide a proper type of validity such as a certificate, label or stamp which is issued by authorized certifiers who are in charge of constantly examining legitimacy (Scheltema, 2014, p. 323), see stamp model on Figure 3. The certification process produced by the CBS is composed of a few steps that need to be taken into consideration. First, there is a consensus need to be fully consistent with the GBP. Second, that best practice methods are being utilised by intrinsic constraints, tracking, reporting and verification by all parties involved. Finally, funding of investments are uniformly aligned with the specified targets that have been set by the Paris Climate Agreement (CBI, 2019, p. 3). A Climate Bond Standard Board is a critical part of the CBS which is made up of highly influential investors paired up with eco-friendly non for-profit organizations. This body administers that all daily imposed functions and decisions making processes made by certifiers are aligned with established requirements (CBI, 2019, p. 4). This is done with the help the CBS Secretariat another governing body of the CBS. "The Climate Bond Certified Mark is used to designate Certified climate Bonds, Certified Climate Loans and Certified Climate Debt Instruments" (CBI, 2019, p. 3).

Figure 3: Climate Bond Standard Certification Stamp (adapted from: (CBI, 2019, p. 1))

Apart from the CBS version 3.0 other regulatory mechanisms created by the CBI are the Climate Bond Taxonomy and the Sector Eligibility Criteria. The Climate Bond

Taxonomy is a high degree plan of action for all the different segments that are involved. This taxonomy is the backbone of the CBS system of information which is exercised by green or climate bonds in order to determine if they are in line with previously established standards (CBI, 2019, p. 5). See CBS taxonomy on Figure 4. This database tool can be used by index contributors, industry experts and any other participants of the GB market. As for the Sector Eligibility Criteria has a much more scientific supported approach. It specifies all relevant information needed to properly asses if a green project is eligible or not while having a targeted mentality that these projects are meant to accomplish the goals set by the Paris Trade Agreement (CBI, 2019, p. 5). The CBS have a tendency of requiring a minimum of 95% of proceeds to be distributed for environment linked projects to enable third-party certificate issuers to be admitted and approved with the CBS official stamp (Katori, 2018, p. 5). Katori argues that certain costs for issuing bodies will increase due to the fact that there are greater fees attached to this transparency process because of the extra due diligence that is required. Additionally, Katori also mentions further costs incorporated include a registration toll of 0.01basis points of the issued sum of any GB (2018, p. 5).

The CBI is one of the most popular and utilized sources of information that currently exist in the GB market (Lebelle, Lajili Jarjir, & Sassi, 2020, p. 18). This internet base databank has been operational since 2013, and by 2018 included a large array of more than 2025 GBs (Lebelle et al., 2020, p. 18).

Figure 4: Climate Bonds Taxonomy (Adapted from: (CBI, 2020b, pp. 1-16))

2.2.3 Green Bond Rating

The previous two GB guidelines and certification frameworks have been some of the most cited documents while going through literature for this research. Later in this study there will be a quantitative analysis on citations quantities, throughout sections 3.0 to 5.0 this will be further explained. Although the GBR do not have the fame of the GBP or the CBS, a study done by Katori over a 19 month period starting in 2016 develops a comparative analysis on how issuers can exploit benefits from a given governing framework of GBs (2018, p. 1). Katori mentions the fact that companies like Moody' and S&P Global Ratings started to promote services such as "Green Bond Assessments" and "Green Evaluations" respectively. More companies apart from these two also began doing their own tailored assessments schemes, but one thing in common was that they were all pretty much aligned to the GBP (2018, p. 5). Katori also mentions that there can be great differences in assessments schemes since companies such as Shanghai Brilliance can mould their standards on customers' requests (Katori, 2018, pp. 5-6). In 2018 Moody became the number one service provider of GBR through its Green Bond Assessment program making it the most popular GBR on the planet (Katori, 2018, p. 5). Although GBR is not a single institution based governing framework, but more of manoeuvrable guide, it has become a standard wording label in GB literature.

2.2.4 Other Public or International Regulators

As the GBR mentioned that there are different assessments schemes, there seems to be even more diversified and flexible frameworks out in the international market. Some relatively renowned international taxonomies for issuing and assessing GB are visible in China, France and India. Cochu et al. put emphasizes on of how international schemes have a positive effect on increasing GB issuance substantially (2016, p. 58). Meanwhile they help promote very similar frameworks that might have completely compatible systems even though some national regulations might differ in minor ways. As most guidelines are completely voluntary there is much freedom to design country-based standards. Cocuh et al. also argue that this methodology might help since this would eliminate the chance of a single country having many versions of standards making them even less compatible on the international market (2016, p. 58). This would create a hindering growth effect of GB being issued and affecting both local and foreign investors.

European Union Green bonds Standards

As a united group of nations, the EU has also implemented a respected set of guidelines for the European GB market. The European Commission assigned responsibility of green finance to a designated group of professionals, the Technical Expert Group (TEG) (TEG, 2019, p. 8). This group would be in charge of implementing a set of GB guidelines. This framework largely influenced by the GBP was given the name of European Union Green Bond Standards (EU GBS) which would make only voluntary suggestions for participating entities in the European GB market without enforcing strict laws or rules (TEG, 2020, p. 10). The 2020 TEG's "Usability Guide EU GBS" report states that the main purpose of this European taxonomy is to promote GBs within Europe but also for participants abroad in foreign markets, by building similarities with the GBP and the CBS (2020, p. 10).

The EU GBS have instituted four main elements within their system:

1. Use of proceeds from GBs must be in harmony with the EU Taxonomy (TEG, 2020, p. 10).
2. Issuers must also design their own frameworks regarding details of any given GB or set of GBs (TEG, 2020, p. 10).
3. The issuance of where funds are being allocated must be coupled with an impact reporting scheme (TEG, 2020, p. 10).
4. External or official reviewers are necessary (TEG, 2020, p. 10).

Finally, the EU GBS have a large spectrum of investment possibilities with the purpose of influencing and funding green ventures that are outside of the EU. As it has the freedom to be used as a financial debt instrument to issue GBs by government or private entities (TEG, 2020, p. 11).

Association of South East Asian Green Bonds Standards

The Associations of South East Asian (ASEAN) block has been successful in triggering a growing concern effect and green market development around investors, buyers and issuers in South East Asia. The ASEAN Capital Market Forum (ACMF) was created in order to incorporate similarities in national standards within this region to promote GB market growth, standardization and association (ACMF, 2018, p. 3). Similar to the EU GBS, the ACMF has designed a set of guidelines called the ASEAN GBS

that are also in line with the GBP and the CBS but have distinctive home divergences in certain areas. These guidelines are meant to provide greater transparency and unite climate and social issues under this one framework (ACMF, 2018, p. 11). Kawabata's research on ASEAN GBS affirms that the more frequent legitimate data is published it will keep on attracting investors in this region of the world towards green investments (Kawabata, 2020, p. 49).

Chinese Green Bond Guidelines & Green Bond Endorsed Project Catalogue

As mentioned in the introduction, one of the three Eras has seen a huge participation surge in GB funding coming from China. This has influence and forced China to bring out their own national standards for the GB market. The National Development and Reform Commission (NDRC) and The People's Bank of China (PBOC) first started issuing China's very own GB framework in 2015 because of the huge economic importance of developing a larger GB market (Y. Wang & Zhang, 2017, p. 16). Like many other international institutions, China's Green Finance Committee (GFC) has utilized the GBP and CBS to create the Chinese Guidelines and the Project Catalogue. This coupled with the global experience from Chinese regulators in order to form a suitable framework given their national agenda (Ehlers & Packer, 2017, p. 93; Y. Wang & Zhang, 2017, p. 16). Chinese guidelines have not only focused on persuading a local alignment for establishing eligible criteria that is needed to produce a legitimate green ventures. They have also facilitated an association of membership or strategical alignment approach to help conciliate practices with other GB guidelines like the ones imposed by the European Union (EIB, 2017).

Japan

In 2017 the Japanese government decided that it would also draft its own local guidelines for issuing GBs. Similarly like many other international guidelines, The Ministry of Environment of Japan (MOEJ) first came out with a framework with the purpose of growing green project venture's while seeking for a long term solution to reduce Co2 emissions (Kawabata, 2020, p. 44).

Other International Guidelines

Throughout the entire planet there are more and more guidelines that are being proposed and drafted. The Hong Kong Green Bond Guidelines, the Nigeria Green Bond

Guidelines, the Mexican Green Bond Principles are other sets of standards that have been dynamically prepared and utilized by nations wanting to have a larger participation in the global GB market (Lebelle et al., 2020, p. 20). In the following section we will examine the evolution of the GB market and its international force of influence.

2.3 Evolution of the Green Bond Market

Since its inception in 2008 the GB market has changed, transformed and evolved all while having a huge economic impact on an international scale. Impact reporting is becoming a popular means to measure performance of social and environmental change. Like in many industries the GB domain has felt the need of incorporating into their dynamical structure the new digital wave of technological change or transformation. This has become a growing phenomenon that is ever more felt worldwide on how information can help develop artificial intelligence and data capabilities in order to increase efficiency and transparency.

2.3.1 Market Development

The green bond market has gone through different phases since its inception in 2008. There were years of little growth after its inception, but for the past half a decade there has been an explosive economic growth. The following section will brief the reader with the gradual enhancements of the GB market. How it has grown, what goals have been set, and how innovative green instruments have been used to adapt to religious or cultural norms.

Economic Growth

Monetary expansion has been a key factor that has maintained GBs a popular financial instrument for the past decade. Since 2007 the GB market has grown tremendously, 2019 ended with an issuance of around USD 263 billion demonstrating a 43% augmentation in GB issuance compared to 2018, consequently making total historic GB issuance at USD 840 billion (SEB, 2020b, p. 6) . The SEB also states that total issuance of GBs is set to hit the trillion mark in the near future. Cumulative and per year issuance can be seen in Appendix 1. It also demonstrates how exponential growth really only started taking off in the year 2013. As of 2014 the GB market gained momentum and started to grow at an incredible rate, at the same time its sector-diversification base has also experienced transformative change. Appendix 2 demonstrates how financials

and corporates have been strong issuance segments and by the end of 2019 these two sectors saw the highest percentages of issuance (SEB, 2020a, pp. 8-9).

Use of proceeds variation of GBs have been quite steady for the past three years as can be seen in Appendix 3. It depicts how energy, building and transport have been constant and leading sectors within the GB market evolution for use of proceeds. In 2019, sustainable energy and green building sectors captured 31% and 30% of the total GB proceeds respectively (CBI, 2020a, pp. 1-3). Finally, the first two months of 2020 have seen higher issuance as compared to the first two months of 2019, however March saw a serious slowdown of GB issuance, most probably due to the economic effects of the COVID-19 crisis (SEB, 2020a, p. 7).

Sustainable Development Goals

In 2015 members of the UN agreed upon a decisive scheme to fight economic poverty and reduce harm to our planet by developing 17 SDGs that would bring upon ecological resilience and world peace (UNDP, 2020). The UN SDG agenda was a cooperative coalition strategy, adopted by all 193 international states that would set a series of challenging objectives that would essentially need to be reached by 2030 (Bergman, Bergman, Fernandes, Grossrieder, & Schneider, 2018, p. 2). The agenda was composed of 169 specific targets complemented by 232 indicators that were all summarized into 17 core domain goals. These goals are illustrated in Appendix 4. With this initiative, all participating countries were counselled to adapt to their own unique cultural and economic requirements. The intended targets of the SDGs have been key reliability benchmark models that have enabled advancements to be measured by producing a quantifiable progression of their environmental impact and performance outcome (Bergman et al., 2018, p. 4).

The SEB is a financial group that has been providing fiscal guidance services since 1856 and acknowledges the fact that SDGs act as a blueprint for future planification that can improve the well-being of our societies and planet (SEB, 2019, p. 4). The SEB has made several correlational impact-reports that state that five of the 17 SDGs have been major recipients of funds obtained by the use of proceeds generated by the issuance GBs (2019, p. 4). These five SDGs are highlighted in Appendix 5. As use of proceeds are labelled by each issuer to be either a Green, Social or Sustainability bond, there has been a growing market phenomenon for labelling themed type bonds (ICMA,

2020a, pp. 2-3). The ICMA accentuates that the GBP may not always be aligned with the SDGs and promotes awareness of this fundamental fact (2020a, p. 2). Through different surveys the ICMA has seen how investors are becoming much more aware and conscious towards SDGs and on how their GB proceeds are being invested. These concerns have been caused by an increase in demand for reports that transparently show the effects that they have on any specific SDG (ICMA, 2020a, p. 2). Of the 17 SDGs the ICMA has identified that 15 can be applicable towards its GBPs, excluding only SDGs 16 & 17, Peace & Justice, and Partnerships for the Goals (2020a, p. 3).

Contrary to the previous statements, the CBI's view towards the categorization of GB proceeds for SDGs are regarded as irrelevant. Since applicable ambitions may differ tremendously from project to project and may have a completely different formulation of how to reach objectives (Siswantoro, 2018b, p. 4). Subsequently, Siswantoro suggest that by doing a more precise labelling of SDG named bonds is a more appropriate means by which green projects may be labelled. A concise quantitative methodology of how each sub-segment or project within all SDGs will be accomplish thru more strategically specified goals that go deeper than just labelling that specific bond as one of the 17 SDGs (2018b, p. 4).

Green Sukuk

The definition of a Sukuk is similar to that of a regular bond investment, nevertheless they strictly follow Shari'ah values of guidance and provide stakeholders the right to collect a given percentage of earnings or interest generated by the sum of assets at stake (Więckowska, 2013, p. 163). As for Green Sukuks are Shari'ah obedient financial instruments like regular Sukuks but with a stronger emphasis to comply with investments in clean energy and eco-friendly assets that stride to improve the protection of our environment (CBI, 2020d). There has been a growing trend to adopt Green Sukuks as strategical financial assets. Rahim mentions that this growing trend has not only raised interest from investors because of their innate features as regular Sukuks. Nevertheless, more so because of an increasing awareness inclination from the part of investors towards climate resilient, social conscious and ethically responsible investment projects that are funded by this Islamic financial mechanism (Rahim & Mohamad, 2018, pp. 139-140). Green Sukuks infer an optimistic mixture between social progress and environmental-friendly investments. While incorporating the desirable characteristics of Islamic finance, making them optimal innovative tools that can

be seen to attract the much needed green capital for the coming years (Alam, Duygun, & Ariss, 2016, pp. 176-177). Three Malaysian energy corporations became the first issuers of a Green Sukuk, making them the initial igniters to promulgate the Green Sukuk era (Rahim & Mohamad, 2018, p. 142). There have been controversial allegations against the previous declaration, claiming that the real first Green Sukuk was issued thru a non-private entity for USD 1.5 bn that was backed by the Indonesian government in 2018 (Siswantoro, 2018a, p. 3).

2.3.2 International Sphere

In an ever more connected economy, the international atmosphere and presence of GBs have become gradually more visible. They have had a powerful role of how they can influence international markets. This section will inform the reader of how GBs have made a striking global presence in the past years.

Overview

Historically, the USA has been the undisputable market leader in the international sphere of GBs. China and France have also traditionally been the next two biggest GB issuers. In 2019 these three countries maintained their commanding positions and together accounted for 44% of the total of all GBs issued (CBI, 2020a, p. 2). According to CBI figures, 2019 saw France and China issue a bit over USD 30bn, while the USA totalled USD 51.3bn (2020a, p. 2). More and more countries seem to be joining the GB market, not only developed economies but also developing countries. 2019 became the year that Ecuador, Panama, Barbados, Kenya, Russia, Saudi Arabia and Greece issued their very first GBs (CBI, 2020a, p. 2). Germany and the Netherlands both issued over USD 17Bn in 2019, during the same period Japan and South Korea issued USD 7bn and USD 4.4bn respectively. The top twenty world GB issuers in 2019 can be seen in Appendix 6 whereas Appendix 7 illustrates the top ten issuers in 2020 until May. Total GBs issued since the first GB was launched in 2007-08 have amounted to USD 817.5bn, Appendix 8 illustrates the sum of historical GB issuance by country until May 2020 (UniCredit & Dax, 2020, p. 20).

In 2019 the Nordic countries issued a total of USD 17.8bn, with Sweden taking the lead with 9.26 of the total market, in turn Norway, Denmark and Finland had, USD 3.92bn, USD 2.49bn and USD 2.14bn correspondingly (SEB, 2020b, pp. 7-9). The next section will explore regional particularities of the GB market.

Region Specifics

Europe has claimed leadership status for several years as the greatest GB issuance region since the foundation of these green financial mechanisms. In 2019 Europe seized more than 45% of the market with a total issuance of USD 116.7bn, and as far as 2020 goes it has already claimed 55% of the total market (CBI, 2020a, p. 2; UniCredit & Dax, 2020, p. 20) as shown in Appendix 9. Second and third place until May of 2020 has seen Asia Pacific issuing USD 8.8bn and North America USD 6bn, while the Nordics have seen little issuance at just USD 3.5bn (SEB, 2020a, p. 7). Historically, North America and Asia-Pacific hold silver and bronze medals for issuance of GBs. While very little action has been seen from the part of Africa which only issued USD 898 Mn worth of GBs in 2019 that went mostly to fund a solar plant implemented by Redstone, a South African based company (CBI, 2020a, p. 5). Regional distribution of GBs issuance since 2007 is shown in Appendix 10. SEB figures demonstrate that Latin America has had generally little participation in the GB market. During the first 5 months of 2020, 95% of all GBs issued in Latin America have been issued by Chile (2020a, p. 7). GB market growth issuance by region since 2007 can be seen in Appendix 11

Issuer types can vary year to year, for example North America has been big on green asset back security (ABS) bonds while Europe has tended to be strong on Government Backed Equity GBs, as for the Asia-Pacific region has released mostly Financial Corporate GBs (CBI, 2020a, p. 2). 2019 issuer type split percentages by region are shown in Appendix 12.

Use of proceeds from GBs have also seen changes region by region and year to year. Appendix 13 depicts a comparative analysis of use of proceeds by region in 2018 and 2019. It is normal to see how developing regions like Africa tend to have less diversification in their use of proceeds compared to more sophisticated economies like Europe (CBI, 2020a, p. 5).

Currency Analysis

The Euro and the American dollar have been the leading currencies of issuance throughout the entire history of the GB. As Appendix 14 shows that 2020 was no different to previous years and the same historical leaders once again took the lead during

this year again. China has seen steady growth and ensures third place in both GB issuance in 2020 and on a historical level (UniCredit & Dax, 2020, p. 24).

As a percentage of total GBs issued in the entire green and conventional bond market, the SEK in 2019 presented itself as the world leader with a whopping 19% (SEB, 2020a, p. 10). Apart from the SEK's strong presence, the USD comes in at second place as displayed in Appendix 15 with less than 4% of Green Bonds being issued in USD. Appendix 15 also illustrates these same types of measurement for other currencies since 2015 until April 2020.

International Companies

The biggest international business involved in the issuance of GBs in 2019 was Fannie Mae who issued USD 22.9 billion, while the next two biggest users were state owned German KFW with an issuance of USD 9bn and Dutch State Treasury Agency (DTSA) who issued USD 6.7bn (CBI, 2020a, p. 2).

The largest GB issuance companies in the non-financial sector in 2019 were all involved in the energy sector, they include; Engie, issuing USD 3.8 billionn, MidAmerican Energy issued USD 3.4 billion and the Portuguese company, Energias de Portugal SA issued USD 1.8 billion (CBI, 2020a, p. 3). The CBI reported that the two biggest financial institutions in 2019 were the Industrial and Commercial banks of China (CBI, 2020a, p. 3) .

The largest three underwriters in the 2019 GB market were Crédit Agricole, BNP Paribas and HSBC, together congregated 17% of the total market (CBI, 2020a, p. 8).

As for the top five reviewers or second party opinion entities in the GB market for 2019 were topped by the also its historical market leaders as can be seen on Appendix 16 (UniCredit & Dax, 2020, p. 28).

2.3.3 Data Supply

The following section will explore the data and database side of the GB market and how it has been evolving and growing throughout the past years. The importance of digitalization is ever clearer today, even in the markets where GBs operate. Researcher have found that there are many benefits that can be obtained through a digital transformations such as increasing efficiency, lowering costs and promoting constant innovation (Hess, Matt, Benlian, & Wiesböck, 2016, p. 127). It can clearly be seen that exploiting new digital and technological tactics can increase the chances of obtaining

positive results. This section will explore the digital side of the GB market and how it is quickly evolving on a digitalization level like many other financial instruments.

Sources of Data

The CBI has produced a database that can be seen as the most widely used forum that provides information across international markets on GBs (Moody's, 2019, p. 2). Nevertheless, there are many other entities producing their own digital-based data hubs.

Since the inception of the GB almost all stakeholders within this market have created their own databases. This has allowed GB innovators to not only retrofit an establish in-house datasets but also provide investors with a much more organized and complete source of information that can be easily accessed (Lebelle et al., 2020, pp. 7-8). Commercial banks have also played a decisive role as the first developers in creating GB datacentres. This is because issuers or underwriters in the primary bond market have steered them to create their own GB digital catalogues (Lebelle et al., 2020, pp. 7-8).

Data Collection Entities

In their studies Lebelle et al., mention that up to 2019 there were five to seven main official contributors of GB data which had their own unique way of functioning. The particular way that these entities have released and operated their datacentres differs from one another by their restrictions on user access, reporting details and market coverage (Lebelle et al., 2020, p. 7). Lebelle et al., include the following entities as the seven legit GB data sources: Bloomberg, Dealogic, Environmental Finance, CBI, Shenzhen Securities Information, Trucost and Amundi (2020, p. 19). Likewise the ICMA concurs with four of these data providers mentioned by Lebelle et Al., nevertheless the ICMA takes into consideration one, Cbonds (ICMA, 2018b, p. 4). All eight data providers can be seen in Appendix 17.

As can be appreciated from table 1, there is no consolidated GB database. Lebelle et al., acknowledges the fact that since the beginning of the GB market, the exiting data sources available can vary tremendously making it really hard to gather a standard record of details (2020, pp. 7-8). The next section will cover how blockchain has begun to influence and change the GB world.

Blockchain

The term blockchain originates from a paper written by Satoshi Nakamoto on crypto-currency in 2008 that propagated the name (Nakamoto, 2008, p. 8). Distributed ledger technology (DTL) is another system/term that has in the past years been highly linked to blockchain. Atzori's research defines blockchain as an irrevocable and completely safe data warehouse for contracts, documentations, ownerships and assets that can be transformed into digital data and commands that can exert an expansive variety of functions (Atzori, 2015, p. 2). As Rauchs et al., studies demonstrate that there are currently numerous definitions for DTL and that each definition has been evolving throughout the past years through scientific literature and journal publications. Furthermore, Rauchs mentions that authors have tended to sculp their own definition of the term in the way it best relates to their current field of research (Rauchs et al., 2018, p. 19). This signifies that there can be very extensive definitions for both terms blockchain and DTL which open the door for controversy. For example Cong et He., describe blockchain as a "distributed database that autonomously maintains a continuously growing list of public records in unit of blocks, secured from tampering" (Cong & He, 2019, p. 1760). As for DTL a common definition by the Worldbank portrays DTL technology as a detailed application that exhibits a repetitive function of shared ledgers in which there is a coordinated function amongst the gathered digital data from a large world spectrum via channels and institutions. In addition the Worldbank mentions that not all DTLs have utilized blockchains and vice versa, but the terms can be employed on a compatible basis (WorldBank, 2017, p. 2). Rauchs et al., agree that it has become popular to unify both terms by simply calling it blockchain-technology instead of segregating DTL and Blockchain from one another (Rauchs et al., 2018, p. 20).

GB have been no stranger to these new and growing digital technologies that are being quickly adopted across the world. There is an increasing pattern of journal publications and reports that have interrelated both blockchain and GBs. These articles delve into how blockchain can improve the GB market. New technologies on the financial market known as financial technology (FinTech). Encompass internet innovations, big data and blockchain and can release the full power of green financial tools that can help accomplish UN-SDGs and Paris Agreement goals (Sachs, Woo, Yoshino, & Taghizadeh-Hesary, 2019, p. 7). First blockchain apps for balanced growth

development: blockchains embedded into clean energy sources. Second, carbon emissions and environmental finance. Third, innovative financial mechanisms such as GBs are three potentially compliant systems that can be used by Fintech to increase market reach and stimulate financially green projects (Nassiry, 2018, p. 2). Nassiry affirms that financial innovative tools like GBs that follow their GB market guidelines and obligations while matching financial risk and returns of stakeholders have the possibility to increase the chances of reaching goals set at planetary summits on climate change and sustainability (2018, p. 2).

Blockchain has been proven to improve the ease of gathering funds for green investments. This is because thru blockchain bigger customer base can be captured because of blockchain's availability to reach minor investors as well as private monetary bodies through its digital channels that can provide dynamic innovative financial techniques (Dorfleitner & Braun, 2019, p. 233). There are numerous reasons why blockchain has improved the effectiveness of green financial instruments. This is because they operate in a non-centralized structure which skips all the costs incurred by having middlemen, as well as highly augmenting transparency and avoiding negative accountability effects such as greenwashing (Dorfleitner & Braun, 2019, p. 233). Further in this study there will be a deeper elaboration of what exactly is greenwashing and how it affects GBs. Dortfleitrner & Braun argue that even though growing the green market has many obstacles, blockchain coupled with other digital tech have the power to flourish in financial world. Nevertheless, investors are still sceptical about green instruments' future performances because a lot depends on how much users actually trust these new financial instruments. As well as if they are economically reliable and all legally binding requirements are satisfactorily met (2019, p. 223). Increasing the number of investors or users can be seen as one of the most important factors for GBs to flourish in an ever more agile and fast changing market.

3.0 Elaborating on the Rationalization of the Problem

The previous section provided the reader with an informative literature review of the topic of GBs as new innovative financial instruments. The Merriam Webster Dictionary defines status quo as "the existing state of affairs" (Merriam-Webster, 2020). As the abstract, question and problem of this study delves on what the status quo of published scientific literature on the GB world is and has been in the past twelve years.

It is important to capture the purpose of this study and seek how the GB field has changed and evolved over time in the financial market. This study seeks to do so through a dual-bibliometrics analysis, meaning two similar but unique types of methodologies utilizing the same data sample. A bibliometrics analysis was first described in 1969 as a process development of the studies that involved bibliographies through which mathematical and statistical methodologies may be applied from a collection of reading materials (Pritchard, 1969, pp. 348-349). To the author's knowledge no bibliometrics analysis of GB to date has been done, neither has a dual-bibliometrics analysis. This essay tries to give guidance thru an overview of the emergence and status quo of this field. With the possibility of allowing future researchers to utilize this study in many ways which will be explored in the final discussion section.

The literature review of this study included many papers, articles, thesis, journals, government reports and other material which brought in data that included peered and non-peered reviewed scientific studies. For the methodological section of this study it is important to understand that the selection of the dataset being analysed by both methods will only include peer reviewed papers. Peered reviewed journal articles chosen only from the Scopus database. Scopus-Elsevier is an abstract and citation database that can be used to extract compatible file formats from a single metadata centre (Scopus, 2020). This may cause a bibliometrics within a bibliometrics effect, which is to say that some references used for the creation of the literature review of this study will also be included within the dataset of 98 articles that will be analysed by a dual method approach that will be explain in the next two chapters.

4.0 Development of an Assessment Process for Green Financial Instruments

In this section there will be an introduction to the dual methodological analysis approach that is being utilized for this study. Inspired in the literature review chapter this section focuses on demonstrating how grey areas in the field of GBs have become ever more apparent and pushed into the narrative works of many scientific authors. These scientific writings have been devised in various areas of the world and published by multiple academic journals. GBs have become a new trend, with a limited amount of peered reviewed papers actually been published (Broadstock & Cheng, 2019, p. 17). The study has been narrowed to analysing a data set of 98 peer reviewed writings available only within the database of Scopus. It will also be limited to an inclusion period of articles published from 2008 until to May of 2020. This section will mostly cover the qualitative side of this paper's dual methodology approach. Qualitative analysis is a type of methodological study left to one's own subjective perspective towards the material and data in hand, additionally logically categorizing it through a strategic process of deciphering, organizing and pinpointing trends or argumentative sub-categories in an orderly manner (Hsieh & Shannon, 2005, p. 1278). The entire methodology being used for this study uses both qualitative and quantitative techniques. This must not be confused as two methodologies but instead as one single method. The quantitative side of this study will be developed upon in this chapter, but mostly presented in chapter 5.

4.1 Bibliometrics Analysis

The extent of this paper will apply an assorted array of bibliometrics methods in order to find out more about GBs as financial instruments for the past 12 years. As mentioned by Dressbach-Bundy & Scheck bibliometric studies can be used to identify research composition, patterns and future paths of development (2017, p. 3). The first time the term bibliometrics was used, was by the fusion of its two core body compositions; statistics and bibliographies, hence the terminology bibliometrics. This method has been defined as a strategical method that utilizes mathematical variables and statistic techniques towards readings and other communication materials (Pritchard, 1969, p. 349). For this precise study, 98 scientifically peered-reviewed academic papers have been included into this dual bibliometrics analysis. The scientific journals were chosen from the Scopus database.

4.1.1 Search Engines, Databanks and Data Mining

Search Engines

For the literature review section of this paper there where three main search engines utilized to gather as much material, data and statistics about GB since 2008. These three were the Bayerische Staatsbibliothek (BSB), Google Scholar and Scopus-Elsevier. These three search engines lead to a wide scope of academic and non-academic sources that impacted the outcome of this paper. Here a wide range of folders where created in order to organize journal articles, magazine articles, ebooks and reports from official GB institutions such as the ICMA and CBI. As well as reports from the SEB, the OECD and European TEG Group were amongst some of the most utilized sources of periodically published reports. It is important to note that these last five entities are some of the most cited works both by peered and non-peered reviewed research currently available. The following was inserted into the search engines of Google Scholar and BSB: "green bonds" and "green bond". These two search engines were initial sources for gathering literature review material as well as pointing towards official governmental sites that have published material on GBs in the past years.

Databanks

As for the main database utilized for the empirical side of the study. The Scopus Elsevier databank was the prime source for gathering a total of 98 peer reviewed papers that will be analysed shortly. The main search term used in the Scopus database was: "Green Bonds" see Appendix 18. For this initial step there was a rigorous filtration process to oust irrelevant articles that had nothing to do with GBs. Appendix 18 also shows the use of various filters. Filters such as year range of articles and language of writing. In this case being from 2008 to 2020 and limited to the English language, were some of the filtration variables utilized to narrow down the search for most relevant material on GBs. The second step was to use two more terms: "green financial instruments" and "green washing" that were frequently mentioned in the abstracts of articles that were found after the filtration process that is shown in Appendix 18. Appendix 19 illustrates how these two last terms also went through a filtration processes in order to expel irrelevant articles in the field of GBs. Finally, each one of the filtration procedures in Appendices 18 and 19 delivered 191, 174, 193 articles respectively.

Data Mining

A data mining process was put into place to unify the sum of 558 articles of the previous section that came up in Appendices 18 and 19. It is important to understand that the total number of articles would not genuinely be 558 articles because many articles were repeated in the search results of two or all three of the steps in Appendices 18 and 19. A filtration method standardizing the real number of articles relevant towards the thesis question was put into place to avoid double entries. In this final set result of articles an even further analysis was done. This more comprehensive evaluation of the articles included an even deeper analysis regarding their abstracts and conclusions. This led to the creation of a list of relevant articles called SAVED_LIST (green bonds) that was composed of 127 articles, see Appendix 20. The final filtration step took into account the document type, see division of the final 127 articles that were chosen in Appendix 20. This final filtration step would take into considerations papers that were only classified as articles. This last step gave this study the final dataset of 98 peered-reviewed articles to be analysed. See appendix 21 for a snapshot of the dataset.

4.1.2 Software Used

Various online and offline software programs were used throughout this study in order to maximize on efficiency, design and impact. Appendix 22 illustrates the software that were employed in this thesis with a short summary of their purpose.
All software utilized for this paper was used for the quantitative side of this essay's empirical methodology. Only Sketchometry was used for the qualitative part.

4.1.3 Keyword Exploration

Various bibliometric investigations have demonstrated that there are numerous elements that can have a strong effect on the total amount of citations other than the actual quality of the scientific research in hand (Uddin & Khan, 2016, p. 1166). Keywords make up an important element that can help guide scientific researchers towards pertinent articles that might have been missed when gathering material about a certain topic. Many times, there is not a thorough exploration of a given topic, because by simply reading a title there isn't enough information to fully grasp its applicable importance. Henceforth, this gives keywords a high prospective value in terms of clarifying substance matter for interested readers (Uddin & Khan, 2016, p. 1275). In section 4.4 controversies in GB literature will be deeply examined and will lead into

section 4.5 where there will be an emphasis on how keyword count and keyword quality are important tools and variables that will be applied during methodological section of this paper. Before moving onto these two crucial steps of this study, the reasoning behind the divisional timeline will be made clear.

4.2 The Eras

In their bibliometrics analysis of over 500 publications on Corporate Volunteering (CV) between 1990 and 2005 Dressbach-Bund & Scheck classified their study dataset of journal articles into three development phases. This type of periodical division can also give readers interested in the GB market a clearer comprehension of the way in which GBs have evolved through-out time. Demonstrating where there have been abnormalities and demonstrating specific trends that might be useful for the projection of future studies (2017, p. 15). As previously mentioned in this thesis we have divided our time lapse on the development of GBs intro three eras.

4.2.1 Era 1

This first era marks the initiation of GBs into the financial system. Utilizing green debt in order to have access to funds that could potentially reduce emissions and help fight climate change made its initial presence around 2007. This happened when the European Investment Bank (EIB) made its *Climate Awareness Bond* a strategic approach that could be copied by other development banks such as the World Bank (Christophers, Bigger, & Johnson, 2020, p. 15). The opening GB was finally launched in 2008. This was done by the World Bank when the Intergovernmental Panel on Climate Change (IPCC) released data that clearly proved that economics and climate change had a strong correlation. It confirmed that humans were a main source of climatic change and natural catastrophes. This led to the idea that these problems could be dealt with and how there was an ever stronger need to finance green projects (Rawat & Anu, 2020, p. 1). The first era of this study includes articles from 2008 until 2013. Appendix 23 complements this first era by depicting some of the main green finance developments that occurred across the world until 2013.

4.2.2 Era 2

The second era includes published papers from 2014 until the end of 2016. It is important to note that before 2014 there were no universal standards that could determine

if an economic venture could be considered green or not. This is why this era marks a crucial point for the development of GB in 2014. When 13 banks came up with an array of voluntary guidelines that suggested a transparent approach while encouraging the expansion of the GB market by fostering a clear method of how a GB ought to be issued (Baulkaran, 2019, p. 335). In a study of time-varying correlations, Broadstock & Cheng found evidence that demonstrated that before 2014 there was a negative correlation between green and non-green bonds. Surprisingly, this tendency completely changed at the end of 2013. This market extension can be explained because of an increase in the amount of GB issuance and the entrance of private institutions into the GB world (2019, p. 20). Appendix 24 demonstrates a conditional correlations analysis between green on non-green bonds price benchmarks from 2009 until 2018. The dramatic change in between 2013 and 2014 is tremendous. Appendix 25 complements this second era by depicting some of the main green finance developments that occurred across the world from 2014 until 2016.

4.2.3 Era 3

Era 3 marks the last time period and includes scientific writings from 2017 until May of 2020. Entitled the Green Leap Forward which bears reference to China's great leap forward, this epoch stresses the robust entrance of China into the scheme of GBs. The foundation of the Chinese GB market is earmarked by the announcement of three governing manuscripts on GBs: The No.39 document released by the PBOC in 2015, the Guidelines on GB issuance published by the National Development and Reform Commission (NRDC) in 2015 and finally the release of the Guiding Opinions for Supporting GBs in 2017 by the China Securities Regulatory Commission (CSRC) (H. Zhang, 2020, p. 2). In order for China to have a forerunner stance in global green finance would not only mean using GBs as transition instruments that assemble private funds into climate improvement initiatives but to truly make the necessary essential alterations in their economic structure and view of green debt (L.-Y. Zhang, 2019, p. 221). Zhou noted that there was a fast growth in the issuance of GBs in China by 2013 (Zhou & Cui, 2019, p. 1), which is confirmed by Wang et al. stating that GBs were quite a new and innovative financial instrument at the time but only saw clear explosive growth until 2016 (Q. Wang, Zhou, Luo, & Ji, 2019, p. 1).

In 2017 China possessed USD 300 billionn of the total worldwide USD 895 billions of climate fighting bonds which placed China as the global leader with a double

amount of bonds compared to the second largest issuer at the time the United States (L.-Y. Zhang, 2019, p. 218). Throughout its explosive growth years between the end of 2016 and 2018 China issued USD 36., USD 37.1 and USD 42.8 billionn worth of all types of GBs. These numbers represent a controversial issue since the criteria to classify a bond as green is not the same in China as in the rest of the world. It was seen that during these three years 33%, 38% and 26% respectively of GB issuance did not meet requirements instilled by international standards (Dou & Qi, 2019, p. 2). Elliot introduces in his studies a collaboration analysis of Chinese reports. The reports show how there has been a large amount of interaction between different entities operating around GBs, see Appendix 26. Elliot also constructed a timeline of the development of the GB market which can be seen in Appendix 27 (Elliott & Zhang, 2019, pp. 8-9). As emerging innovative financial instruments GBs take an important role into the transformation of Chinese economy into a much more ecologically sustainable one (Elliott & Zhang, 2019, p. 2).

4.3 The Eight Controversial Metrics

Inspired by the literature review section of this study and reports released by five of the most prominent GB analysts and mediators; ICMA, CBI, SEB, Bloomberg and TEG. This section emphasis on eight essential topics or categories that have become the grey zone areas where there is a certain degree of disagreement, misalignment or simply an area of controversial argument released in academic literature by many authors in the field of GBs. These Eight Controversial Metrics (8CMs) provide a crucial add-on component into the bibliometrics analysis of this study by exploring in depth the elements that will enhance the understanding of GBs as financial instruments.

4.3.1 Credibility

The literature review section revealed that one of the biggest areas of concern and debate has been the trustworthiness of proceeds for investments funded by GBs. Greenwashing has become a mainstream topic amongst many researchers studying green initiatives that included the GB market. Introduction of reliable frameworks have been seen as means to gain investor trust and provide them with incentives to invest more and more into sustainable green projects (Monasterolo & Raberto, 2018, p. 228). In their research of green finance credibility Hassan & Guo results showed an imbalance on how credible official company reports are when it comes to their

exposure of negative impact on the environment. Their studies showed that many European companies that separate periodical financial reports from periodical environmental reports tended to do a much better job in providing credible figures in their annual environmental impact reports (Hassan & Guo, 2017, p. 21).

Credibility of Proceeds

Where proceeds from GBs are re-invested has been a central argument. It has been a quintessential way of measuring the credibility status of these innovative financial instruments. How or the method in which proceeds are then distributed has also become a controversial topic. Even though the GB market has been expanding rapidly it has not showed real signs of formalizing. An official global framework that provides firm transparency and efficient transmission of collaborations efforts has not been standardized (Sartzetakis, 2020, pp. 11-12). It seems that communication between issuers and investors is a main concern that can promulgate credibility of proceeds. In their research Karpf & Mandel accentuate that in the past years municipal GBs have become increasingly more trustworthy and have instilled a solid economic base (2018, p. 4).

GBs have had an essential role in how a business in the GB world have generally managed their green marketing efforts. Notwithstanding, the management of proceeds and reinvestment of proceeds have been an area of concern for many companies. This is because one wrongdoing in where proceeds where invested might dramatically hinder one's reputation because proceeds went into unethical or non-sustainable projects. Nevertheless GBs have been seen to be great financial instruments to finance projects in clean energy and sustainable buildings (Paranque & Revelli, 2019, p. 7). There are numerous examples that demonstrate that international companies need to follow a strict process in order to assure its credibility. This includes hiring third party verifiers, periodical control over management and rigorous monitoring of accounting figures (Ng, 2018, p. 12). Christophers argues that green-labelling should not be considered enough for GBs to be credibly respectful because to become an interchangeable product, GBs need to gain a level that ensure their economical and fungible value (2018, pp. 14-15). Appendix 28 demonstrates some success and failures of GB as innovative products.

Greenwashing

Greenwashing involves a deceptive approach towards buyers by making false claims of hypothetically environmental-friendly practices of a company's' product and services (Lane, 2012, p. 583). As for reverse greenwashing, considered an opposite strategy approach. It entails falsely perpetrating fake advertising towards competitors who have not committed greenwashing practices but are still incorrectly criticized and judged in a public manner thus harming their reputation (2012, p. 583). Even though Nanayakkara & Colombage assert that GBS can provide investors with a premium, as well as a safe investment option, this could only be possible given that buyers of GBs can deal with the unrest caused by greenwashing (2019, p. 11).

4.3.2 Sustainable Development Goals

The UN SDGs have already been introduced earlier in this study. They seem to play an important role in the GB market. This is because their targeted efforts in many ways is directly correlated to some of the targeted problems that GBs are meant to provide environmental and societal solutions. The controversial part has mostly been on the labelling of a specific SDG as a bond. For example: SDG 7 *Affordable and Clean Energy* goes hand in hand with many projects that have been financed by GBs. This can cause certain confusion amongst investors of what is legitimately labelled and how a specific project will be provide benefits. By promoting SDGs investors interested in fighting climate change and solving social problems for humanity have become key elements or means by which a change can be instilled in the perception in the minds of consumers. Thus increasing investments efforts towards green or social projects (Pimonenko, Bilan, Horák, Starchenko, & Gajda, 2020, p. 1). Climate finance has been a concern by many investors tackling SDGs, but no clear evidence exists if green financial instruments can be sufficiently gathered to cover workforce, machinery and technology costs needed to reach SDGs targets (Lagoarde-Segot, 2020, p. 20). A similar distress has happened with the labelling of Green Sukuks which cover a more religious fulfilment aspect rather than categorizing problems by their underlying concerns that are affecting the planet. This could essentially cause confusion in investors of what classifies as a Green Sukuk because it would have to add another variable of concern for GB participants. In this case it would be the religion of Islam. The conglomerate Kagayaki Energy Sdn Bhd was responsible for issuing the first Green Sukuk

bond nicknamed in Malaysia as Green Sri Sukuk Tadua (Keshmindera, Singhb, Wahid, & Abdullahd, p. 6).

4.3.3 Psychology

The psychological aspect of investors' minds towards environmental concerns has been going through an evolution of harsh and sometimes critical changes. In the GB market mental behaviour amongst all entities involved have caused certain concerns and writers have had different perceptions and views published in their scientific studies. For example, in the banking industry, a pro-environmental autonomous approach has been up taken by individual employees. These approaches have strongly influenced management policy towards greener practices that in the long run have been proven to be more cost effective (Laskowska, 2018b, p. 134).

It is clear that green finance focuses strongly on humanity and environmental concerns. In an empirical study, evidence found by Zhou demonstrated that GBs not only cause a positive effect in the stock price of a business, net marginal gains and operational efficiency but also increase innovative practices that enhance a company's core values (Zhou & Cui, 2019, p. 1). The growth of the GB market has been greatly linked to a phenomenon caused by an increase in investor's consciousness towards environmental concerns. As a result psychologically green awareness has had strong change that has caused a surge in responsible purchasing (Gabteni & Bami, 2018, p. 154). Karpf agrees with these views and affirms that GBs have gradually become more appealing in the past years for investors and have caused an increase in demand for them, and an even stronger inclination to re-invest in them (Karpf & Mandel, 2018, p. 5). Even if GBs have sometimes caused inferior cashflows compared to their brown counterparts. It has not seemed to damage the mental devotion in investors' minds to financially incline more towards green or ethical undertakings. Evidence of this can be seen in the American GB municipal market where stakeholders have given up returns because of their willingness to finance green initiatives (Larcker & Watts, 2020, p. 33; Nanayakkara & Colombage, 2019, p. 1).

Sometimes it can be said that GBs can take a purely marketing approach for gaining investor interest, or that GB bond attitude towards them can be easily influenced through media channels (Broadstock & Cheng, 2019, p. 18; Paranque & Revelli, 2019, pp. 7-8). Finally, evidence towards investors willingness to invest in green finance

can be damaged by controversial issues. Issues such as greenwashing practices being exposed on online channels such as websites will not only damage an individual's mindset towards a company brand or image but can also directly affect one's own happiness due to new high conscious levels towards environmental practices and investments (Szabo & Webster, 2020, p. 1).

4.3.4 Performance

The level of performance that GBs have had in the financial market since their inception has been a critical subject matter that has been investigated by various authors. This fourth CM slowly started gaining attention in scientific writings that have gained momentum since 2018. These metrics on how well GBs do in concrete statistical figures have caused huge concerns for investors and issuers. Whom have had limited access to actual proof that a GB could possibly outperform regular bonds (Febi, Schäfer, Stephan, & Sun, 2018, pp. 5-6).

Certification agreements between external organizations and issuers have played an important role in the performance of a GB. Its risk premium can be affected by a wide variety of factors. Such as the size of a given green project, the amount of debt needed, time of release, credit history, return on investment and finally current market interest rate can also have a large influence on this risk premium (Q. Wang et al., 2019, p. 12). In a comparison study of two sets of 89 regular bonds and GBs it was found that generally GBs enjoyed greater yields and liquidity and tended to be more stable. Making them also less volatile than their conventional counterparts. Although GBs may have negative premiums which means that funding has been made at a discount implicating that a sense of consciousness is what finally pushes buyers to enjoy less returns for having a financial stake in green environmental developments (Bachelet, Becchetti, & Manfredonia, 2019, p. 16; Karpf & Mandel, 2018, pp. 4-5). Partidrige & Meda demonstrated opposite findings in their comparative analysis research that went from 2014 to 2018 where they studied an index made up of municipal GBs and a comparable S&P index made up of regular bonds. They found that GBs bested their conventional bond rivals and found a premium or which is now labelled as a greenium. In their analysis they found that in the secondary market green municipal bonds have usually had a 5 basis points lead ahead of regular bonds within their study set (Partridge & Medda, 2020, p. 1).

Gianfrate & Peri argue that a GB's advantage is more prominent to happen when they are issued by the very biggest of corporations, therefore making large companies the real true crucial players in ecologically transforming our economy (2019, p. 127). In a numerical study by Shaydurova et al. showed that during economic recessions GBs have been proven to be much less susceptible to negative impact than other financial instruments (Shaydurova, Panova, Fedosova, & Zlotnikova, 2018, pp. 114-115). Much debate has been seen throughout the past years in scientific papers which clearly makes the performance of GBs a controversial topic that includes many dissimilarities and disagreements within the research community.

4.3.5 Green Bond Sector

Another area of debate is how the GB sector has been divided into many categories or types of GBs in the financial market. The literature reviewed showed that there are numerous types of green bonds with different purposes issued by countries, municipalities, private entities and supranational organizations (Baulkaran, 2019, p. 349). This has been a topic of debate because classification of GBs has not really seen a standard list of them being officially published and even greater confusion is generated because different countries have separated types of GBs and created their own schemes of classification of GBs. They can always be categorized by an issuer's standards.

When it comes to privately issued bonds there are usually seven types: sovereign bond, local government bond, supranational or sub-sovereign and agency bond, asset-backed security bond, project bond, corporate bond and loan bond (OECD, 2017b, pp. 71-91; Sartzetakis, 2020, p. 16). Larcker and Watts also make a clear distinction that different types of bond have seen different outcomes or effects. For example, their results showed that municipal GB had less of a greenium than green corporate bonds and that both along with all the other types of bonds have very different institutional foundations(Larcker & Watts, 2020, p. 33). This makes it even harder to generalize how well a GB performs since there are many types with different purposes and features. Challenges to evaluate how green a GB is are critical issues by pension funds, national wealth funds, insurance firms, mutual funds, banks and other types of government organizations which have also caused much debate within how sector division of GBs ought to be (Hyun, Park, & Tian, 2020, p. 5). An example of how a country might have a different legal system to divide GBs into different categories can be seen in China's booming GB market. Appendix 29 illustrates the different types of GB's in

the Chinese economy and how some of them are administered by different officials and managed by entities in separate markets.

4.3.6 International Regulations

One of the most controversial topics that this bibliometrics analysis has encountered has been how global regulatory systems have advanced very little in coming up with a world standard framework for GBs as financial instruments. Global warming efforts saw their first global climate-change treaty signed in Kyoto in 1998. It made it the first-time countries met together to come up with collective solutions. Even though it did not include developing countries it was seen as a start to modernize the international sphere towards fighting climate change (Seo, 2017, p. 4). It is true that the GBP from the ICMA have been a guiding tool towards improving the trustworthiness and transparency of GBs (Reboredo & Ugolini, 2019, p. 1). The creation of GB indexes in stock exchanges have also promoted an enhancing effect on GB liquidity. This has happened in indexes such as the Luxemburg Green Exchange which started with an initial investment of USD 45 billion (Gabteni & Bami, 2018, p. 154; Reboredo & Ugolini, 2019, p. 1). Other exchanges in cities like Oslo, London, Mexico and Shanghai have ameliorated regulatory controls for GBs, as well as indexes such as Solactive Green Bond index, Bloomberg Global/Europe/US indexes and S&P GB Index (Pham, 2016, p. 7; Pham & Huynh, 2020, p. 3). These wide array of distinct index exchanges have caused an increase in GB desirability (Ng, 2018, pp. 20-21; Reboredo & Ugolini, 2019, p. 1).

Within the international sphere of GBs another controversial topic is how GB have been working in developing countries. Researchers have found that countries that are on their developing stages can make the most of green finance with instruments like GBs. This can be an advantage for an increase in cooperation with local, foreign, private and public entities towards more sustainability oriented goals (Banga, 2019, p. 13; Chiesa & Barua, 2019, p. 17). There are authors who oppose this view claiming that in Africa GBs are hindered because there is lack of professional rating institutions. (Bracking, 2019, p. 5). It is true that there seems to be a huge gap in finding a solution for greening the economy at a global scale since banks and governments clearly have different financial structure and policies (D'Orazio & Popoyan, 2019, p. 34). If there were regulations instilled, then harmonizing theses regulatory frameworks would prove challenging. This is because of the risk of a GB not meeting international

requirements elsewhere. It would thus make it impossible to connect demand with supply for GBs and create standardized guidelines that would incentivize GB investment options (Ehlers & Packer, 2017, p. 93; Sartzetakis, 2020, p. 22). Even if no single optimal rulebook has been produced to genuinely provide rating, data statistics, certification schemes, issuance of origin and other disclosures of information. If it were possible to create a standard set of guidelines on an international level it would have its pros. Global standards for GB compliance and validation would permit buyers to really be able to differentiate GB from conventional bonds (Huang & Yue, 2020, p. 4; Pham & Huynh, 2020, p. 11). The controversial scheme of one international standard guideline for everyone seems to be a topic that authors will be debating on for some time.

4.3.7 Company Focus

In the literature review we saw how many private companies have had a strong influence in the GB market since its inception as an innovative financial instrument. Seeking the benefits that can be obtained by private entities compared to government agencies is a complete other topic that merits a whole new and different study. In the GB market it is clear that companies such as Eletricite de France (EDF) which is mostly publicly owned announced back in 2013 an issuance of a EUR 1.4 billion worth of GBs with a coupon rate of 2.25%. Yet it was assessed by a privately owned French rating firm Vigeo who later teamed up with Eiris from Britain in a joint venture manoeuvre and became Vigeo Eiris (Baulkaran, 2019, pp. 335-336; Christophers, 2018, p. 18).

Issuers tend to choose external agencies to either value, standardize or rate a certain GB. They are seen as secondary opinion moderators which include companies from Norway like Cicero, German ISS OEKOM and Dutch/Canadian Sustananalytics. These companies play a huge role in transmitting a higher level of trust and transparency for all private and public players in the GB market (Huang & Yue, 2020, p. 5; Ng, 2018, p. 20; Sartzetakis, 2020, p. 16). The controversial factor remains in how profoundly rating agencies or any type of mostly privately funded company actually does their due diligence in a transparent and efficient manner. Even though extra costs arise from having an external body in one's logistic scheme. There needs to be some sort of balance that does not cause an extremely expensive GB appraisal because this

could pose a tremendous threat in GB's performance capabilities and ability to grow market share (Nanayakkara & Colombage, 2019, p. 12).

4.3.8 Digital Transformation

The final controversial topic is the digital side of the GB market and how GB support-ers can benefit from this global transformation that is affecting almost every single industry in our world today. Blockchain seems like a prominent area for future studies in improving GB transparency and has a huge potential that at this date is very limited due to both data availability and data measurability. Just like GBs, blockchain still seems to be at its early stages. Digital transformation has been included as one of the eight controversial factors in this study, not because it has been a huge cause of debate but because there is very limited information currently available of both scientifically peer-reviewed and non-peer-reviewed research but yet still proffers great potential.

Data can be a tool that can provide GBs with model development visualization and analysis techniques. Like the issuance of GBs throughout time that can be seen in Ap-pendix 30 created by Tang and Zhang. In their studies Tang & Zhang demonstrate another good example like the one before where knowledge can be exploited and where two databases can be merged together in order to build a model that illustrates GB growth on a global scale (2020, p. 6). This can provide readers with distribution models like the one in Appendix 31 that also merges datasets of different institutions to produce a global map of where GBs have been issued and using colour visualisation density to demonstrate that the darker a country is , the more GBs have been issued in that specific country.

4.4 Keyword Selection Process and The Green Bond Octagon

Section 4.3 demonstrated that there are gaps and much debate in certain topics that merited a deeper evaluation of published literature on GBs from its inception until May 2020. This has led to an assessment of how to design the qualitative portion of this study and will also play an important role in chapter five's empirical method. This portion of this thesis is not directly included in the methodological section because it can only be replicated to a certain extent. The 8CMs have been the foundation of two qualitative visual tools that will be created in order to increase the intellectual depth and clarity of this bibliometric study.

4.4.1 Keyword Metrics and Sets

There is a general assumption that any type of research discipline can be portrayed to have a set of most important terms or keywords. Subsequently a specific publication within that discipline can be deemed to have a subset of key words (Börner, Chen, & Boyack, 2003, p. 185; Callon, Courtial, Turner, & Bauin, 1983, pp. 199-200). In a bibliometric analysis co-wording analysis is the only analytical tool that has the ability to utilize subject matter to build a relation measure. Other methods use indirect techniques to associate research papers by their citations (Aria & Cuccurullo, 2017, p. 3). Aria & Cucurullo also see co-wording evaluation as way to elaborate linguistic models of a given topic that will aid with the comprehension of a paper's reasoning fundamentals. This method can be tested not only on an author's established collection of keywords in a given paper but also on the entire text or its abstract (Aria & Cuccurullo, 2017, p. 3).

This study has created a set of eight specific keywords which have entitled the focus of the previous section's 8CMs: Credibility, SDGs, Psychology, Performance, Bond Sector, International Regulations, Company Focus, and Digital Transformation. Within each of these subjects a list of sub-words within these topics have been generated. It is important to note that the creation of this subset of words relates and is influenced by the topic in hand, GBs. In investigative research, it has been noted that each journal article usually has a set of keywords either in the paper's abstract or on the title that can highly reflect the purpose of the emphasis of a study. "Removing suffixes from words by automatic means is an operation which is especially useful in the field of information retrieval and by ignoring the issue of precisely where the words originate, we can say that a document is represented by a vector of words, or terms". (Porter, 2006, pp. 211-212)". A model created by Porter demonstrates how searching and finding the stem of a word can allow one to discover related connotations. For example, with the word connect: "connected, connecting, connection, connections" would all evolve from the same stem. By doing so, this can help to bring down the total amount of terms and convolution within a given study sample (Porter, 2006, pp. 211-212). We have applied the same concept to the qualitative side of this study and made table that is shown on table Appendix 32. The importance of this table is highly valuable for the next step in our development of an assessment process of GBS. This table will also be needed to complement our empirical methodology chapter 5.0 and

will be a notable instrument that will be included in the Green Bond Dashboard Template (GBDT).

4.4.2 Green Bond Octagon

Analyses that are focused on co-wording methods can be applied differently depending on the given topic in hand. This may permit one to conceptually construct themes, figure and images that help build a meaningful bibliometric map (Cobo, López-Herrera, Herrera-Viedma, & Herrera, 2011, p. 164). The following segment will explain how the grading section of the GB Qualitative Assessment Tool can be implemented and how it can be visually illustrated.

GB Controversial Grading Scale

Inspired in the Standards Based Grading method (Reform, 2017). This study has formulated an in-house grading scale to assess the qualitative side of this study. Each one of the articles within the experimental group will be graded based on their performance in each one of the 8CMs. Studies that strongly cover a controversial metric will be given a score of 4, meaning the highest possible grade, and a 1 for not covering that topic at all. Further explanation can be appreciated in Appendix 33.

Visualization Effect

"Human visualization is the process of forming a mental image of a domain space. It is a cognitive process performed by humans in an attempt to form a mental image of the nature of functions, objects, and processes" (Olsen, Korfhage, Sochats, Spring, & Williams, 1993). This can be done graphically or linguistically. The previous section demonstrated a linguistic method. As for this technique will transform the information that will be gathered by the rating scale utilized to grade the 8CM terms. Graphical visualization models tend to have a faster analytical impact on readers which demand less cerebral retention techniques and produce visual effects that can enhance comprehension while easing identification development (Olsen et al., 1993, pp. 71-73).

The Green Bond Octagon has been created to enhance the ability of readers to comprehend the assessment of any one of our 98 articles within our experimental group that delve in the GB subject. We have used the previously mentioned tool, Sketchometry, in order to create octagons representing the given scores of the narrowed down

controversial topics within the GB field. As each one of the 8CMs (A,B,C,D,E,F,G and H) will have received a grade from 1-4 which will then be plotted as a dot with its assigned letter on a scale in an f(x) function graph. The higher a grade is the further from the origin of a graph will the dot be located. Appendix 34 illustrates six possible outcomes and how they could possible look after our Green Bond Octagon visualization procedure. As we can see octagon 1 proofs to be a perfect square and not an octagon, this can only happen if a given journal article strongly covers all 8CMs. This is very improbable to happen but helps to understand the purpose. An article strongly covering only one of the eight metrics will be plotted as in case 2, more examples of possibilities can be observed in Appendix 34 with example cases; 3,4,5, and 6. The variations of different octagon shapes in this study is 1680. This figure will be explained in chapter 5. Each one of the octagons may be unique unless two or more journal article receive the same grades on all 8CMs. Having similar shapes would signify a similarity between two or more articles. These graphical representations will be included in our GBDT in chapter 5.

4.4.3 Three-Word Green Bond Pie Chart

Within our assessment process keywords are of great importance and play a crucial role in our analytical journey. It is clear that extracting key terms can facilitate one to consolidate or compress the significance of a journal article in a more efficient manner (Onan, Korukoğlu, & Bulut, 2016, p. 1). After doing a filtration process and examining each one of the 98 journal articles, the number of new keywords within a given study will be counted. The words that will be used to search if one of the journal articles strongly covers one of the 8CMS can be seen again in Appendix 32, under other relevant words. It is important to understand that this list of words is not only limited to that specific set of words. As explained before a word may have other synonyms that are not within this table. Suffix removal for standardization purposes has been used. Words that will included in our word count will not include those within the reference section, title, or margins. It is also important to understand that each journal in most cases has a set of keywords that are usually placed bellow a journal article's title or abstract that highly represent the article in hand. This set of keywords will also not be included within the words in the word count calculation analysis, but a synonym from them may be included in the count. Only the three words or terms that appear the greatest number of times will be illustrated in pie charts like the one in Appendix 35.

The total number of times one of these three most used words is cited within a given journal article will be included within this supplementary analysis and displayed in our GB Three Word Pie Chart. This pie chart will play a significant function in the design of the GBDT that will be explained in the next chapter.

5.0 Methodology:

This chapter covers the empirical element of this study. The previous chapter did an assessment of some of the controversial points prevailing in the field of GBs that have led to the conception of this methodological process. Given that the objective of this thesis is to explore the nature of GB since their inception until 2020, this empirical segment of the study will be applied to relevant literature. This will help to comprehend the entire methodological journey of this bibliometric analysis. This chapter will highly concentrate on the quantitative aspects of our methodology which encompasses a systematic organization and classification of data that will be statistically portrayed (Hsieh & Shannon, 2005, p. 1278; Morgan, 1993, pp. 115-116; Zupic & Čater, 2015, p. 457). Nevertheless, as previously mentioned our methodology must not be seen as two methodologies but as an assessment that led to a quantitative and qualitative synthesis. This methodological approach was inspired in Zupic & Cater's framework for science mapping research in bibliometrics studies that has five stages. This has stimulated the creation of our own bibliometric system with relevant variables that can enhance the comprehension of the status quo of GBs (Aria & Cuccurullo, 2017, p. 960; Zupic & Čater, 2015, pp. 431-449). The Five Stage Bibliometric Journey is presented in Appendix 36.

5.1 Method Selection Process

The first step of the bibliometric journey has already been thoroughly covered as has the bibliometric data collection and the filtration of this data. Software selection has also been presented in the chapter before, please refer to Appendix 22. The data cleaning process can be seen in chapter 4 section 4.1.1. Now we will have a deeper view of how a research sample has and can be selected. As well as how to select a dynamic and efficient bibliometric research scheme with meaningful strategic parameters.

5.1.1 Research Samples

Given that the software selected for this bibliometric analysis on GBs is currently only compatible with 5 databases: Web of Science, Scopus, Dimensions, PubMed and Cochran Library. The Scopus database was selected because it is the only one that can be freely access by university students from Munich Business School. A filtration funnel has been developed, please see Figure 5. This funnel highlights three of the most

important steps into selecting a suitable research sample. In our initial search process three terms were used: green bonds, green financial instruments and greenwashing.

Figure 5: Filtration Funnel for Isolating Relevant Articles
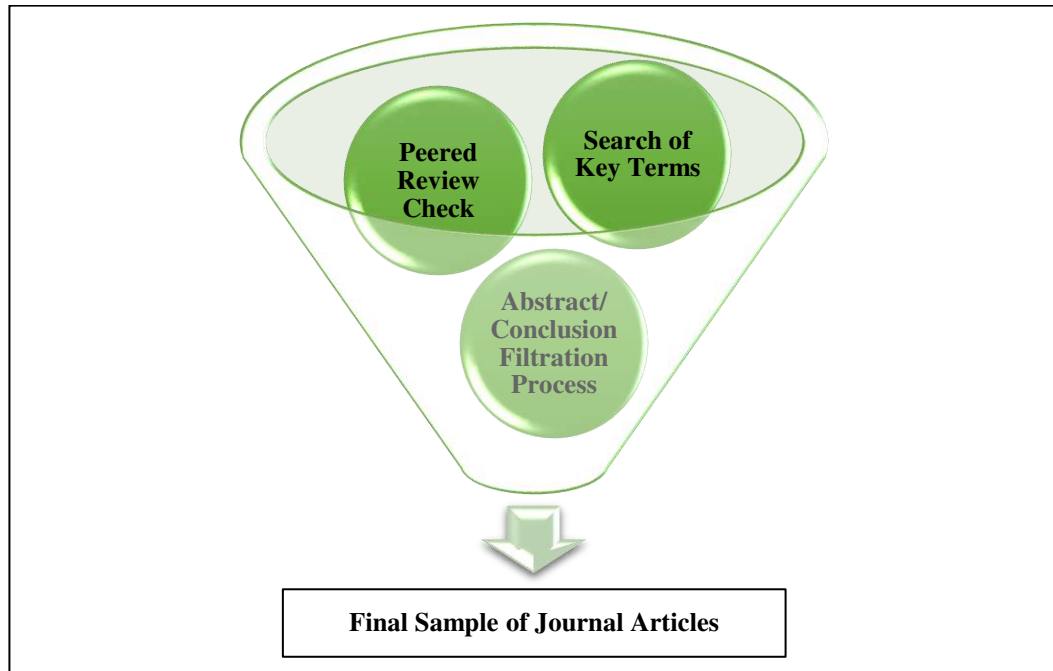
The more tedious and final step after having set a time-lapse of published material if necessary, would be reading through the entire content of the sample of articles that have been selected and doing a more qualitative filtration examination. After a full filtration process this research on GBs is based on a final number of 98 peer-reviewed journal articles.

5.1.2 Types of Bibliometrics Research

According to Aria & Cuccurullo and Cobo et al. the following table in Appendix 37 illustrates the different types of popular bibliometric taxonomy techniques. Our method has a applied a mix of taxonomies and units of analysis. The units of analysis used in our study from these styles of bibliometric taxonomies are highlighted and pointed with arrows in Appendix 37.

5.2 Empirical Research

The aim of this paper is to see how GBs have developed into innovative financial instruments since 2008 until May of 2020. An empirical exploration will try to pro-gressively respond to this question. This empirical research, in tandem with the

literature review and last chapter's assessment process will allow for a much deeper and compressive response to the research question.

5.2.1 Data Analysis

The data in this part of the study has been analysed in a quantitative manner using a combination of R program software coupled with statistical R-packages and web interfaces. As for the qualitative side has taken a much more rhetorical approach with the creation and elaboration of the 8CMs.

R package and Biblioshiny

The installation of the selected software packages for this study have utilized R and R studios as the backbone software programs. Very little programming is required for these programs to work simultaneously which use an add-on called Bibliometrix. Bibliometrix is a software package that specializes in bibliometric analyses and can be downloaded as a package add-on, on R-Studio. When the set-up of these R, R-Studio and Bibliometrix is done the final analysis can be completed using Biblioshiny which is a web-interface tool that is considerably more user friendly for non-programmers. Biblioshiny allows Scopus files to be uploaded. Compatibility of these files is of great importance since the format of this files can only be read by Biblioshiny if they have the configuration format that can only be downloaded from the Scopus web-database or from the other four databases mentioned in section 5.1.1.

Controversial Metrics

In the previous chapter, section 4.4.2 explained the GB Octagon which was a qualitative way of achieving a deeper understanding of GBs. It utilized the GB Qualitative Assessment Tool and Controversial Metric Grading Scale to form a visual outcome of the results. Given that the 8CMs contained 8 *objects* and 4 *samples* or levels of grading. This would amount to a total of 1680 different possibilities of octagon shapes. The shape/result of these octagons would depend on how well a specific journal article covered each one of the 8 metrics. The following permutation equation can generate the number of different results that are possible in the GB Octagon scheme, as well as the calculation used for this study, in Appendix 38. For future studies, an octagon shape or geometric shape can take a different form, given that any other study might

have less or more *objects* and could possibly have a different grading scale with less or more *samples,* but the same formula could be potentially applied.

The total average of the results of the whole data set of 98 GB Octagons will be assessed. This will allow for an overview of the total averages of each one of the 8CMs. A similar procedure will be done with the results of all the Three-word GB Pie Charts to determine the three key terms that are utilized the most throughout the entire analysis of all the articles.

The Eras

Dividing the sample of 98 articles into three eras may allow one to grasp a more profound understanding of how GBs have developed in a time basis perspective. The ensuing parameters in section 5.3 will be applied given their bibliometric relevance that will clarify the purpose of this study on GBs. Future studies can construct different periodical divisions depending on subject and when it first appeared in academic or non-academic literature.

5.2.2 Fusion of Data Analysis

Setting up an empirical research format for bibliometrics studies has been done so in this study through a combination of a quantitative data tools or group of software programs. Coupled with a more qualitative analysis side that has led to the creation of the 8CMs model that will allow for the better assessment of peered reviewed papers that are relevant towards GBs. Using these two types of strategies while devising time lapse splits can generate a powerful data analysis instrument that can be implemented into future studies of GBs.

5.3 Analysis Design

The design of the methodological analysis of this study has been inspired through readings from (Aria & Cuccurullo, 2017; Cobo et al., 2011; Dreesbach-Bundy & Scheck, 2017; Zupic & Čater, 2015). In these scientific journal articles the authors have selected a set of different parameters with which they have based their studies on. This signifies that each study has a unique bibliometric analysis. With a different selection of parameters that may be determined by the selected topic being analysed. This has inspired this study to come up with a set of parameters that will permit a more

profound analysis of GBs as innovative financial instruments. This will be coupled with a visualization technique that will permit for a dynamic evocative demonstration of results that will be presented in chapter 6.

5.3.1 Parameters

The different parameters utilized in the future union of this study's qualitative and quantitative dual method will be described in this section.

R- Biblioshiny

Appendix 39 and Appendix 40 describe the seven applications available on the R-Biblioshiny software: Dataset, Sources, Authors, Documents, Conceptual Structure, Intellectual Structure and Social Structure. Each of the seven applications from Appendices 39 and 40 have a wide variety of paraments that incorporate different formula techniques and algorithms that can analyse a literature sample with an X amount of journal articles. The limit of the number of articles that the Biblioshiny software can process is currently capped at 500. In our 98-journal article thesis sample a filtration process by the author chose 20 parameters or subfields from the seven applications available on Biblioshiny. A filtration process was done by the author to create Appendix 41 that represents a diagram of all the parameters from Biblioshiny that will be used to help answer the purpose of this study. Note that in Appendix 41 circles represent applications and squares represent parameters. Appendix 42 enumerates these 20 parameters on a table. The logic, selection and filtration process behind choosing these 20 parameters has been done at the desecration of the author after many trials and errors with the entire software ecosystem and its analysing and visual capabilities. These parameters have been chosen for the quantitative portion of this study.

Controversial Metrics

The parameters for the 8CMs have been covered in chapter 4. In this study on GBs this has been done so by employing a filtration process tool. Figure 6 is a simple but effective method of determining CMs within a given study field. It is important to note that the selection of key terms or subject/subfields that determine controversial metrics is a subjective evaluation. This can be done by researchers that have already achieved a high attainment of knowledge within a given topic to compose an extensive literature review.

Figure 6: Analysis Design Attainment of Controversial Metrics
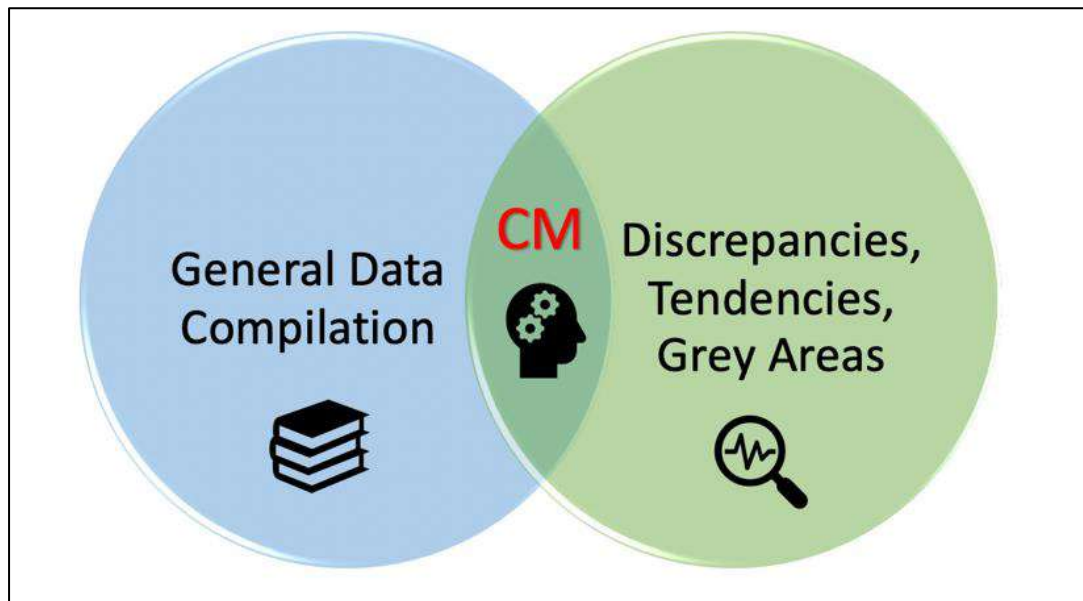
5.3.2 Data Visualization

Visualization systems are fundamental to fully understand the results of our study. This is why different visual techniques have been designed to provide readers with a wider perspective and interpretation of the results ahead.

R- Biblioshiny

The analysis section of this study that has utilized R software and Biblioshiny will present its results in various forms of graphs, figures and tables in chapter 6.

Controversial Metrics

The visualization method and design for CMs have already been seen in Chapter 4. The two visualization techniques are the GB Octagon and the Three-Word GB Pie Chart.

5.3.3 Segmentation of R-Biblioshiny and Controversial Metrics

Section 5.3.1 demonstrated a selected group of parameters that are available and were chosen to be used with the Biblioshiny software system. Given that there are so many parameters apart from the 20 in Biblioshiny. A sub categorization has been created and divided all of this study's parameters into 4 sub-groups: A, B, C, D.

Group A: This groups includes Biblioshiny parameters that will be shown in the results section but will not be included in the Green Bonds Dashboard Template (GBDT). More on the GBDT in section 5.4.

Group B: This groups includes Biblioshiny parameters that will be shown in both the results section and in the GBDT.

Group C: This groups includes Biblioshiny parameters that will be shown in both the results section and in the GBDT with the distinction that it will focus on parameter results that are unique to each era.

Group D: This groups includes 8CMs parameters from the qualitative side of this study that will be shown in both the results section and in the GBDT.

5.4 The Green Bond Dashboard Template

This section makes up the heart of this study. The GBDT has been devised by gathering tools from the previous section's systematic steps on analysis design. This has facilitated the creation of a dynamic dashboard that can help researchers understand the development of GBs since their inception. Visualisation plays a major role in this section to improve a more effective communication technique. The GBDT will only use extracted data from groups B, C and D.

5.4.1 Modus Operandi

The design of the GBDT has been designed to include the following bibliometric parameters of measure that have been divided into the following four segments:

A. General Information from Data:

This portion of the GBDT covers: the title of journal article. Assigned chronological number #, 1 being the oldest published journal article and 98 the newest according to Scopus. Author(s). Era: 1, 2 or 3. Year of publishing on Scopus and finally the digital object identifier (DOI) if available of the journal article.

See Figure 7 in the next page for general information data highlighted in red.

Figure 7: GBDT General Information Section

B. Biblioshiny Data:

This will include the author(s)' key words in each journal article if available. The three sources or journals that are most locally cited from the reference list during the era of that journal article. The three most frequent key words from author(s) during the era of publication of that journal article. The three most frequent key words from that article's abstract during that era. The country of origin of the publishing institution, shown with a corresponding flag(s). Global citation amount of that journal article. Finally, a collaboration world map highlighting the countries were the author(s)'s institution is located but only during that journal article's era.

See Figure 8 in the next page for Biblioshiny data highlighted in red.

Figure 8: Biblioshiny Data Section

C. 8CMs Data:

The Green Bond Octagon can be generated using the Controversial Metric Grading Scale. The Three Word Pie chart uses the GB Qualitative Assessment Tool explained in section 4.4.1 and Appendix 32. After a filtration and counting process of every single one of the 98 article. The Three Word GB Pie Chart illustrates the three most used words from the GB Qualitative Assessment Tool and their frequency count within the article that is being analysed. PDF wordcount was used to determine the frequency of the 3 keywords that appeared the most. This may allow the reader to see visual weight divisions of three most common terms that appeared in each article by using the GB Qualitative Assessment Tool from Appendix 32.

See Figure 9 in the next page for 8CMs data highlighted in red.

Figure 9: Eight CMs Data Sections
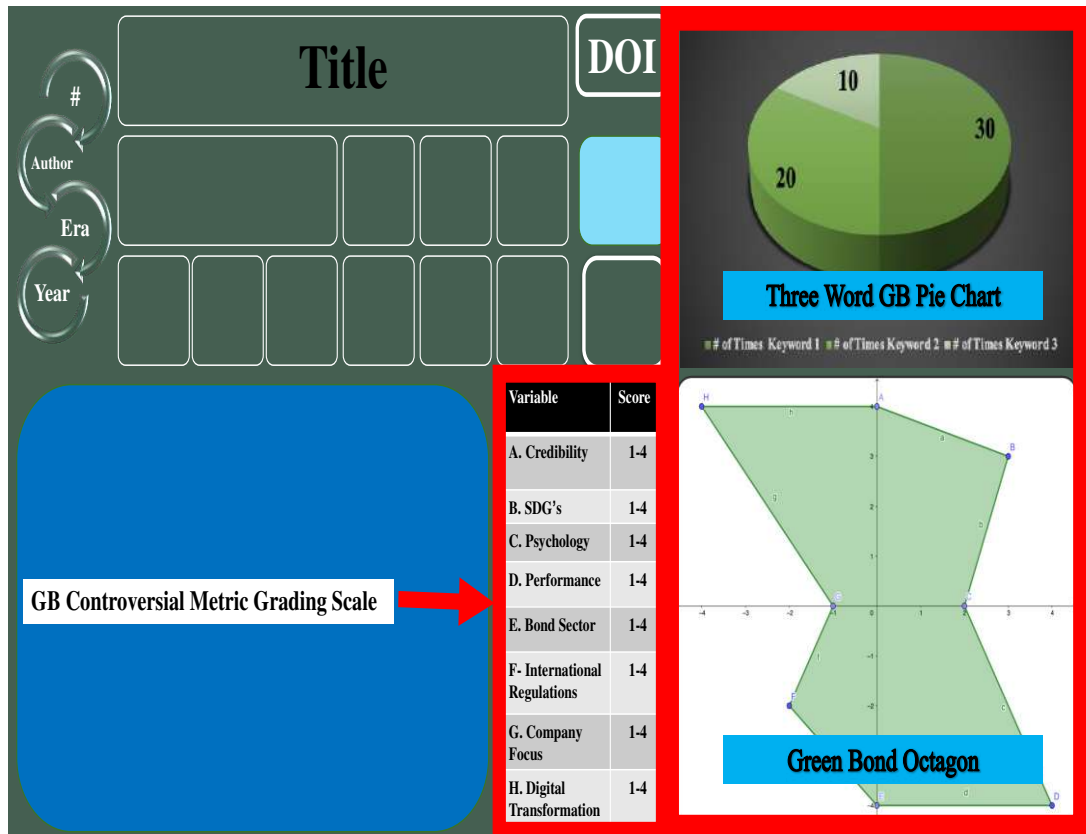
D. Era Data:

There are four main information tables, one for each one of the eras. Additionally, a total one with a summary of all eras that have been generated to analyse the following set of variables in Appendix 43. The results will reflect the total figures for each one of the eras and of the whole intervention group of 98 articles.

5.5 Limitations of the Method

Replication of the given study is clearly possible. Although the current method possesses various drawbacks that might limit its full potential. The combination of parameters is one of the main limiting variables that can occur by applying this method. This is because future studies may have more or less parameters or CMs depending on the topic. Therefore, a different approach towards a studies design and visualization techniques might differ.

5.4.1 Limitations of Biblioshiny

Having access to the six different databases that are compatible with R-software and Biblioshiny might be problematic. In this study Scopus was the only one used. All these metadata centres might have articles that have been peered reviewed at different times or sometimes never even included. This entails that merging all databases might be problematic since the same article might have different years of publication. Some of these data centres focus on a niche of journals or medical studies. The lack of unification among all databases might limit the reach of the method.

The amount of research available on a given subject may also prove to be an important element that could possibly limit this study. An example can be if given subject has very few peered reviewed articles, then this intervention group might be too small to make efficient use of many of the algorithms within the applications available in Biblioshiny.

Updates on the R-software and Biblioshiny applications might include new parameters and formulas that can provide even deeper analysis on a given topic.
New ways of graph/figure visualisation could also change with future updates of the software eco-system.

5.4.2 Limitations of Eight Controversial Metrics

The 8CMs were conceived through an extensive literature assessment of peer and non-peered reviewed articles. Depending on the topic that is to be analysed, different sources of information might prove to be vital to clearly understand the origin, development, evolution and controversial areas of a given subject. The subjective side that may cause limitation to this empirical process might be that a researcher's perception of how a topic has developed might be different. Even more different might be the key terms selected to represent the controversial areas of a given topic. As well as the number of CMs that a study can have. This number will be important since it will be decisive to the shape that will come out of a similar geometric shape like the one in this study. Further the wording of the GB Qualitative Assessment Tool in Appendix 32 could also have a subjective selection of key wording that would determine which words are analysed within the sample of articles.

5.4.2 Limitations of the Green Bond Dashboard Template

The GBDT is designed to incorporate a dynamic and robust version of this paper's methodology by uniting qualitative and quantitative empirical strategies through a visualisation system. One must keep in mind that the selection of which parameters would be relevant or could better inform researchers or readers interested in the advancements or development of GBs. As GBs progress ever more so as innovative financial instruments this fabrication of a template design might defer if the topic were to be other than GBs. Some topics might have huge sets of documents available which would most likely make it a better study for a quantitative analysis rather than doing a very tedious and long qualitative analysis of a huge sample set.

Since there are so many different parameters that use complicated algorithms within the applications provided by Biblioshiny. Choosing the correct set or mixture of parameters that are to be visualized like in the GBDT ponders a subjective elaborative design. Meaning that depending on the sample size and focus of a study, may be possibly determined by a logical yet subjective combination of variables and features that will best illustrate a possible outcome of results.

6.0 Data Analysis and Results:

After applying the entire methodological process, the following chapter delves into the analysis's outcomes. The results from *Biblioshiny, the 8CM, and Eras* can be collectively found on appendices 64, 65 and 66 which include the full set of GBDTs.

6.1 R- Biblioshiny Results

6.1.1 Parameters

The following 20 parameters have been analysed by using a combination of software and interfaces previously mentioned. The following results have been processed and Biblioshiny will facilitate the visualization of these results.

Annual Scientific Production Plot

The graph in Appendix 44 represent the annual scientific production of our data sample of 98 peer-reviewed articles. Appendix 44 includes a table with the annual release of our sample. There is an annual growth of 32.39% in the production of journal articles. Growth increases exceptionally 2017 onwards.

Average Citation Per Year Plot

The parameter results in Appendix 45 demonstrates the number of times a journal article within our intervention group has been cited by other papers throughout the span of the period of focus in our study. This type of popularity of any given paper highly depends on, if Scopus includes all the scientific articles that have cited the paper being analysed.

Three Field Plot

Appendix 46 is the outcome of three fields plot analysis within a single relationship diagram. The three fields being analysed during this step were keywords used, authors and the country origin of the articles. The larger the square representing a given keyword, author or country the more it participated as a variable during the analysis of the 98 articles.

Most Relevant Sources Plot

Appendix 47 illustrates the 15 most utilized sources or journals. The Journal of Sustainable Finance and Investment is clearly the largest source of the sample group.

Most Relevant Authors Plot

Appendix 48 illustrates the ten authors that participated in the publishing of papers within the sample of 98 articles the most. Reboredo JC. is the only author that participated in the writing of more than two journal articles.

Most Local Cited Authors Plot

The 20 most locally cited authors are plotted on Appendix 49. The results demonstrate which articles of our sample data have been cited the most within our intervention group of 98 articles. Researcher Ryu D. is the most locally cited with 36 citations.

Most Relevant Affiliations Plot

The most relevant affiliations plot on Appendix 50 shows which ten universities have been the ones with the highest amount of publishing. Within our sample it can be appreciated that the University College London takes the first place with four articles being published during our time period of analysis.

Country of Scientific Production Plot

Appendix 51 illustrates a world atlas indicating the countries were the articles within our study group have been published. The darker the blue a country is the more articles that given country published peered-reviewed articles on the Scopus database. It is important to understand that some papers might have a collaboration of more than one author with a different nationality, meaning that a single journal article can come from more than one country. The top five countries with the most publication of journal articles are the UK, USA, China, France and Germany with 21, 20, 18, 10 and 10 journal articles respectively.

Most Cited Countries Plot

The most cited countries imply that the countries in Appendix 52 represent the top ten nations that have been cited the most within the 98 articles. Ireland, Germany and China take gold, silver and bronze with a total of 89, 55 and 47 citations respectively.

Most Global Cited Documents

Appendix 53 is a graphical representation of how many times an author's paper within our study sample has been cited by scientific research outside our study group. The most cited document was article number 10, *Corporate Social Responsibility in the Banking Industry: Motives and Financial Performance*, by Wu MW. It topped the list with a total of 168 citations. The bottom table in Appendix 53 shows the top ten most cited papers and their total citation per year since their publication.

Keyword Plus Plot

Appendix 54 utilized an algorithmic Biblioshiny option and demonstrates the 10 most frequent phrases or words that only appear in the reference section of the journal articles of the study group. Climate change was number one with a total of 11 occurrences.

Author's Keywords Plot

Appendix 55 shows a similar analysis as the step before, but this time with words specified by the author(s) of a paper. These words usually appear after a journal article's title or abstract.

Abstract's Keywords Plot

Appendix 56 shows the results for most relevant keywords within the abstracts of all the papers in our study sample. This takes into consideration the entire set of words within any paper's abstract or summary. This might cause the algorithm to not couple full terms together and might take only individual parts of a two-word term.

WorldCloud Most Frequent Words in Titles

Appendix 57 illustrates the most frequent words in all the titles of the 98 articles in this study in a WorldCloud visual design. The bigger a word is on this image, the higher the frequency of appearance.

TreeMap Author's Keywords

Appendix 58 is a visual representation of the author's 20 most frequent key words demonstrated in a TreeMap model.

TreeMap Abstracts

Appendix 59 exhibits the same process as the step before. A similar TreeMap outcome is displayed with the 20 most frequent words but this time from the abstracts of our sample of 98 articles.

Co-occurrence Network Map

Appendix 60 provides a very interesting graphical visualisation of the relationship between terms used by all 98 articles of our study and how they have been clusters into different groups or categories. Colour here shows how a certain term or word is grouped with others because of their mutual use when applying them to the different articles of this study. It is a way of interconnecting words based on their coupled-occurrence and distrusted into different sets of text that allow for a clearer visualization of data in hand.

Factorial Analysis Word Map

Appendix 61 shows the results of this paper's factorial or conceptual structure. This type of algorithm is used to see how primary variables within our study set can generate different subsets of variables from were the primary variables originally came from. Colour is used to differentiate concept aggrupation. The number of clusters can be inputted into the formula. In this case the divisional analysis of our study was divided into six groups.

Co-Citation Network Graph

Appendix 62 illustrates a co-citation network graph. A co-citation analysis of two or more articles is when they are "cited in a third article. Thus, co-citation is the counter part of bibliographic coupling. A co-citation network can be obtained by using the general formula: Bcocit $=A \times A'$ where A is a Document $\times$ Cited reference matrix. Bcocit contains the number of documents where a reference is cited in our data frame. Element bij indicates how many co-citations exist between documents i and j." (Aria & Cuccurullo, 2017, p. 969)

Collaboration World Map Graph

Appendix 63 depicts a world map of where publications that have been written by more than one author come from in our 98 article-set. This is a demonstration of the

cooperation that occurs between academic institutions that are based in different parts of the world and how they have conjointly produced a journal article in our data set. The darker the country is, the higher the number of articles that have been produced by an institution in that country. The more red-connecting-lines appear between two or more countries, means a more frequent cooperation between two or more institutions.

6.2 Controversial Metrics Results

The results of the 8CMs can be viewed throughout the bundle of GBDTs in the following set of appendices that are organized as the following:

- Appendix 64:
    - Summary of Era 1
    - GBDTs bundle for Era 1
- Appendix 65:
    - Summary of Era 2
    - GBDTs bundle for Era 1
- Appendix 66:
    - Summary of Era 3
    - GBDTs bundle for Era 1
- Appendix 67: Summary of all Eras

This last four appendices portray the results from the entire set of 98 articles and highlight averages and word frequencies. Along with an incorporation of the GB Octagon with the Three-Word GB Pie Chart. 3 out the 98 journal articles have not been included in the GBDTs. These 3 articles were not able to be found on any search engine or by using their DOIs, but it still appeared in the Scopus Database and were used for all the previous results. This was possible since all the parameters within Biblioshiny had access to data that it needed to generate the results that this study has achieved. These 3 articles can be seen on Appendix 68.

6.2.1 Green Bond Octagon Results

Appendix 69 contains a table with the average of the entire sample set of 98 articles, minus the three articles that were omitted because they were not possible to be found.

The full list of results of each article in the 8CMs can be viewed in Appendix 70. Figure 10 illustrates graphical summary of Appendix 69.

Figure 10: Average Results of Eras and Total of Green Bond Octagons
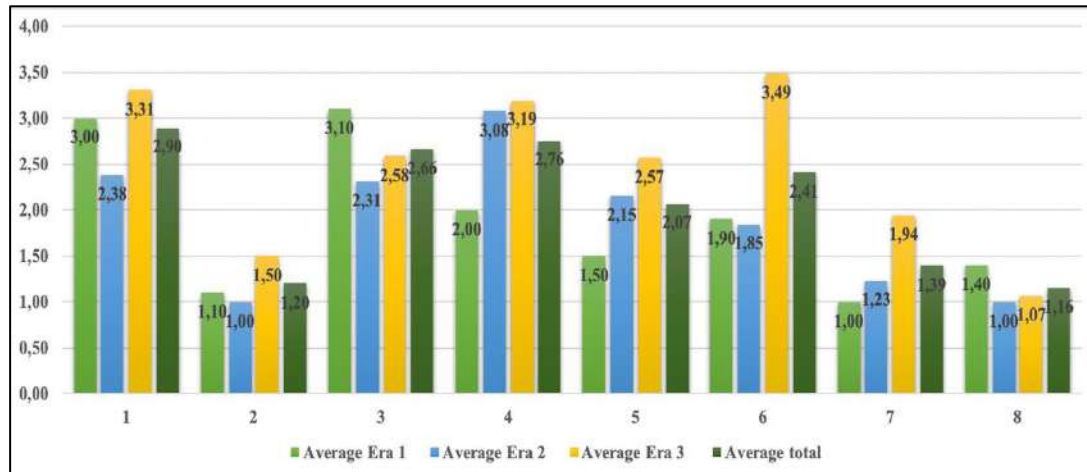
1=Credibility, 2=SDGs, 3=Psychology, 4=Performance, 5=Bond Sector, 6=International Regulations, 7=Company Focus, 8=Digital Transformation

6.2.2 Three-Word Green Bond Pie Chart Results

Table 1 shows the top five words or terms that appeared the most in the entire dataset results after applying the Three-Word GB Pie Chart analysis. Appendix 71 demonstrate the entire set of different word or term variables that were used to create the entire set of the Three-Word GB Pie Chart. *Table 2* in the next page depicts the words that were used the most amount of times when adding all category levels.

Table 1: Top 5 Words Category Key Word 1

Environment	**11**
Performance	4
Index	4
Greenwashing	3
Premium	3

Table 2: Top 5 Words Total of 3 Key Word Categories

Term	Key word 1	Key word 2	Key word 3	Total
Environment	11	8	3	22
Performance	4	5	10	19
Greenwashing	3	3	4	10
Sustainable	2	3	3	8
Measure	2	4	2	8

6.3 Era Results

The individual results for each Era are placed in appendices 64, 65 and 66 chronologically and are used to divide one era from the next. The original parameters can be viewed once more in the table of Appendix 43.

6.4 Result Synthesis

Section 5.4.1 Modus Operandi explains how the GBDT was created by selecting 3 segments out of 4 that were part of the division that was done in order to create a dynamic dashboard template. Appendix 72 is a final creation of a GB Octagon showing the average of the entire dataset results. Appendix 73 demonstrates a similar outcome but emphasizing on the top 3 key words in category 1 of the entire Three-Word GB Pie chart.

7.0 Discussion, Limitations and Avenues for Future Research:

The post hoc analysis and results of this study points to a clear coverage of the problem statement in regard to exploring the development of GBs through a bibliometric analysis. GBs have faced a variety of controversial factors and framework dissimilarities in their short life span. The dual methodology applied to this GB analysis has helped to comprehend a deeper understanding of how peered reviewed scientific literature has evolved from 2008 until May of 2020.

7.1 Interpretation and Implications of Results

A brief discussion of the results will be assessed in the next three sections. The bibliometrics analysis applied has aided in the interpretation and development of the GB market. This type of methodology approach confirms Dressbach-Bundy and Schecks' views of how results achieved through a bibliometric analysis can help examine trends and gaps in academic research. It confirms that by applying this technique a deeper interpretation and evolution of results can allow for a better understanding of academic literature in this or any other topic (Dreesbach-Bundy & Scheck, 2017, p. 1).

7.1.1 Biblioshiny

The results of the 20 Biblioshiny parameters utilized during the analysis of this study played and essential role to demonstrate a quantitative approach of how scientific peer-reviewed research on GBs has progressed.

There is a clear increase in publication of articles as time passes by from 2008 until May 2020. From the results it can be seen that most peer-reviewed research on Scopus has only began to be published in large numbers in recent years. This can be the cause of why most of the articles in this study had a very small amount of global citations. Meaning that authors in all fields of academic research have seldomly utilized or cited most of the studies in our dataset.

The Biblioshiny results helped to see the interconnection and networking effect that happens between articles of our study. This signifies that commonalities clearly exist in the topic division, and internal re-citation. The results helped achieved a clearer picture of where scientific researched is being produced, co-produced and from which journal sources they come from.

The results demonstrate that most research has been published in developed economies. Mostly northern hemisphere nations in Europe and North America. Although China clearly positions itself as a global leader in the production of scientific research on GBs. The small quantity of scientific research published in emerging economies endorses Guild and Hanif et al. views that delve into the constraints that obstruct the economic growth of the GB market in the developing world. Constraints such as knowledge and lack of human capital (Guild, 2020, pp. 9-10; Hanif, Aziz, & Chaudhry, 2019, p. 8). The bibliometric results demonstrate that developing countries have published very little academic material on GBs. All these implications can be correlated as to answer why there has been a hindering effect in the growth of the GB market in the developing world.

Keywords played an important role as variables of measure that have been used in previous bibliometric studies. There is a clear alignment with research produce by Li that states that keywords highlighted by an author(s) are of crucial importance in demonstrating the outcome of results in bibliometric analyses. This importance of keywords can aid in co-wording analysis, data query and selecting specific subject terminologies (Li, 2018, p. 1).The results demonstrated visual representations of terminologies, terms, labels or wording that were most frequently utilized in the 95 articles. The results displayed a different array of graphical and illustration effects generated by a series of algorithms that are incorporated in the Biblioshiny software. These optical illusions can helped capture a deeper understanding of scientific work published on GBs.

7.1.2 Controversial Metrics

The outcomes of the CMs have been displayed in a set of GBDTs that were used to display a mixture of a qualitative and a quantitative research strategy. The GBDTs allow readers to use them as a guideline that quickly captures the development of GB research. Additionally, the GBDTs can act as a GB encyclopaedia that is much more exclusive and specific because it narrows down to truly specific peer-reviewed research that is available on the Scopus database. There was a clear advancement in recently published articles gradually started to achieve higher results in the 8CMs and can be seen in the visual progression of dynamically amenable GB Octagon. Some of the 8CMs such as SDGs and even more so Digital Transformation scored the lowest out of all the controversial metrics. Meaning that most material of the 95 articles does

not cover these two topics. As for the metric Credibility, scored the highest results. This clearly means that the stem topic of credibility is the most widely used subject field in the sample of all the journal articles.

7.1.3 Eras

The production of scientific articles within our study's time-lapse analysis was the following: 10 articles for the first era, 13 for the second era and 75 for the third era. 52 articles of the entire study sample were all produced within 2019 and 2020. This clearly demonstrate that the field of GB is a very young topic.

7.1.4 Summarizing Remarks of Results

This research had the purpose of revealing the development of GBs as innovative financial instruments through a bibliometric analysis. The objective was identifying patterns and trends in the field of GBs. This study only took into consideration scientific peer-reviewed-articles from one of the biggest databases on academic literature, Scopus. The results summarize the qualitative and quantitative methodology used for this study. They have been displayed in various visualization techniques. The usage of software strongly aided the depth of the study on a quantitative level.

7.2 Limitations of Findings

7.2.1 Sources of Threat to Internal Validity

Three studies were unable to be found on any online database. Therefore, they were not analysed completely excluding the qualitative side of the methodology. As for two more studies can also be marked as invalid. Article 14 from the second era was not a peered reviewed article but a report published by the Economist. As for article 49 from the third era was a website report on hydropower that can also be said to not be a peered-reviewed paper. This signifies that the Scopus database may have internal errors that might affect the accuracy of results. It could mean a glitch in the system or a simple misclassification during the filtration process of limiting a study sample of only peer-reviewed papers.

Selection of a database can be a limiting function. Scopus was chosen because it proofed to be a substantially big enough database that includes a large amount peer-reviewed article and was freely accessible to students in Germany through the BSB.

Having access to other databases and potentially standardizing a final list of articles into a global one would be a great way to generate a larger and more inclusive dataset. Some drawbacks could be that not all databases have a compatible downloadable format that can allow R-software and Biblioshiny to analyse the data files provided.

Some articles might have been written before their implied year of publication. Since Scopus can take a large amount of time to finally process an article and mark it as peer reviewed. This can also open room for imprecisions of the exact dates that the data being analysed was actually published and how it affects its era or time division model classification. Some of the articles used in this study had up to a year difference between publishing that and peer-reviewed data by Scopus.

7.2.2 Imprecisions of Measures

Word counting done in the section of the GB Three-Pie Chart was all done manually from one article to the next. This leaves a fair level of human error in counting the words used to create all GB Pie Charts.

If the methodology used for this study were to be applied on a different topic the 8CMs would severely change. Not only into what entitles them but also the number and variance of controversial topics would be very different to a large extent. There would have to be a new construction of relevant metrics towards any given topic.

7.2.3 Size Limitations

The size of our study started with a final dataset selection of 98 articles. After this analysis five readings have been ruled out. The R package software coupled with the Biblioshiny interface may currently only analyse 500 articles at a time. Our dataset was much smaller than the limit. What this small quantity implies is that it still leaves much room for utilizing a few more sophisticated parameters and algorithms that are available on the Biblioshiny software. Some of these parameters that were not used in this study can only be generated with a larger set of around 300 journal articles. Since the peer-reviewed published articles until May of 2020 is quite limited in number. It would take an extended amount of time that would depend on how fast and how much GB research is published and is peer-reviewed in the near future. A larger set of articles would allow for a much more extensive and deeper use of other algorithms within the R and Biblioshiny software.

7.2.4 Other Limitations and Weaknesses

The creation of the GBDT was made to provide readers with a quick visualization understanding of useful data on each one of the articles of this study. The parameters used were meant to create a dynamic template. The limit of the number of parameters that were used on the GBDTs can also be a drawback. Selecting a right array of parameters to be displayed on a template is highly dependent on an author's educated yet subjective decision.

This study has used a wide selection of visualization tools to demonstrate examples, results and all other sorts of imagery techniques that have helped grasp a deeper understanding of GB studies. An important downside that merits being pointed out is the quality that a printed version may omit. Online visualization or an electronic version of this research would be the preferred choice for new readers, but it would definitely be a heavy file.

7.3 Avenues for Future Research

There is large room for future studies to utilize the methods or findings within this thesis. The tools developed can be re-applied by adding more articles released from May 2020 and onwards. These new articles published on the Scopus database would enlarge the dataset. The same analysis could be applied after using the same filtration process if a newly added article on GBs is peered reviewed and its file format is compatible with R and Biblioshiny Software.

The methodology can also be applied to other topics that might relate to environmental finance. This dual bibliometric methodology could also be applied to topics that are completely outside of the world of green finance. Nevertheless, this could only be possible for the quantitative side of the approach used during this thesis. Repeating the qualitative side may allow for future research to come up with new controversial metrics in their own subject and create similar visual results shapes like the GB Octagon.

Another crucial avenue for future research can be on what files or reports this type of bibliometrics analysis could be applied to outside of peered reviewed research. This research witnessed that many of the articles analysed during this study have used reports from official GB entities. Reports from the ICMA and CBI were cited with a

very high frequency. As well as reports from other entities like Bloomberg, SEB and the World Bank are frequently being updated and published. All of these reports if standardized and formatted to a file compatible with R and Biblioshiny software could be of huge benefit because of various reasons. There could be a deeper analysis of how reports have changed across time and the changes in the GB market. What their citation count status is on peered and non-peered reviewed studies could also help researchers view what sources are being used the most in the sphere of academic research on GBs.

Finally, it would be interesting to see how the qualitative side of this methodology could be embedded into the R-Studio software that requires a much higher level of coding software and programming. This could allow the possibility to create an application or app that includes the parameters used in the creation of the GBDT and can generate them more accurately and quickly. Creating each GBDT can be time consuming, this can be avoided by having a flexible online dashboard that can be easily used to generate bibliometric analysis like the one in this study.

8.0 Conclusion:

GBs have been very controversial, unstable and somewhat problematic financial in-
struments since their inception in 2008. The main areas explored in this paper looked
at what the current status quo of the GB market is and were controversial zones exist.
GBs have had to face several stages of change and growth throughout the past years.
A lack of uniform definitions, certification qualifications, standards, issuance prob-
lems and legitimacy are amongst the main issues attached to academic material that
has been published since the inception of the GB more than a decade ago. Definitions
of what is a GB, a sustainable bond or a climate bond have been changing throughout
time and have posed many doubts and questions into investors' portfolios decisions.
Not only have various definitions of a GB been evolving but so have the validity of
the institutions that have issued them. Different organizations both public and private
across the globe have also been in charge of setting standards and rules. A bibliometric
study with a dual methodology approach was used by the the author and experimented
with finding gaps in academic peer-reviewed research on GBs. Trends or gaps were
identified through an empirical analysis that provided a large array of results. Software
and a qualitative method aided in the visualization of different results achieved through
the application of different parameters.

To the best of this author's knowledge no other bibliometric analysis has been done
on the emergence of GBs. There was a total analysis of 98 articles that were furthered
narrowed down to 93 after three articles weren't available and two others were con-
firmed to not be peer-reviewed journal articles. A chronological division into three
eras was used from 2008 until May of 2020 to illustrate the development and evolution
that has occurred in the field of GBs. The number of peered-reviewed articles released
has been quite limited. In the past two years publishing of GB related papers has grown
dramatically. The focus of this research displayed that GBs can aid in the development
of the financial system. Publishing research that has achieved a high academic level
can provide essential knowledge for future generations. Forthcoming researchers can
develop on trying to capture the full potential of finance towards environmental goals.
Balancing our economy and our planet's health is a difficult task. One can state pre-
cious words from Confucius "Nature can live without humanity but humanity without
nature will perish". This expresses the huge importance that involves in looking after
the planet on all environmental scopes including the financial world.

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Appendix

Appendix 1: Green Bond Accumulative Issuance in (USD bn) **(SEB, 2020b, p. 6)**

Appendix 2: Green Bond Market Growth by Sector (USD bn) (SEB, 2020a, p. 9))

Appendix 3: Use of Proceeds Evolution % Division (CBI, 2020a, p. 1)
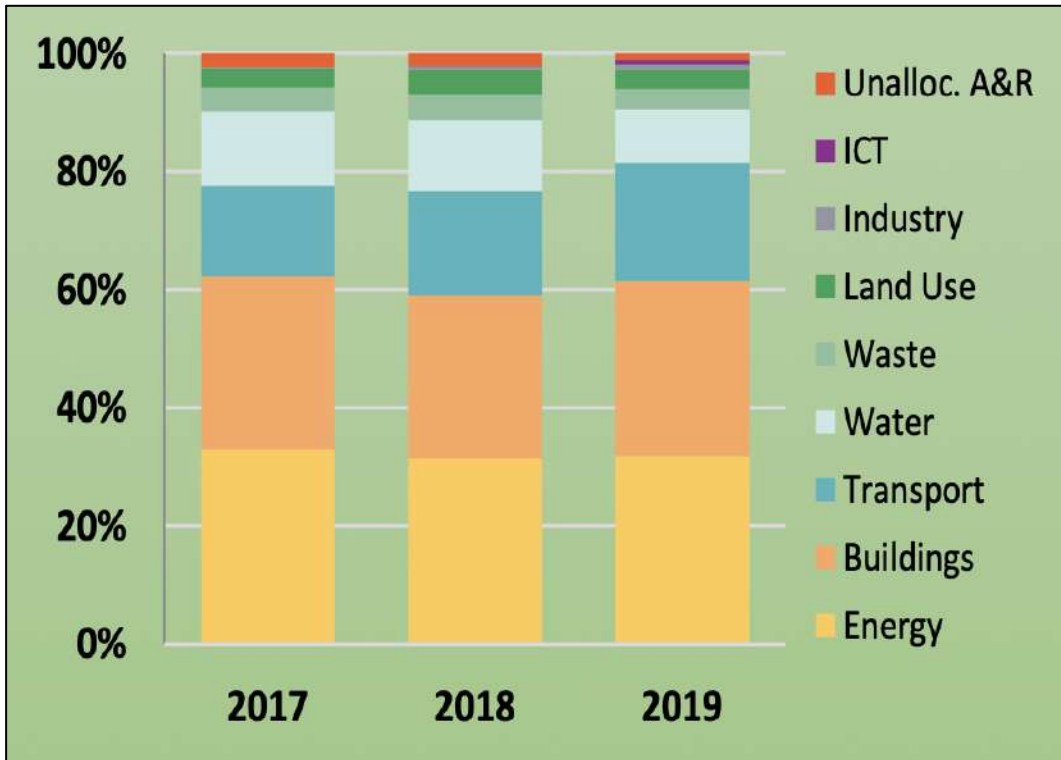
Appendix 4: Green and Social Bonds Mapping to Sustainable Development Goals (Adapted from: (ICMA, 2020a, p. 1))

Appendix 5: Five Primary SDGs impacted by funds from GBs (Adapted from:(SEB, 2019, p. 4))

Appendix 6: Top 20 2019 Green Bond Issuers in USD bn (CBI, 2020c, p. 4)
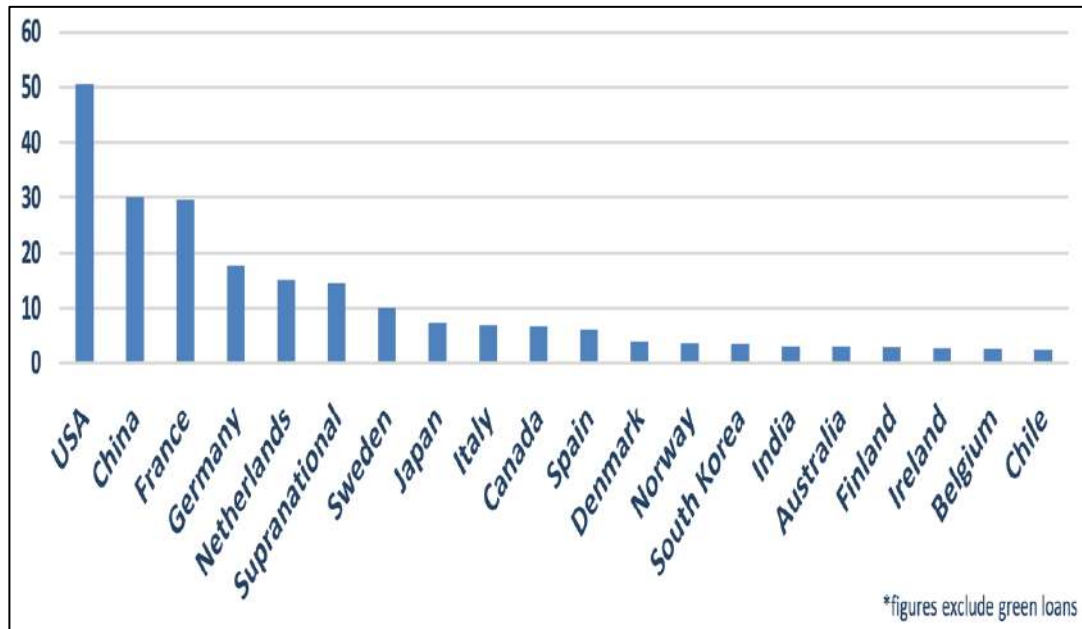
Appendix 7: Geographic Distribution in 2020 YTD (UniCredit & Dax, 2020, p. 16)
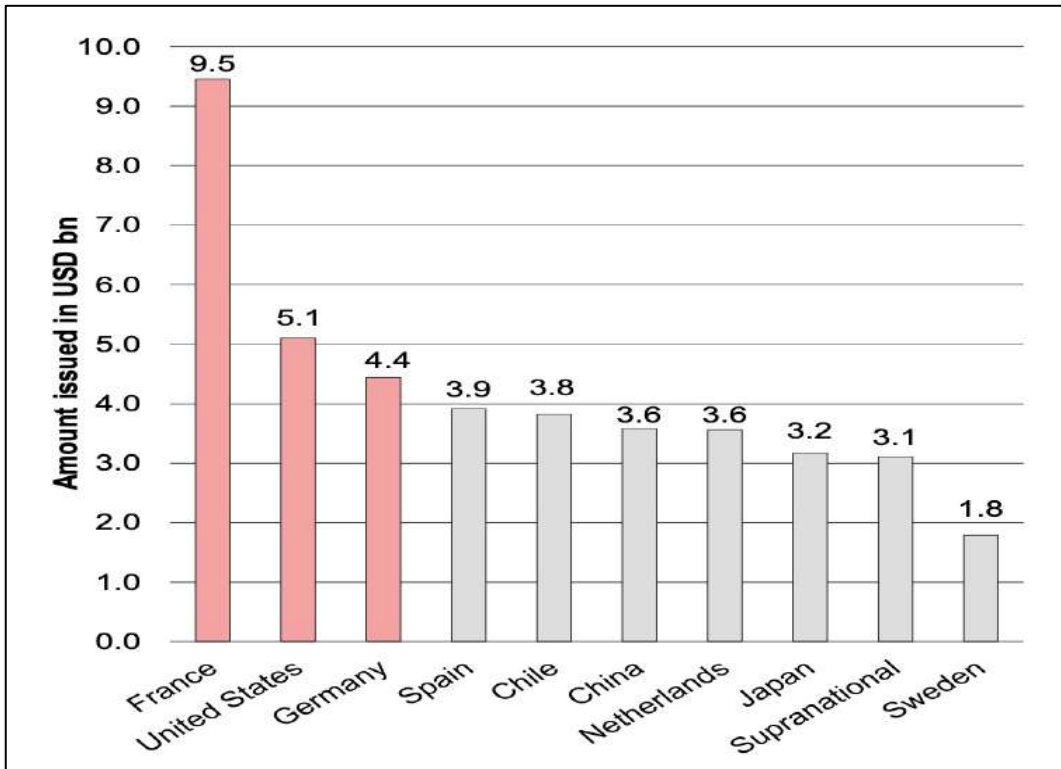
Appendix 8: Geographic Distribution Overall Geographic Distribution Overall *(UniCredit & Dax, 2020, p. 16)*
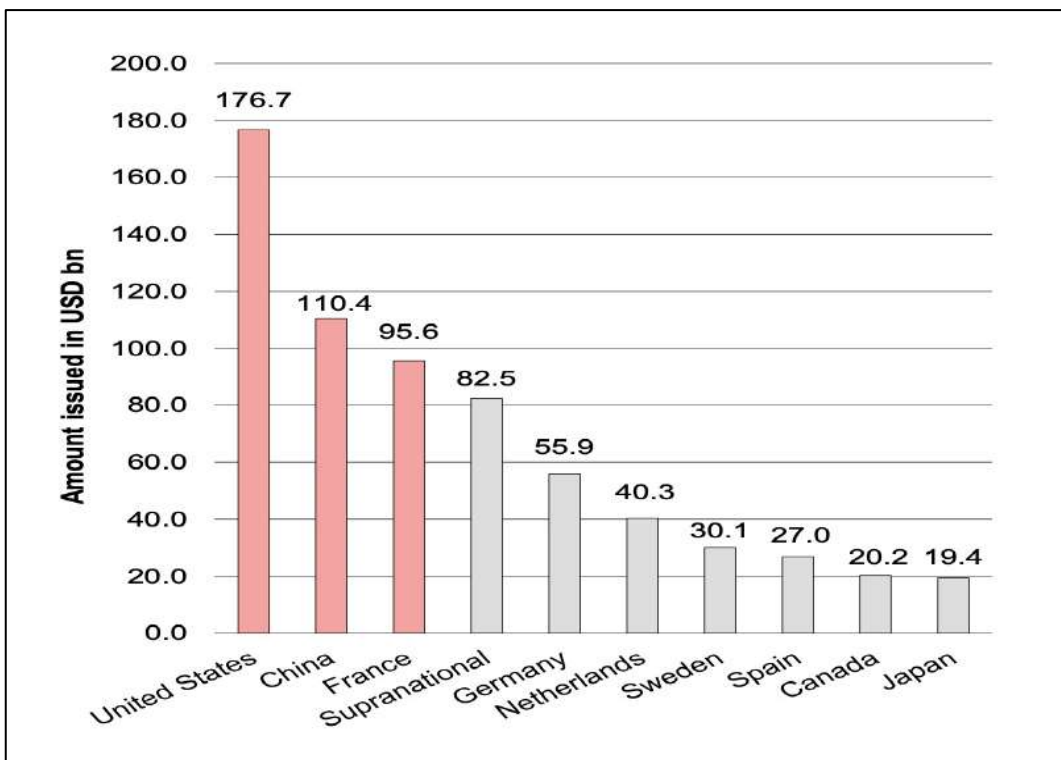
Appendix 9: Geographic distribution in 2020 YTD (total USD 49.8bn) (UniCredit & Dax, 2020, p. 20)
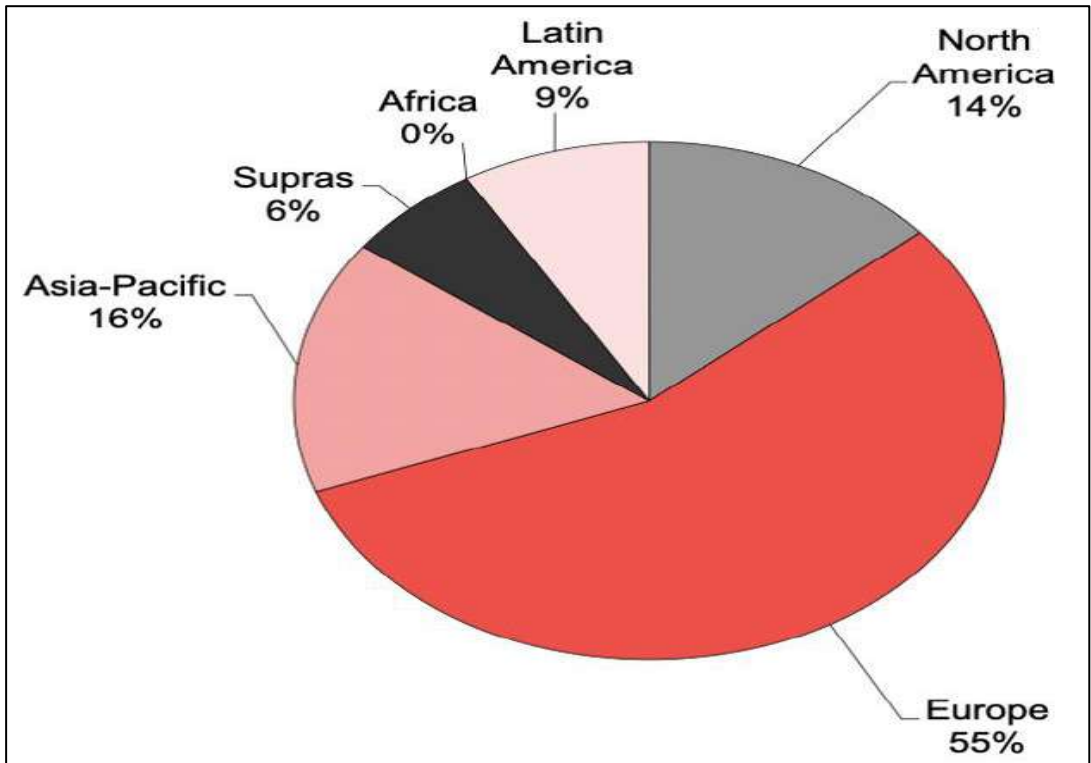
Appendix 10: Geographic % Distribution Since 2007 (total USD 817.4bn) (UniCredit & Dax, 2020, p. 20)
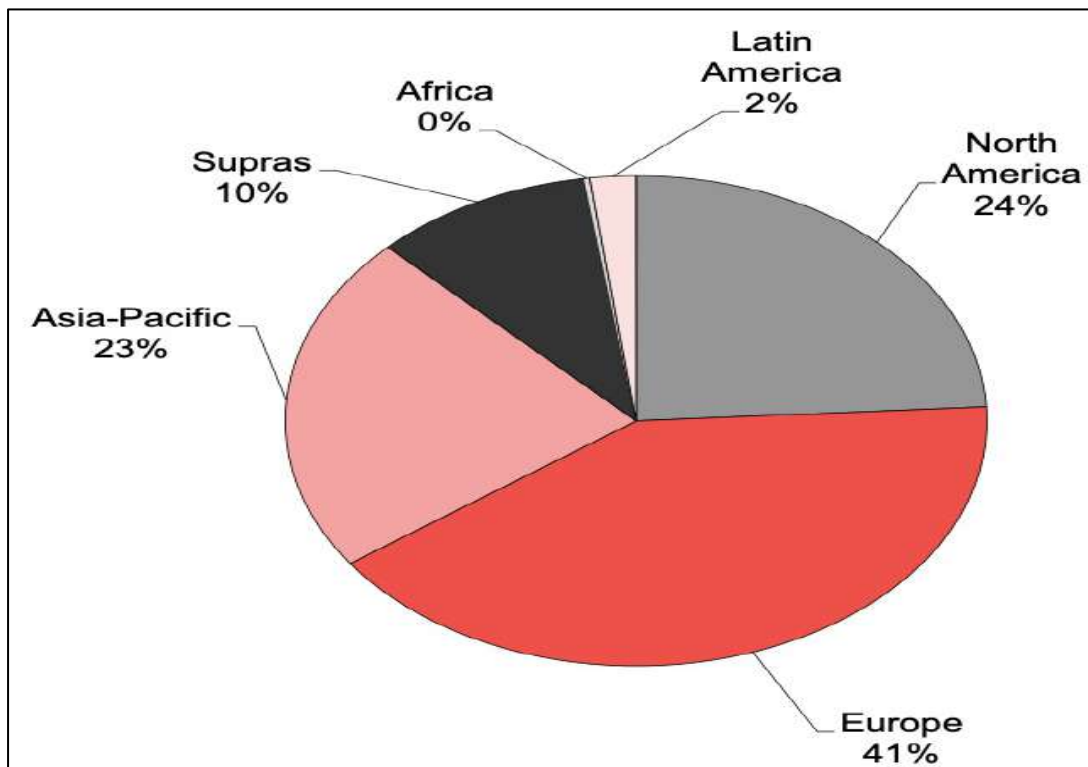
Appendix 11: Green Bond Market Growth by Region (USD bn) (SEB, 2020a, p. 9)
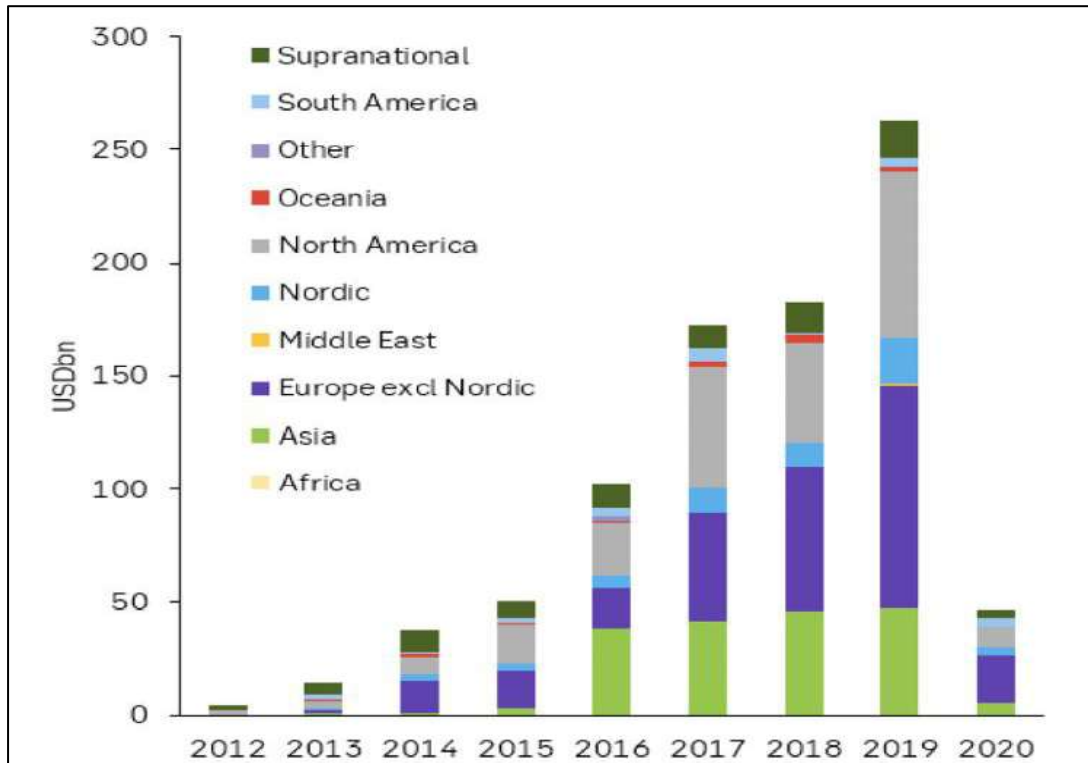
Appendix 12: % Allocation of GB Types by Region in 2019 (CBI, 2020a, p. 2)
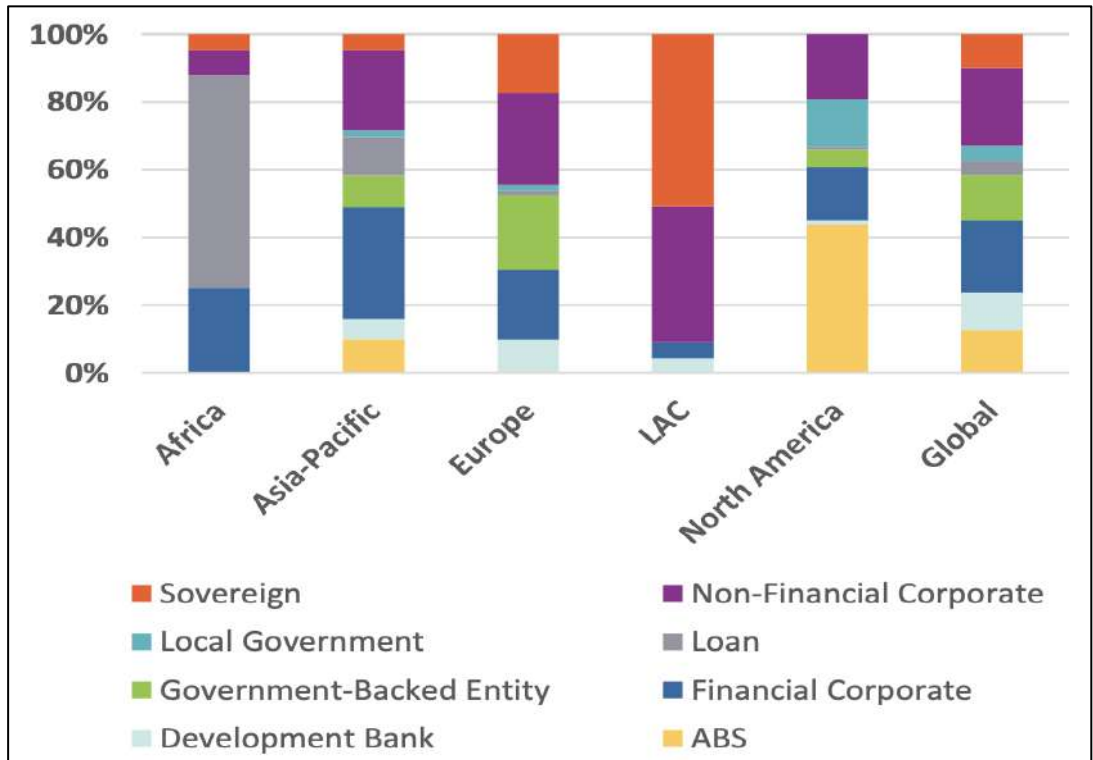
Appendix 13: Use of Proceeds Allocation by Region 2018-2019 (CBI, 2020a, p. 5)
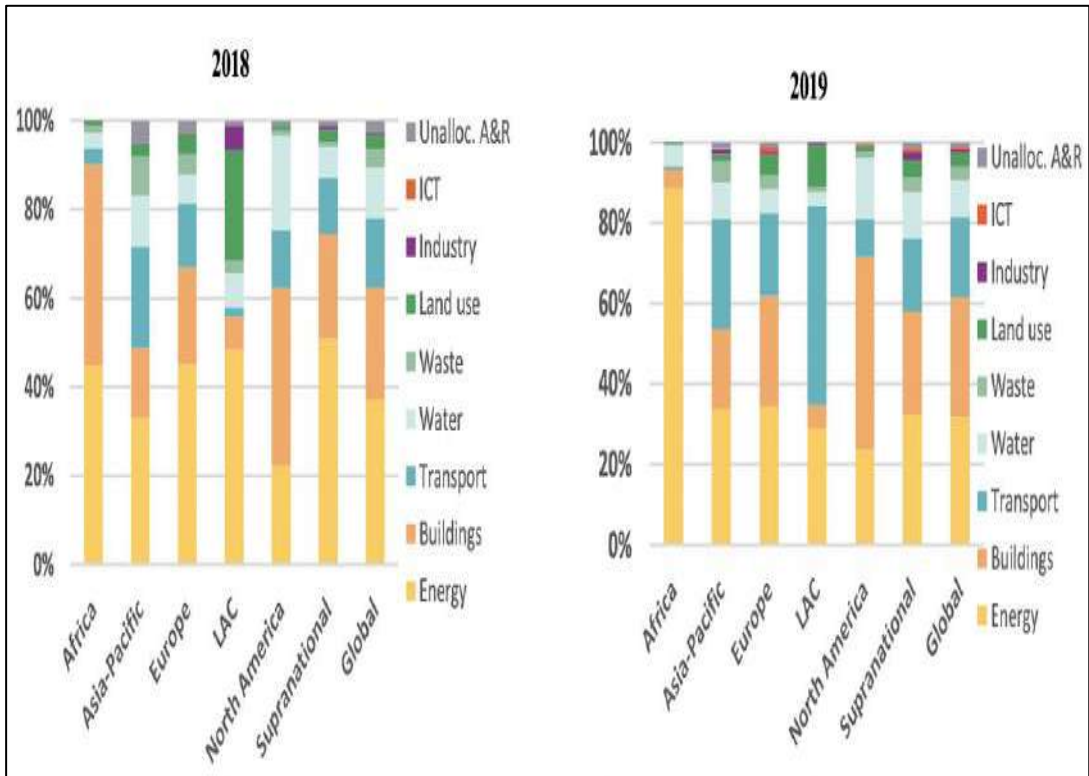
Appendix 14: Currencies Overview (UniCredit & Dax, 2020, p. 24)
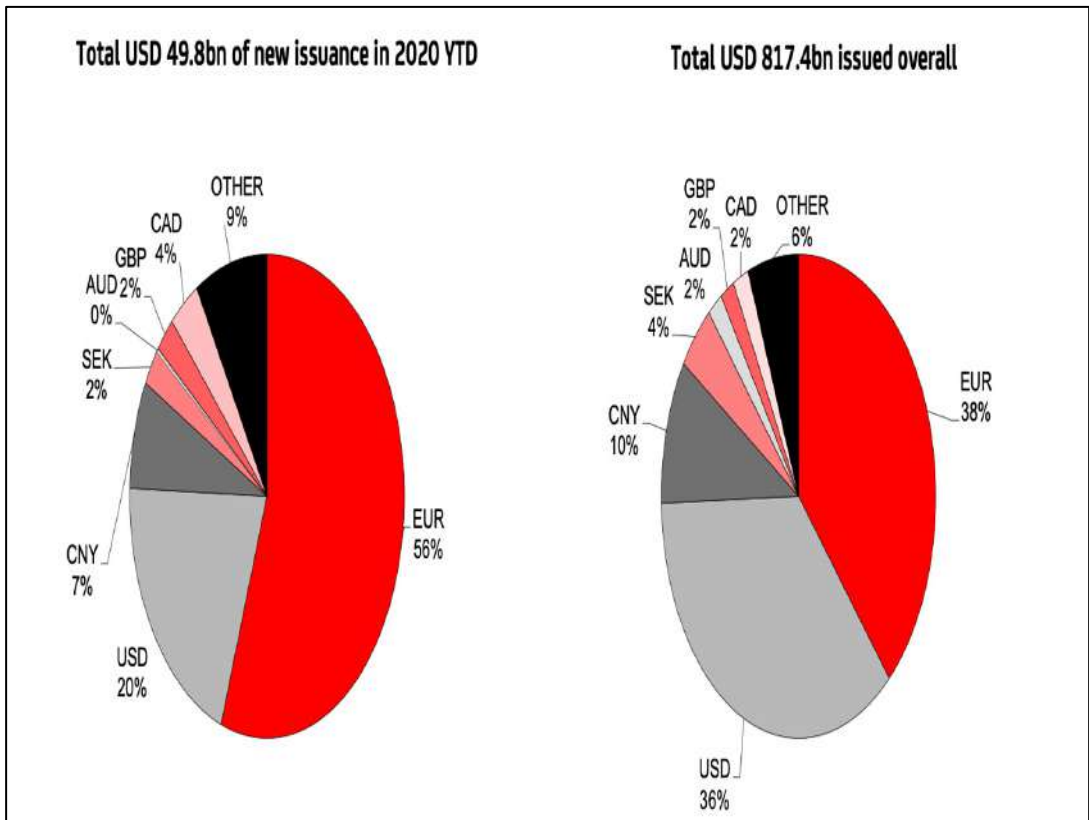
Appendix 15: Green Bond Issuance as a % of Total Bond Issuance (USDbn) (SEB, 2020a, p. 10)
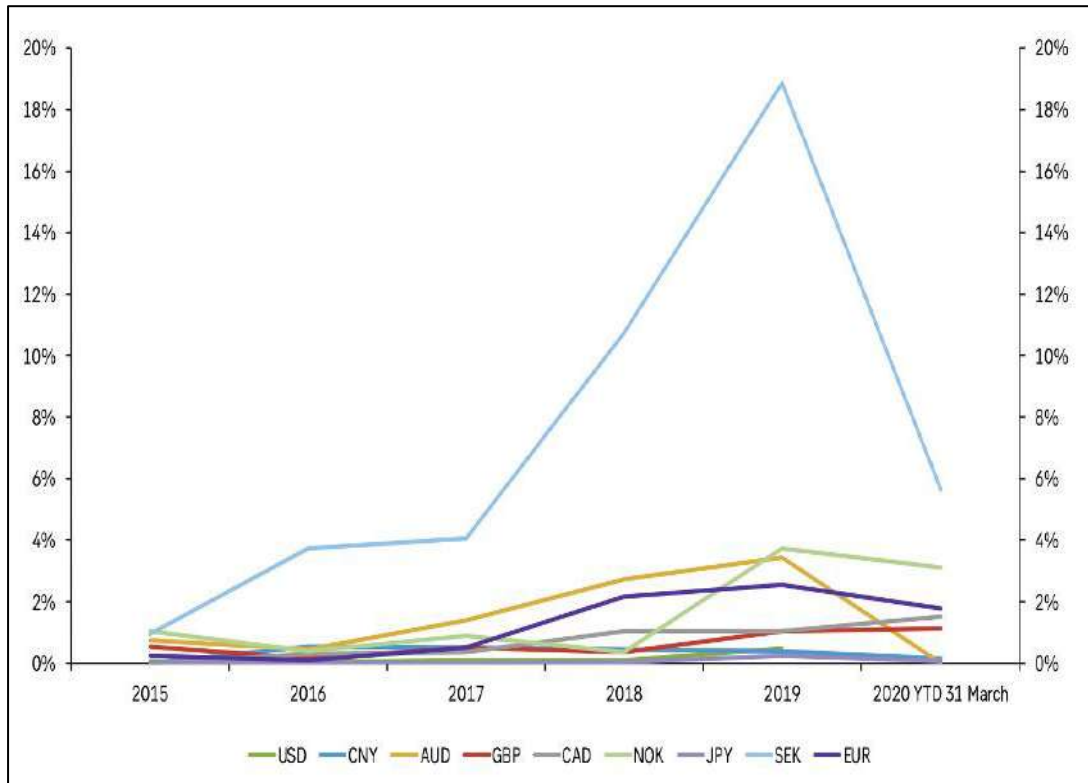
Appendix 16: Reviewers/Second Party Opinion (UniCredit & Dax, 2020, p. 28)
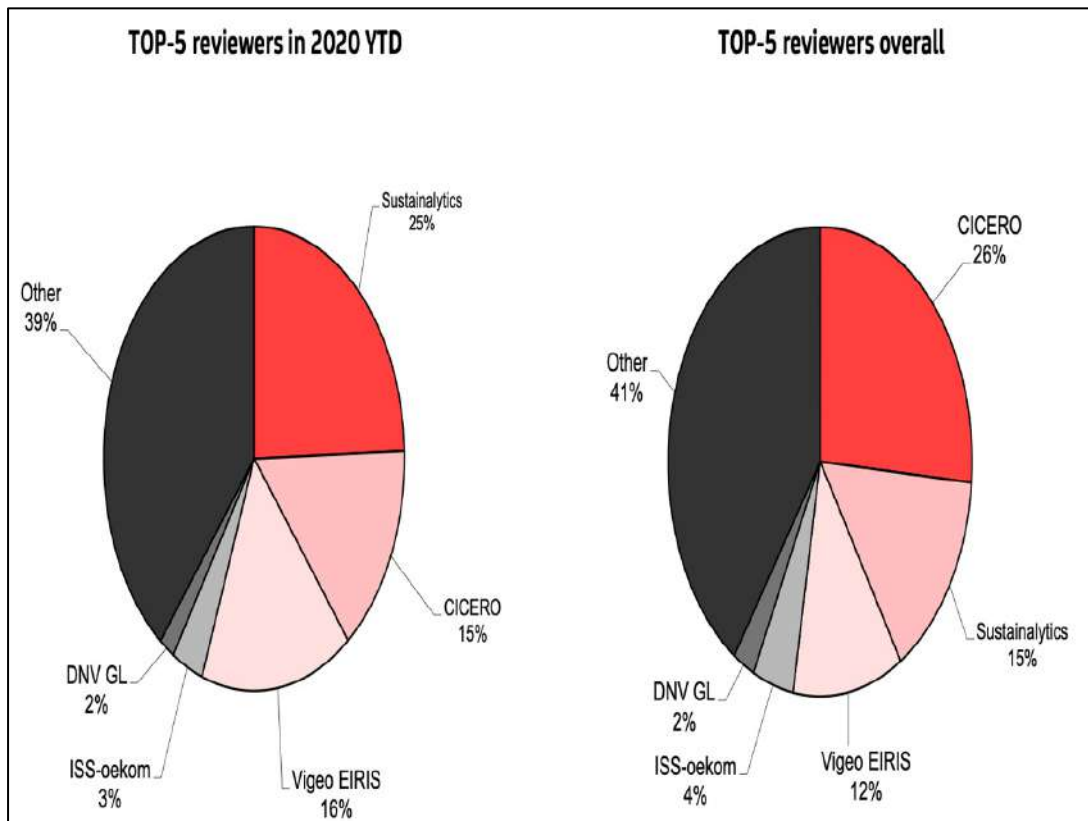
Appendix 17: GB Database Providers (Adapted from: (ICMA, 2018b, p. 4; Lebelle et al., 2020, pp. 18-19))

Data Provider	Database Release Year	Interface
Bloomberg	2014	Bloomberg Terminal
Dealogic	2015	Internet Browser
Enviornmental Finance	2015	Internet Browser
Climate Bonds Initiative	2015	Internet Browser
Cbonds	2015	Website/APP/Excel-Add in
Trucost	2014	EBoard
Shenzen Securities Information	2016	Excel, CSV/TXT, Database
Amundi	2018	ALTO2/Confidential

Appendix 18: First Extensive Step in Search Process on Scopus

191 document results

TITLE-ABS-KEY (green AND bonds) AND (LIMIT-TO (PUBYEAR , 2020) OR LIMIT-TO (PUBYEAR , 2019) OR LIMIT-TO (PUBYEAR , 2018) OR LIMIT-TO (PUBYEAR , 2017) OR LIMIT-TO (PUBYEAR , 2016) OR LIMIT-TO (PUBYEAR , 2015) OR LIMIT-TO (PUBYEAR , 2014) OR LIMIT-TO (PUBYEAR , 2013) OR LIMIT-TO (PUBYEAR , 2012) OR LIMIT-TO (PUBYEAR , 2011) OR LIMIT-TO (PUBYEAR , 2010) OR LIMIT-TO (PUBYEAR , 2009) OR LIMIT-TO (PUBYEAR , 2008) OR LIMIT-TO (PUBYEAR , 2007)) AND (EXCLUDE (SUBJAREA , "CHEM") OR EXCLUDE (SUBJAREA , "MATE") OR EXCLUDE (SUBJAREA , "CENG") OR EXCLUDE (SUBJAREA , "BIOC") OR EXCLUDE (SUBJAREA , "PHYS") OR EXCLUDE (SUBJAREA , "ENGI") OR EXCLUDE (SUBJAREA , "PHAR") OR EXCLUDE (SUBJAREA , "AGRI") OR EXCLUDE (SUBJAREA , "MEDI") OR EXCLUDE (SUBJAREA , "IMMU") OR EXCLUDE (SUBJAREA , "NEUR") OR EXCLUDE (SUBJAREA , "DENT") OR EXCLUDE (SUBJAREA , "HEAL") OR EXCLUDE (SUBJAREA , "NURS") OR EXCLUDE (SUBJAREA , "VETE")) AND (EXCLUDE (LANGUAGE , "Chinese") OR EXCLUDE (LANGUAGE , "Russian") OR EXCLUDE (LANGUAGE , "Dutch") OR EXCLUDE (LANGUAGE , "Italian") OR EXCLUDE (LANGUAGE , "Persian") OR EXCLUDE (LANGUAGE , "Polish")) AND (LIMIT-TO (DOCTYPE , "ar") OR LIMIT-TO (DOCTYPE , "cp")) AND (EXCLUDE (EXACTSRCTITLE , "Green Chemistry") OR EXCLUDE (EXACTSRCTITLE , "Journal Of Hazardous Materials")) AND (EXCLUDE (EXACTKEYWORD , "Chemistry") OR EXCLUDE (EXACTKEYWORD , "Chemical Bond")) AND (LIMIT-TO (SUBJAREA , "ENVI") OR LIMIT-TO (SUBJAREA , "EART") OR LIMIT-TO (SUBJAREA , "ECON") OR LIMIT-TO (SUBJAREA , "ENER") OR LIMIT-TO (SUBJAREA , "MULT") OR LIMIT-TO (SUBJAREA , "SOCI") OR LIMIT-TO (SUBJAREA , "BUSI") OR LIMIT-TO (SUBJAREA , "COMP") OR LIMIT-TO (SUBJAREA , "DECI")) AND (EXCLUDE (EXACTKEYWORD , "Hydrogen Bonds") OR EXCLUDE (EXACTKEYWORD , "Chemical Bonds") OR EXCLUDE (EXACTKEYWORD , "Chemical Analysis") OR EXCLUDE (EXACTKEYWORD , "Chemical Bonding") OR EXCLUDE (EXACTKEYWORD , "Chemical Composition") OR EXCLUDE (EXACTKEYWORD , "X-ray Diffraction") OR EXCLUDE (EXACTKEYWORD , "Crystal Chemistry") OR EXCLUDE (EXACTKEYWORD , "Metabolism") OR EXCLUDE (EXACTKEYWORD , "Crystallography") OR EXCLUDE (EXACTKEYWORD , "Infrared Spectroscopy") OR EXCLUDE (EXACTKEYWORD , "Scanning Electron Microscopy") OR EXCLUDE (EXACTKEYWORD , "Sodium") OR EXCLUDE (EXACTKEYWORD , "Solvents") OR EXCLUDE (EXACTKEYWORD , "Sulfur Compounds") OR EXCLUDE (EXACTKEYWORD , "Uranyl Sulfate") OR EXCLUDE (EXACTKEYWORD , "Ionic Liquids") OR EXCLUDE (EXACTKEYWORD , "Mohs Scale") OR EXCLUDE (EXACTKEYWORD , "PH") OR EXCLUDE (EXACTKEYWORD , "Protein Expression") OR EXCLUDE (EXACTKEYWORD , "Uranium") OR EXCLUDE (EXACTKEYWORD , "Carbon Dioxide") OR EXCLUDE (EXACTKEYWORD , "Green Chemistry") OR EXCLUDE (EXACTKEYWORD , "Iron") OR EXCLUDE (EXACTKEYWORD , "Lead") OR EXCLUDE (EXACTKEYWORD , "Mineralogy") OR EXCLUDE (EXACTKEYWORD , "Particle Size") OR EXCLUDE (EXACTKEYWORD , "Ultraviolet Radiation") OR EXCLUDE (EXACTKEYWORD , "X Ray Powder Diffraction") OR EXCLUDE (EXACTKEYWORD , "Crystallization") OR EXCLUDE (EXACTKEYWORD , "Escherichia Coli") OR EXCLUDE (EXACTKEYWORD , "Green Alga") OR EXCLUDE (EXACTKEYWORD , "Hydrogen") OR EXCLUDE (EXACTKEYWORD , "Hydrogen Bond Donors") OR EXCLUDE (EXACTKEYWORD , "Hydrophobicity") OR EXCLUDE (EXACTKEYWORD , "Isomerization") OR EXCLUDE (EXACTKEYWORD , "Molecular Dynamics") OR EXCLUDE (EXACTKEYWORD , "Sulfate") OR EXCLUDE (EXACTKEYWORD , "Sulfate Group") OR EXCLUDE (EXACTKEYWORD , "Calcium") OR EXCLUDE (EXACTKEYWORD , "Chemical Compositions") OR EXCLUDE (EXACTKEYWORD , "Chemical Structure") OR EXCLUDE (EXACTKEYWORD , "Chlorine Compounds") OR EXCLUDE (EXACTKEYWORD , "Crystal Atomic Structure") OR EXCLUDE (EXACTKEYWORD , "Cysteine") OR EXCLUDE (EXACTKEYWORD , "Dyes") OR EXCLUDE (EXACTKEYWORD , "Electron") OR EXCLUDE (EXACTKEYWORD , "Enzyme Activity") OR EXCLUDE (EXACTKEYWORD , "Green Fluorescent Proteins") OR EXCLUDE (EXACTKEYWORD , "Human Cell") OR EXCLUDE (EXACTKEYWORD , "Hydrolysis") OR EXCLUDE (EXACTKEYWORD , "Magnesium") OR EXCLUDE (EXACTKEYWORD , "Physical Chemistry") OR EXCLUDE (EXACTKEYWORD , "Protein Conformation") OR EXCLUDE (EXACTKEYWORD , "Silicate Minerals") OR EXCLUDE (EXACTKEYWORD , "Sulfur") OR EXCLUDE (EXACTKEYWORD , "Tellurate") OR EXCLUDE (EXACTKEYWORD , "Uranium Alloys") OR EXCLUDE (EXACTKEYWORD , "Aluminum") OR EXCLUDE (EXACTKEYWORD , "Amino Acid") OR EXCLUDE (EXACTKEYWORD , "Animal Cell")) AND (EXCLUDE (EXACTSRCTITLE , "Atmospheric Chemistry And Physics") OR EXCLUDE (EXACTSRCTITLE , "Environmental Chemistry Letters") OR EXCLUDE (EXACTSRCTITLE , "Heliyon") OR EXCLUDE (EXACTSRCTITLE , "Hydrological Processes")) AND (EXCLUDE (EXACTKEYWORD , "Density Functional Theory") OR EXCLUDE (EXACTKEYWORD , "Hydrogen Production") OR EXCLUDE (EXACTKEYWORD , "II-VI Semiconductors") OR EXCLUDE (EXACTKEYWORD , "Photoluminescence"))

View less ^

Appendix 19: Second Step in Search Process on Scopus

174 document results

TITLE-ABS-KEY (green AND financial AND instruments) AND (LIMIT-TO (SUBJAREA, "ENVI") OR LIMIT-TO (SUBJAREA, "SOCI") OR LIMIT-TO (SUBJAREA, "ENER") OR LIMIT-TO (SUBJAREA, "ECON") OR LIMIT-TO (SUBJAREA, "BUSI") OR LIMIT-TO (SUBJAREA, "COMP") OR LIMIT-TO (SUBJAREA, "EART") OR LIMIT-TO (SUBJAREA, "MATH") OR LIMIT-TO (SUBJAREA, "PSYC")) AND (EXCLUDE (PUBYEAR, 2006) OR EXCLUDE (PUBYEAR, 2005) OR EXCLUDE (PUBYEAR, 2004) OR EXCLUDE (PUBYEAR, 2003) OR EXCLUDE (PUBYEAR, 2002) OR EXCLUDE (PUBYEAR, 2001) OR EXCLUDE (PUBYEAR, 2000) OR EXCLUDE (PUBYEAR, 1999) OR EXCLUDE (PUBYEAR, 1998) OR EXCLUDE (PUBYEAR, 1994) OR EXCLUDE (PUBYEAR, 1987) OR EXCLUDE (PUBYEAR, 1981)) AND (LIMIT-TO (LANGUAGE, "English") OR LIMIT-TO (LANGUAGE, "French"))

193 document results

TITLE-ABS-KEY (greenwashing) AND (LIMIT-TO (PUBYEAR, 2020) OR LIMIT-TO (PUBYEAR, 2019) OR LIMIT-TO (PUBYEAR, 2018) OR LIMIT-TO (PUBYEAR, 2017) OR LIMIT-TO (PUBYEAR, 2016) OR LIMIT-TO (PUBYEAR, 2015) OR LIMIT-TO (PUBYEAR, 2014) OR LIMIT-TO (PUBYEAR, 2013) OR LIMIT-TO (PUBYEAR, 2012) OR LIMIT-TO (PUBYEAR, 2011) OR LIMIT-TO (PUBYEAR, 2010) OR LIMIT-TO (PUBYEAR, 2009) OR LIMIT-TO (PUBYEAR, 2008)) AND (EXCLUDE (SUBJAREA, "MATE") OR EXCLUDE (SUBJAREA, "BIOC") OR EXCLUDE (SUBJAREA, "MEDI") OR EXCLUDE (SUBJAREA, "CENG") OR EXCLUDE (SUBJAREA, "CHEM") OR EXCLUDE (SUBJAREA, "MULT") OR EXCLUDE (SUBJAREA, "NURS") OR EXCLUDE (SUBJAREA, "PHYS")) AND (LIMIT-TO (LANGUAGE, "English")) AND (LIMIT-TO (DOCTYPE, "ar") OR LIMIT-TO (DOCTYPE, "cp")) AND (EXCLUDE (SUBJAREA, "ENGI") OR EXCLUDE (SUBJAREA, "AGRI"))

Appendix 20: Final List and Final Filtration Step on Scopus

Scopus   Search   Sources   Lists   SciVal ⇗   ⑦   ⌁   🏛   NP

127 document results

‹ Back to Saved lists

SAVED_LIST (green bonds)

Document type	⌃
☐ Article	(98) ›
☐ Conference Paper	(18) ›
☐ Review	(6) ›
☐ Book Chapter	(3) ›
☐ Editorial	(1) ›
☐ Undefined	(1) ›
View less	View all

Appendix 21: Quick-View of Dataset

#	Author(s)	Title	Year
1	FRIEDEL TL	(NOT SO) CRUDE TEXT AND IMAGES: STAGING NATIVE IN BIG OIL ADVERTISING	2008
2	MARCINIAK A	GREENWASHING AS AN EXAMPLE OF ECOLOGICAL MARKETING MISLEADING PRACTICES	2009
3	GLEMAREC Y	FINANCING THE TRANSITION TO A LOW-CARBON SOCIETY	2010
4	PROTHERO A;MCDONAGH P;DOBSCHA S	IS GREEN THE NEW BLACK? REFLECTIONS ON A GREEN COMMODITY DISCOURSE	2010
5	SABBAGHI O	THE BEHAVIOR OF GREEN EXCHANGE-TRADED FUNDS	2011
6	MATHEWS JA	NATURALIZING CAPITALISM: THE NEXT GREAT TRANSFORMATION	2011
7	NYILASY G;GANGADHARBATLA H;PALADINO A	GREENWASHING: A CONSUMER PERSPECTIVE	2012
8	MARES MD;MARES V	GREEN DOCUMENTS THROUGH ELECTRONIC DATA MANAGEMENT	2012
9	LANE EL	GREEN MARKETING GOES NEGATIVE: THE ADVENT OF REVERSE GREENWASHING	2012
10	WU MW;SHEN CH	CORPORATE SOCIAL RESPONSIBILITY IN THE BANKING INDUSTRY: MOTIVES AND FINANCIAL P	2013
11	MATEJEK S;GSSLING T	BEYOND LEGITIMACY: A CASE STUDY IN BP'S "GREEN LASHING"	2014
12	REN XM;JIANG LS	ON PRICING OF CORPORATE SECURITIES IN THE CASE OF JUMP-DIFFUSION	2014
13	LEMKE F;LUZIO JPP	EXPLORING GREEN CONSUMERS' MIND-SET TOWARD GREEN PRODUCT DESIGN AND LIFE CYC	2014
14	NA NA	GREEN BONDS: SPRING IN THE AIR	2014
15	SCHRDER M	FINANCIAL EFFECTS OF CORPORATE SOCIAL RESPONSIBILITY: A LITERATURE REVIEW	2014
16	GIOVANNINI A;MAYER C;MICOSSI S;DI NOIA C;O	RESTARTING EUROPEAN LONG-TERM INVESTMENT FINANCE: A GREEN PAPER DISCUSSION DO	2015
17	SZUMILO N;FUERST F	WHO CAPTURES THE GREEN VALUE IN THE US OFFICE MARKET?	2015
18	DU X	HOW THE MARKET VALUES GREENWASHING? EVIDENCE FROM CHINA	2015
19	FRIEDE G;BUSCH T;BASSEN A	ESG AND FINANCIAL PERFORMANCE: AGGREGATED EVIDENCE FROM MORE THAN 2000 EMPI	2015
20	BRACKING S	PERFORMATIVITY IN THE GREEN ECONOMY: HOW FAR DOES CLIMATE FINANCE CREATE A FICT	2015
21	NG TH;TAO JY	BOND FINANCING FOR RENEWABLE ENERGY IN ASIA	2016
22	PHAM L	IS IT RISKY TO GO GREEN? A VOLATILITY ANALYSIS OF THE GREEN BOND MARKET	2016
23	PUASCHUNDER JM	MAPPING CLIMATE IN THE TWENTY-FIRST CENTURY	2016
24	MOREA D;POGGI LA	AN INNOVATIVE MODEL FOR THE SUSTAINABILITY OF INVESTMENTS IN THE WIND ENERGY SEC	2017
25	KHALIL S;O'SULLIVAN P	CORPORATE SOCIAL RESPONSIBILITY: INTERNET SOCIAL AND ENVIRONMENTAL REPORTING B	2017
26	HASSAN A;GUO X	THE RELATIONSHIPS BETWEEN REPORTING FORMAT, ENVIRONMENTAL DISCLOSURE AND ENV	2017
27	YAMAGUCHI R;MANAGI S	NEW FINANCING FOR SUSTAINABLE DEVELOPMENT: THE CASE FOR NNP- OR INCLUSIVE WEAL	2017
28	SEO SN	BEYOND THE PARIS AGREEMENT: CLIMATE CHANGE POLICY NEGOTIATIONS AND FUTURE DIRE	2017
29	LAZURKO A;VENEMA HD	FINANCING HIGH PERFORMANCE CLIMATE ADAPTATION IN AGRICULTURE: CLIMATE BONDS F	2017
30	FLAHERTY M;GEVORKYAN A;RADPOUR S;SEMML	FINANCING CLIMATE POLICIES THROUGH CLIMATE BONDS A THREE STAGE MODEL AND EMPI	2017
31	GABTENI H;BAMI A	ENERGY TRANSITION: BETWEEN ECONOMIC OPPORTUNITY AND THE NEED FOR FINANCING?	2018
32	LASKOWSKA A	GREEN BANKING AS THE PROSPECTIVE DIMENSION OF BANKING IN POLAND	2018
33	LIU J;RUAN W	ANALYSIS ON THE ROLE AND EFFECT OF INCLUSIVE FINANCE IN THE DEVELOPMENT OF GREEN	2018
34	SHAYDUROVA A;PANOVA S;FEDOSOVA R;ZLOTN	INVESTMENT ATTRACTIVENESS OF "GREEN" FINANCIAL INSTRUMENTS	2018
35	MONASTEROLO I;RABERTO M	THE EIRIN FLOW-OF-FUNDS BEHAVIOURAL MODEL OF GREEN FISCAL POLICIES AND GREEN SO	2018
36	KARPF A;MANDEL A	THE CHANGING VALUE OF THE 'GREEN' LABEL ON THE US MUNICIPAL BOND MARKET	2018
37	CHYGRYN O;PIMONENKO T;LUYLYOV O;GONCHA	GREEN BONDS LIKE THE INCENTIVE INSTRUMENT FOR CLEANER PRODUCTION AT THE GOVERN	2018
38	GLOMSRD S;WEI T	BUSINESS AS UNUSUAL: THE IMPLICATIONS OF FOSSIL DIVESTMENT AND GREEN BONDS FOR F	2018
39	CHRISTOPHERS B	RISKING VALUE THEORY IN THE POLITICAL ECONOMY OF FINANCE AND NATURE	2018
40	CUI Y;GEOBEY S;WEBER O;LIN H	THE IMPACT OF GREEN LENDING ON CREDIT RISK IN CHINA	2018
41	PATEL S	HYDROPOWER GROWS BUT INDUSTRY IS CHANGING	2018
42	REBOREDO JC	GREEN BOND AND FINANCIAL MARKETS: CO-MOVEMENT, DIVERSIFICATION AND PRICE SPILL	2018
43	NG AW	FROM SUSTAINABILITY ACCOUNTING TO A GREEN FINANCING SYSTEM: INSTITUTIONAL LEGITI	2018
44	HACHENBERG B;SCHIERECK D	ARE GREEN BONDS PRICED DIFFERENTLY FROM CONVENTIONAL BONDS?	2018
45	FEBI W;SCHFER D;STEPHAN A;SUN C	THE IMPACT OF LIQUIDITY RISK ON THE YIELD SPREAD OF GREEN BONDS	2018
46	AASSOULI D;EBRAHIM MS;BASIRUDDIN R	CAN UGITS PROMOTE LIQUIDITY MANAGEMENT AND SUSTAINABLE DEVELOPMENT?	2018
47	PARANQUE B;REVELLI C	ETHICO-ECONOMIC ANALYSIS OF IMPACT FINANCE: THE CASE OF GREEN BONDS	2019
48	ZERBIB OD	THE EFFECT OF PRO-ENVIRONMENTAL PREFERENCES ON BOND PRICES: EVIDENCE FROM GREE	2019
49	LIU Z;TAO Y;TIAN G	CHANGE OF CHINAS GREEN FINANCIAL POLICY AND ITS ALLOCATION EFFICIENCY--AN EMPIRIO	2019
50	CHEBANOV SV	GREEN ECONOMY: ROLE OF SOVEREIGN FUNDS [:]	2019
51	ELLIOTT C;ZHANG LY	DIFFUSION AND INNOVATION FOR TRANSITION: TRANSNATIONAL GOVERNANCE IN CHINAS G	2019
52	DOU X;QI S	THE CHOICE OF GREEN BOND FINANCING INSTRUMENTS	2019
53	KESHMINDER JS;SINGH GKB;WAHID ZAB;ABDUI	GREEN SUKUK: MALAYSIA TAKING THE LEAD	2019
54	AGLIARDI E;CASARI M;XEPAPADEAS A	INTRODUCTION: SPECIAL ISSUE ON THE ECONOMICS OF CLIMATE CHANGE AND SUSTAINABIL	2019
55	BANGA J	THE GREEN BOND MARKET: A POTENTIAL SOURCE OF CLIMATE FINANCE FOR DEVELOPING CO	2019
56	ZHANG LY	GREEN BONDS IN CHINA AND THE SINO-BRITISH COLLABORATION: MORE A PARTNERSHIP OF	2019
57	BACHELET MJ;BECCHETTI L;MANFREDONIA S	THE GREEN BONDS PREMIUM PUZZLE: THE ROLE OF ISSUER CHARACTERISTICS AND THIRD-PA	2019
58	CHIESA M;BARUA S	THE SURGE OF IMPACT BORROWING: THE MAGNITUDE AND DETERMINANTS OF GREEN BOND	2019
59	GIANFRATE G;PERI M	THE GREEN ADVANTAGE: EXPLORING THE CONVENIENCE OF ISSUING GREEN BONDS	2019
60	BRACKING S	FINANCIALISATION, CLIMATE FINANCE, AND THE CALCULATIVE CHALLENGES OF MANAGING E	2019
61	D'ORAZIO P;POPOYAN L	FOSTERING GREEN INVESTMENTS AND TACKLING CLIMATE-RELATED FINANCIAL RISKS: WHICH	2019
62	BROADSTOCK DC;CHENG LTW	TIME-VARYING RELATION BETWEEN BLACK AND GREEN BOND PRICE BENCHMARKS: MACROE	2019
63	MCINERNEY C;BUNN DW	EXPANSION OF THE INVESTOR BASE FOR THE ENERGY TRANSITION	2019
64	NANAYAKKARA M;COLOMBAGE S	DO INVESTORS IN GREEN BOND MARKET PAY A PREMIUM? GLOBAL EVIDENCE	2019
65	BAULKARAN V	STOCK MARKET REACTION TO GREEN BOND ISSUANCE	2019
66	BARUA S;CHIESA M	SUSTAINABLE FINANCING PRACTICES THROUGH GREEN BONDS: WHAT AFFECTS THE FUNDING	2019
67	WANG Q;ZHOU Y;LUO L;JI J	RESEARCH ON THE FACTORS AFFECTING THE RISK PREMIUM OF CHINA'S GREEN BOND ISSUAN	2019
68	HANIF I;AZIZ B;CHAUDHRY IS	CARBON EMISSIONS ACROSS THE SPECTRUM OF RENEWABLE AND NONRENEWABLE ENERGY	2019
69	ZHOU X;CUI Y	GREEN BONDS, CORPORATE PERFORMANCE, AND CORPORATE SOCIAL RESPONSIBILITY	2019
70	BAGNOLI M;WATTS SG	ON THE CORPORATE USE OF GREEN BONDS	2020
71	SARTZETAKIS ES	GREEN BONDS AS AN INSTRUMENT TO FINANCE LOW CARBON TRANSITION	2020
72	MALTAIS A;NYKVIST B	UNDERSTANDING THE ROLE OF GREEN BONDS IN ADVANCING SUSTAINABILITY	2020
73	TU CA;RASOULINEZHAD E;SARKER T	INVESTIGATING SOLUTIONS FOR THE DEVELOPMENT OF A GREEN BOND MARKET: EVIDENCE F	2020
74	SZABO S;WEBSTER J	PERCEIVED GREENWASHING: THE EFFECTS OF GREEN MARKETING ON ENVIRONMENTAL AND	2020
75	NGWENYA N;SIMATELE MD	UNBUNDLING THE GREEN BOND MARKET IN THE ECONOMIC HUBS OF AFRICA: CASE STUD	2020
76	HILBRANDT H;GRUBBAUER M	STANDARDS AND SSOS IN THE CONTESTED WIDENING AND DEEPENING OF FINANCIAL MARKE	2020
77	MILLER VV;SU Q;PEREZ-BATRES LA;PISANI MJ	CHINAS GREEN WATCH PROGRAM: BEYOND GREENWASHING	2020
78	PHAM L;LUU DUC HUYNH T	HOW DOES INVESTOR ATTENTION INFLUENCE THE GREEN BOND MARKET?	2020
79	PARTRIDGE C;MEDDA FR	THE EVOLUTION OF PRICING PERFORMANCE OF GREEN MUNICIPAL BONDS	2020
80	CHRISTOPHERS B;BIGGER P;JOHNSON L	STRETCHING SCALES? RISK AND SOCIALITY IN CLIMATE FINANCE	2020
81	REBOREDO JC;UGOLINI A;AIUBE FAL	NETWORK CONNECTEDNESS OF GREEN BONDS AND ASSET CLASSES	2020
82	PIMONENKO T;BILAN Y;HORK J;STARCHENKO L;	GREEN BRAND OF COMPANIES AND GREENWASHING UNDER SUSTAINABLE DEVELOPMENT G	2020
83	HYUN S;PARK D;TIAN S	THE PRICE OF GOING GREEN: THE ROLE OF GREENNESS IN GREEN BOND MARKETS	2020
84	HUANG T;YUE Q	HOW THE GAME CHANGER WAS GENERATED? AN ANALYSIS ON THE LEGAL RULES AND DEVEL	2020
85	ANTONCIC M	UNCOVERING HIDDEN SIGNALS FOR SUSTAINABLE INVESTING USING BIG DATA: ARTIFICIAL IN	2020
86	RAWAT SK;ANU A	GREEN FINANCE: AN EMERGING PROSPECTIVE TOWARDS SUSTAINABLE DEVELOPMENT IN INI	2020
87	TANG DY;ZHANG Y	DO SHAREHOLDERS BENEFIT FROM GREEN BONDS?	2020
88	WANG J;CHEN X;LI X;YU J;ZHONG R	THE MARKET REACTION TO GREEN BOND ISSUANCE: EVIDENCE FROM CHINA	2020
89	LARCKER DF;WATTS EM	WHERE'S THE GREENIUM?	2020
90	LAGOARDE-SEGOT T	FINANCING THE SUSTAINABLE DEVELOPMENT GOALS	2020
91	ZHANG H	REGULATING GREEN BOND IN CHINA: DEFINITION DIVERGENCE AND IMPLICATIONS FOR POL	2020
92	AZHGALIYEVA D;KAPOOR A;LIU Y	GREEN BONDS FOR FINANCING RENEWABLE ENERGY AND ENERGY EFFICIENCY IN SOUTH-EAST	2020
93	GUILD J	THE POLITICAL AND INSTITUTIONAL CONSTRAINTS ON GREEN FINANCE IN INDONESIA	2020
94	SCHUMACHER K;CHENET H;VOLZ U	SUSTAINABLE FINANCE IN JAPAN	2020
95	KANAMURA T	ARE GREEN BONDS ENVIRONMENTALLY FRIENDLY AND GOOD PERFORMING ASSETS?	2020
96	PARK D;PARK J;RYU D	VOLATILITY SPILLOVERS BETWEEN EQUITY AND GREEN BOND MARKETS	2020
97	REBOREDO JC;UGOLINI A	PRICE CONNECTEDNESS BETWEEN GREEN BOND AND FINANCIAL MARKETS	2020
98	TOLLIVER C;KEELEY AR;MANAGI S	POLICY TARGETS BEHIND GREEN BONDS FOR RENEWABLE ENERGY: DO CLIMATE COMMITMEN	2020

Appendix 22: Software Employed and Short Description

R

- "A free software environment for statistical computing and graphics. It compiles and runs on a wide variety of UNIX platforms, Windows and MacOS."

  https://www.r-project.org

R-studio

- "RStudio is dedicated to sustainable investment in free and open-source software for data science, to help people understand and improve the world through data."

  https://rstudio.com

Bibliometrix 3.0

- "An R-tool for comprehensive science mapping analysis."

  https://www.bibliometrix.org/index.html

Biblioshiny

- "An application providing a web-interface for bibliometrix."

  https://bibliometrix.org/Biblioshiny.html

Sketchometry

- Dynamic geometry sofware in Javascript. Used to create geometric figures in the Green Bond Dashboard Templates for visualizing analysis results.

  https://sketchometry.org/en/index.html

Scopus Elsevier

- Abstract and citation database used to extract compatible file formats that were inputed into the R software programs and Biblioshiny.

  https://service.elsevier.com/app/answers/detail/a_id/15534/supporthub/scopus/#tips

Appendix 23: Historical Events On Green Finance: Previous to and until the end of the First Era (adapted from: (Rawat & Anu, 2020, p. 4))

Year	Phase
1987	Montreal Protocol
1988	IPCC Established
1992	Rio Summit: UNFCC Established
1994	UNFCCC executed
1997	KYOTO Protocol Signed
2000	MDGs launched
2001	COP7 Marrakesh Accord
2005	COP11 KYOTO executed
2007	COP13 Bali Roadmap
2009	Copenhagen Accord
2010	COP16 Cancun Accord
2012	Doha Agreement

Appendix 24: Dynamic Conditional Correlations; Green and Non-Green Bond Price Benchmarks from 2008 until 2018 (adapted from: (Broadstock & Cheng, 2019, p. 20))
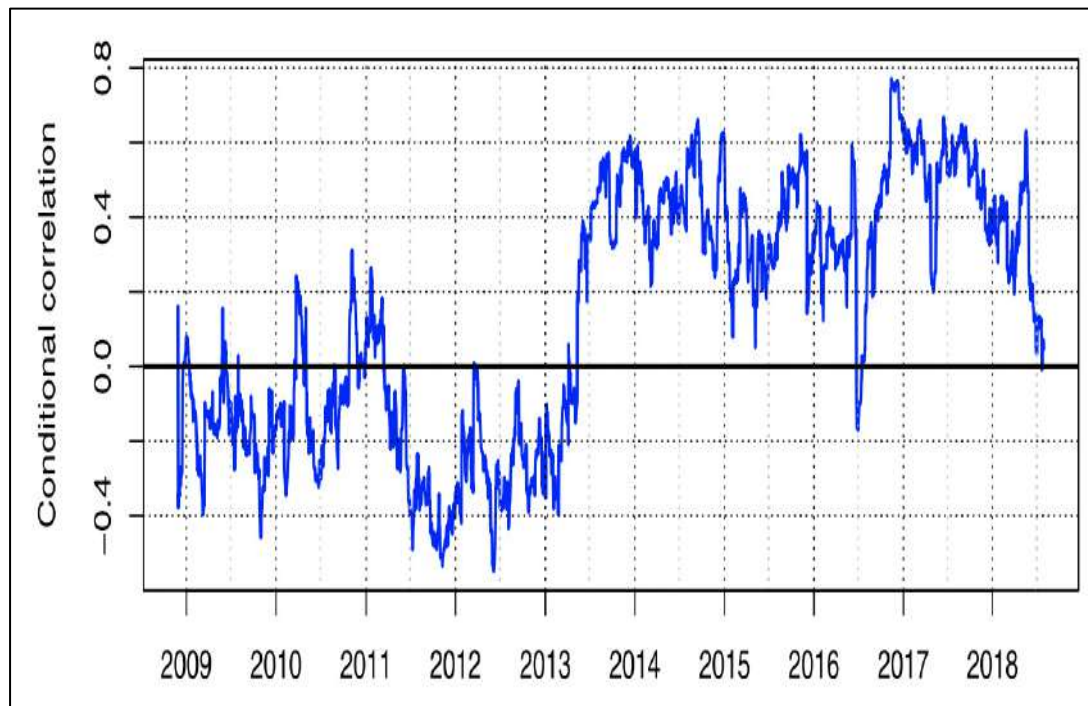
Appendix 25: Historical Events On Green Finance: During Second Era (adapted from: (Rawat & Anu, 2020, p. 4))

Year	Phase
2015	SDGs Launch
2015	Sendai Framework
2015	Addis Abab Action Agenda
2015	Paris Accord: 1st Universal Climate Agreement
2016	COP22 Marrakesh Accord
2016	Kigali Amendment to Montreal Protocol

Appendix 26: Collaborations in Report Outputs in China's GB Market Evolution (adapted from (Elliott & Zhang, 2019, p. 8))
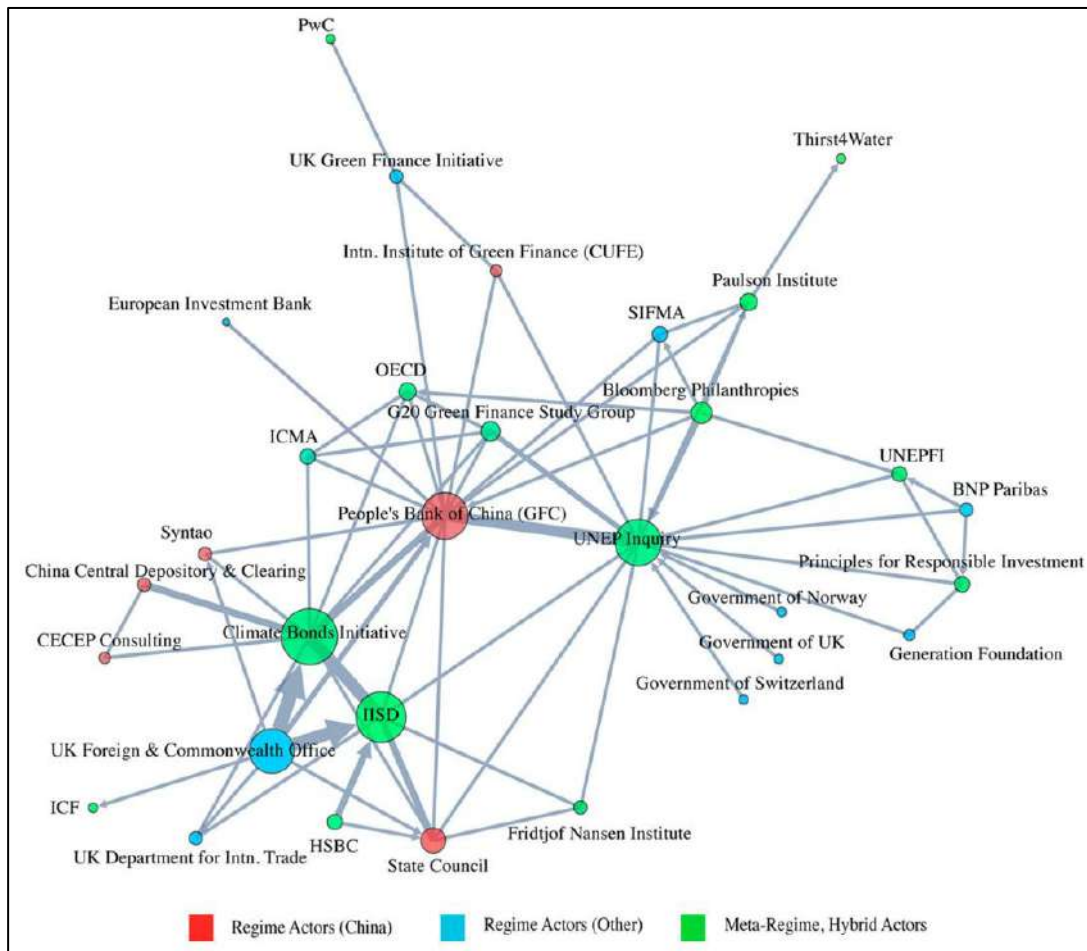
Appendix 27: Timeline Development of GBs in the Chinese Market from 2013 until 2017 (adapted from: (Elliott & Zhang, 2019, p. 9))
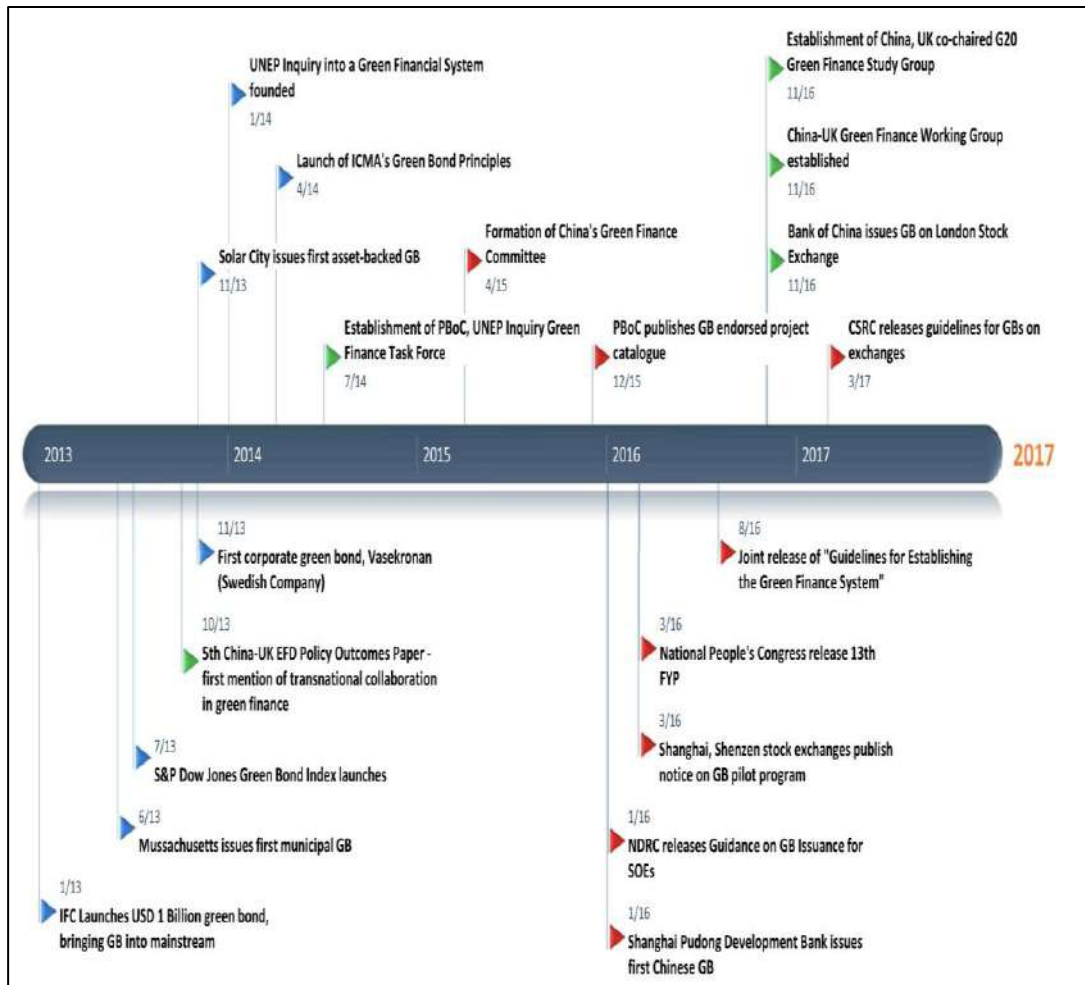
Appendix 28: GBs success and failures as innovative instruments (adapted from: (McInerney & Bunn, 2019, p. 1243))

	Successes	Failures
Green Bonds	✓ Standardised ✓ Highly liquid asset – traded on exchange ✓ Price transparency ✓ Information asymmetry reduced due to information disclosure through exchanges/credit rating agencies	✗ Concerns re 'green-washing' ✗ No single accreditation standard ✗ No ex poste audit to verify use of funds

Appendix 29: Types of Chinese GBs Under Legal framework with Respective Control Authorities (adapted from: (Huang & Yue, 2020, pp. 12-13))

Authority	Types	Market
PBC	Financial bonds	Inter-bank market
NDRC	Enterprise bonds	
NAFMII	Debt financing instruments of non-financial enterprises[a]	
CSRC	Corporate bonds, extendible bonds, local government bonds, asset-backed securities, etc.	Exchange market
SSE	Corporate bonds (public offering)	
SZSE		
Interotc	Corporate bonds (private offering)	Inter-agency quotation system

Including short-term financing bonds, mid-term notes, asset-backed notes, etc.

Appendix 30: Global GB Issuance Until 2018 (Tang & Zhang, 2020, p. 6)
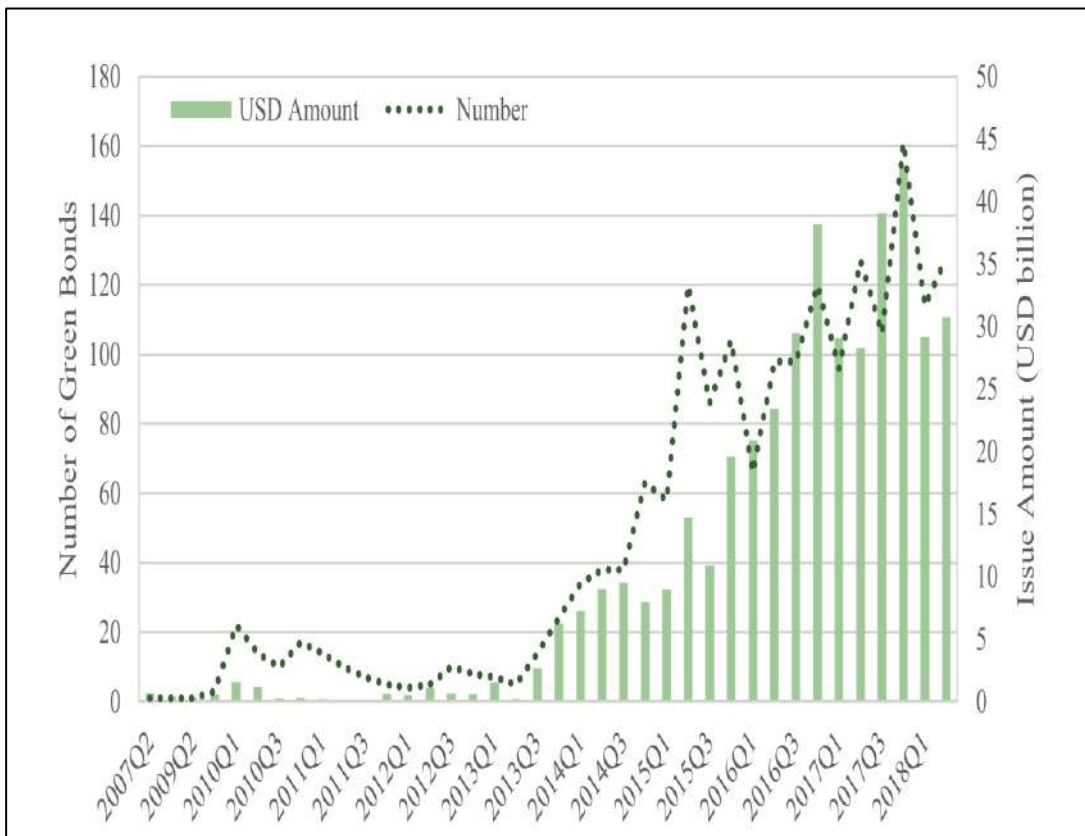
Appendix 31: Geographical Distribution of GBs (Tang & Zhang, 2020, p. 6)
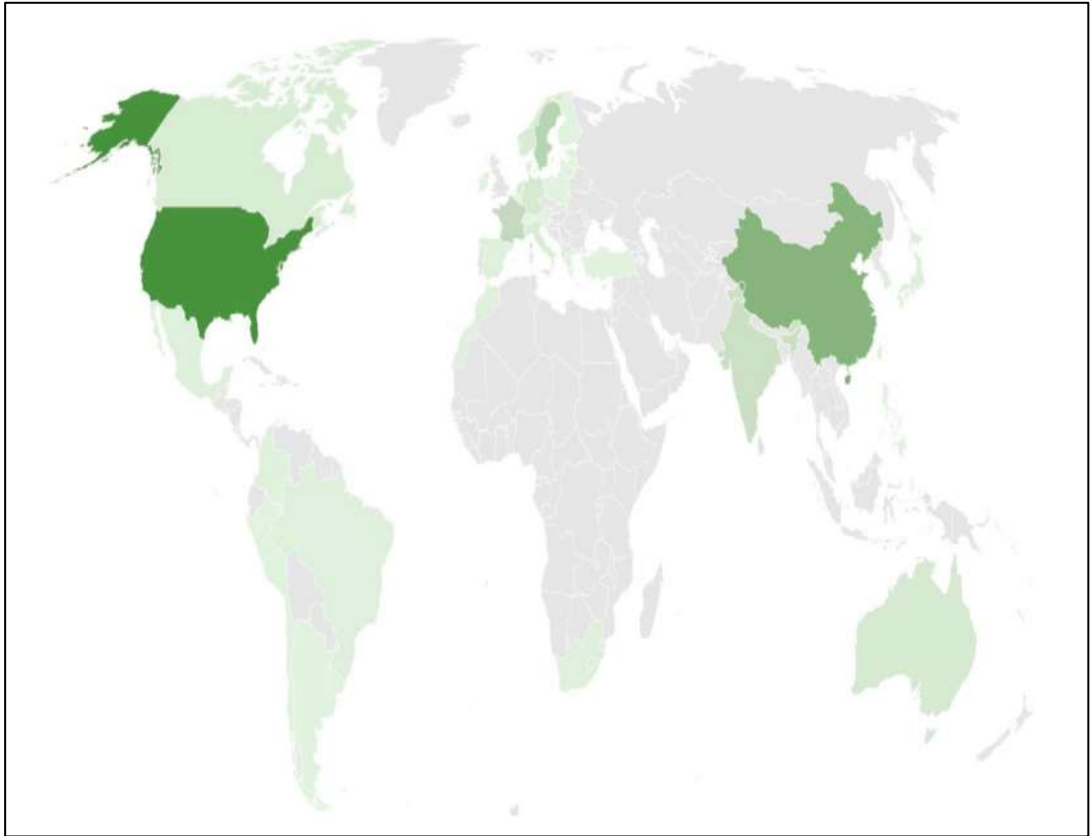
Appendix 32: GB Qualitative Assessment Tool

	Title of Article Being Analysed		Year of Publication
CM	**Main Word**	**Other Relevant Words**	**Score**
A.	*Credibility*	Greenwashing, Measure, Quantifiable, Use of proceeds, Ethic	1-4
B.	*SDG's*	Zero Hunger, Good Health and Well-being, Quality Education, Gender Equality, Clean Water and Sanitation, Affordable and Clean Energy, Decent Work and Economic Growth, Industry, Innovation, and Infrastructure, Reducing Inequality, Sustainable Cities and Communities, Responsible Consumption and Production, Climate Action, Life Below Water, Life Below Water, Life On Land + Green Sukuk	1-4
C.	*Psychology*	Communication, Marketing, Enviormental Friendly, Eco Friendly, Long Term	1-4
D.	*Performance*	Pricing, Premium, Investment grade, Classification AAA, Yield Spread, Volatility, Stability	1-4
E.	*Bond Sector*	Green financial bond, Green project bond, Sovereign bond, Muni/Municipal Green Bond, Asset backed security (ABS), Green securitzed bond, Mortage backed security (MBS), Supranational, Green revenue bond, Green securitised bond, Corporate bond	1-4
F.	*International Regulations*	Green Bond Principles (GBP/ICMA), Climate Bond Standards (CBS/CBI), Green Bond Rating (GBR), EU Green Bonds Standars (EU GBS), Technical Expert Group (TEG), ASEAN Green Bonds Standard (ASEAN GBS), National Development and Reform Commission (NDRC), The People's Bank of China (PBOC), Green Finance Committee (GFC), Chinese Guidelines and the Project Catalogue, Green Bond Guidelines (country or area)	1-4
G.	*Company Focus*	Sustainanalytics, Cicero, Vigeo Eiris, Oekom, HSBC, Credit Agricole CIB, Merril Lynch, Fanie Mae, SEB, BAML, JP Morgan, Engie, KFWM, BNP Paribas	1-4
H.	*Digital Transformation*	Block chain, Digitalization, Distributed ledger technology (DTL)	1-4

Appendix 33: GB Controversial Metric Grading Scale

	4	• Strongly Covers One of the Eight Contraversial Metric
	3	• Regular Performance In Covering One of the Eight Specific Contraversial Metric
	2	• Vaguely Covers Specifc Contraversial Metric
	1	• Does Not Cover Specific Contraversial Metric
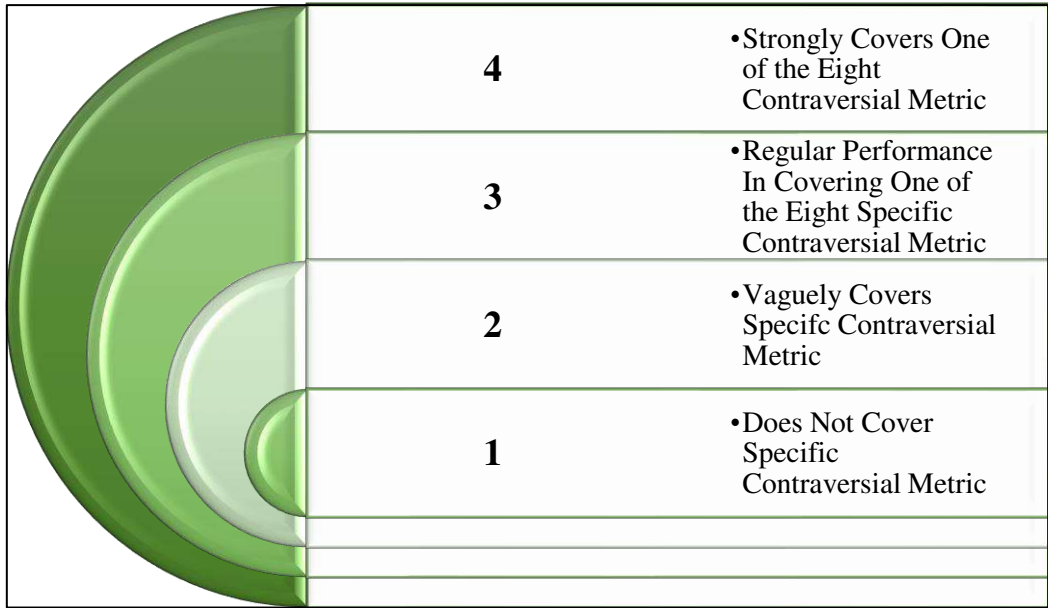
Appendix 34: Visualization Possibilities from GB Octagon Results

1. Perfect Square **2. One Topic Specific** **3. Three Topic Specific**

4. Vague but Covers All **5. Strong in Most Topics** **6. Almost Irrelevant**
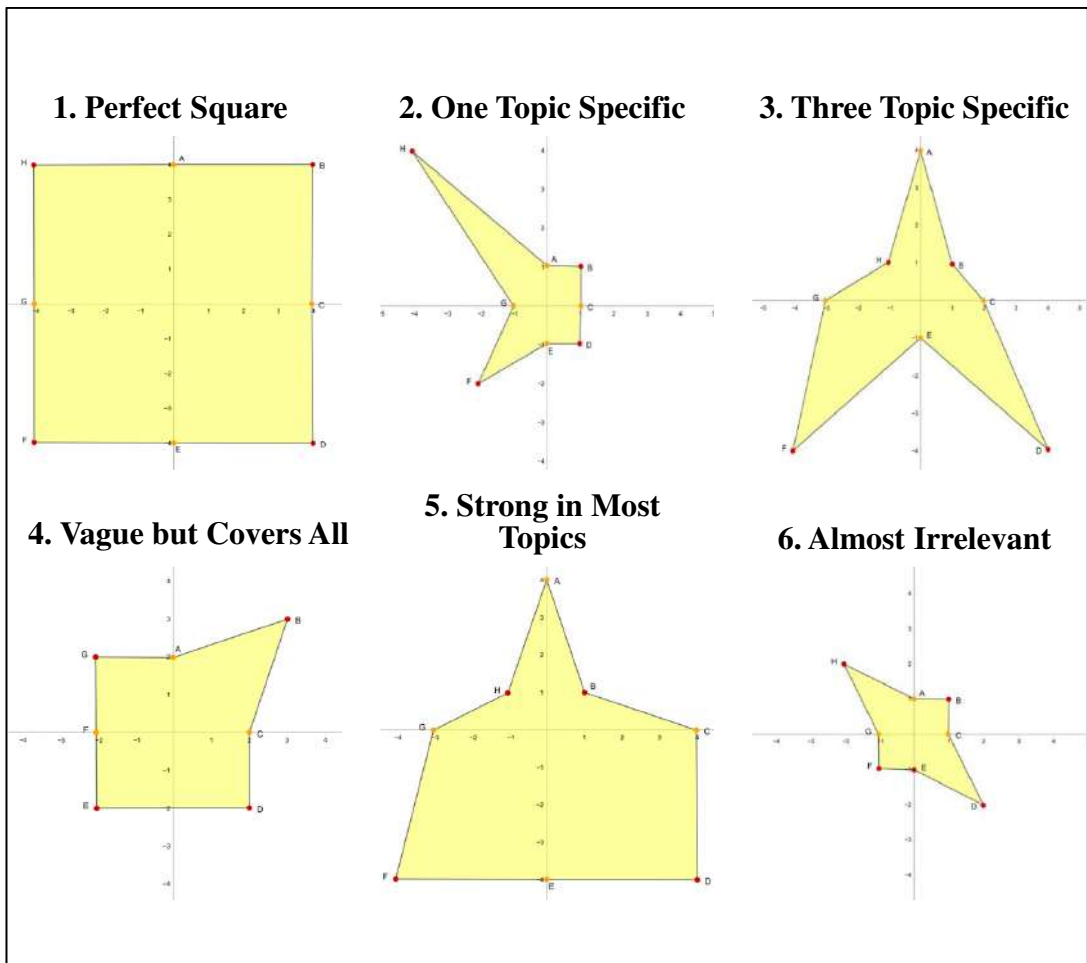
Appendix 35: Three-Word Green Bond Pie Chart
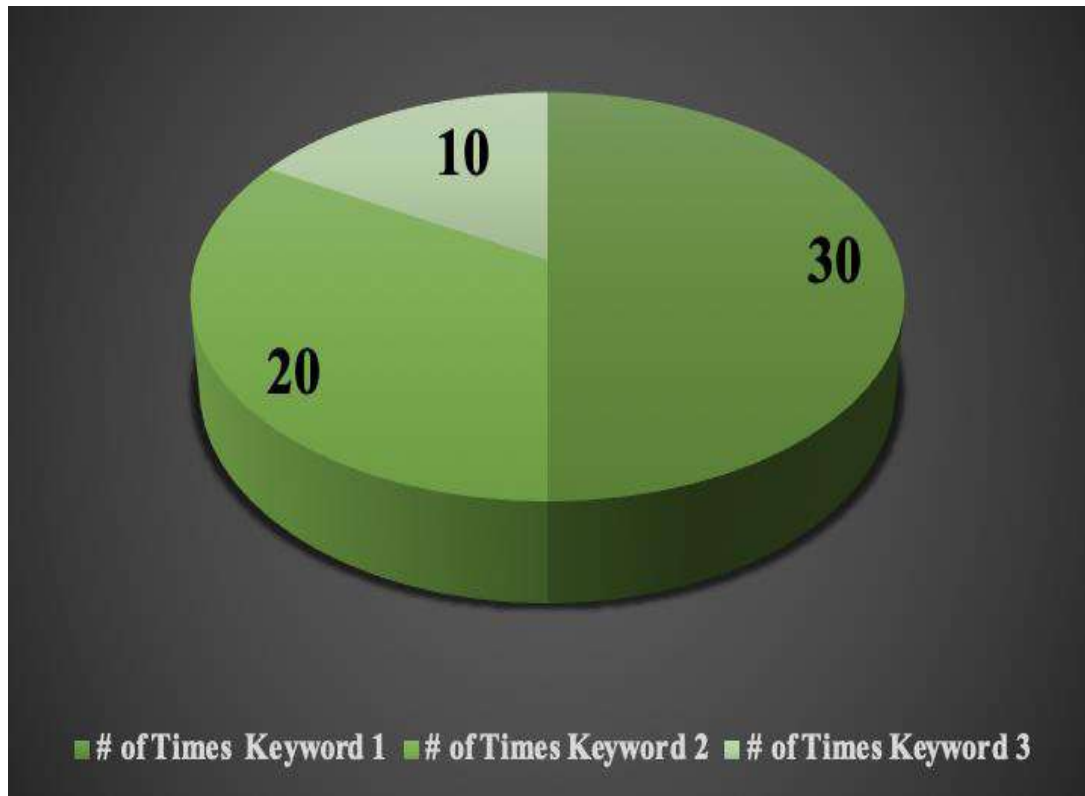
Appendix 36: Five Stage Bibliometric Journey (Adapted from: (Aria & Cuccurullo, 2017, p. 960; Zupic & Čater, 2015, p. 433))

Thesis Design	
Resarch Question	Method Selection Process

Bibliometric Data Collection	
Database Selection Stage	Filtration Process of Bibliometric Data

Analysis		
Bibliometric Software Selection	Data Cleanse	Methodological Identification

Visual Conception	
Visualization Selection	Software Display

Analysis Enlightment
Deciphering of Results and Findings

Appendix 37: Conventional Bibliometric Methods per Unit of Analysis (Adapted from:(Aria & Cuccurullo, 2017))

Bibliometric technique taxonomy	Unit of analysis used	Kind of relation
Bibliographic Coupling	• Author • Document • Journal	• Common references in authors' oeuvres • Common references in documents • Common references in journals' oeuvres
Co-citation	• Author • Reference • Journal	• Co-cited authors • Co-cited documents • Co-cited journals
Co-author	• Author • Country from affiliation • Institution from affiliation	• Co-occurrence of authors in the author list of a document • Co-occurrence of countries in the address list of a document • Co-occurrence of institutions in the address list of a document
Co-word	• Keyword, or term extracted from title, abstract or document's body	• Co-occurrence of terms in a document

Appendix 38: Permutation Calculation for GB Octagon Variability

$$P(n,r) = \frac{n!}{(n-r)!} = ?$$

$$P(n,r) = P(8,4)$$
$$= \frac{8!}{(8-4)!}$$
$$= 1680$$

Appendix 39: R-Biblioshiny Software Interface (Part 1)
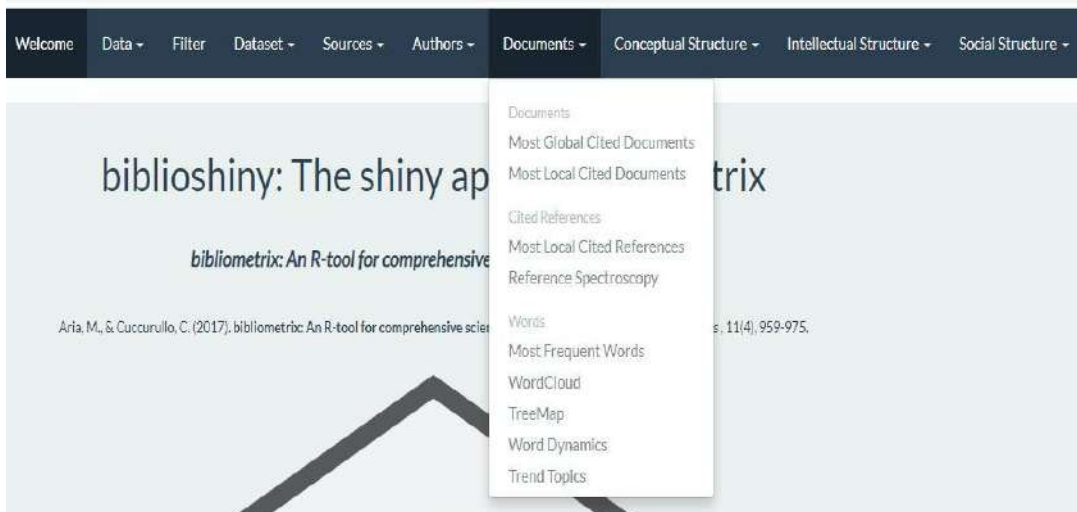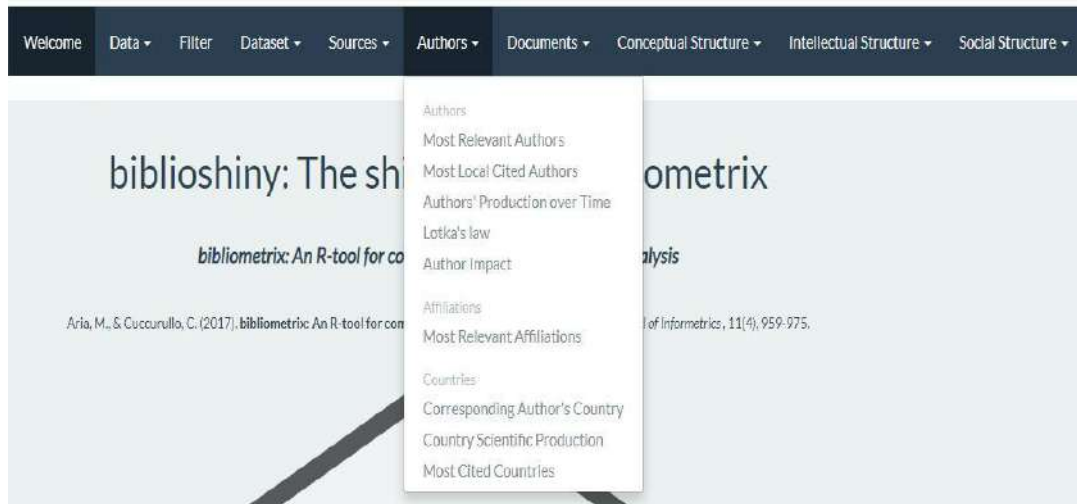
Appendix 40: R-Biblioshiny Software Interface (Part 2)

Appendix 41: Diagram Design for Selection Process of Parameters
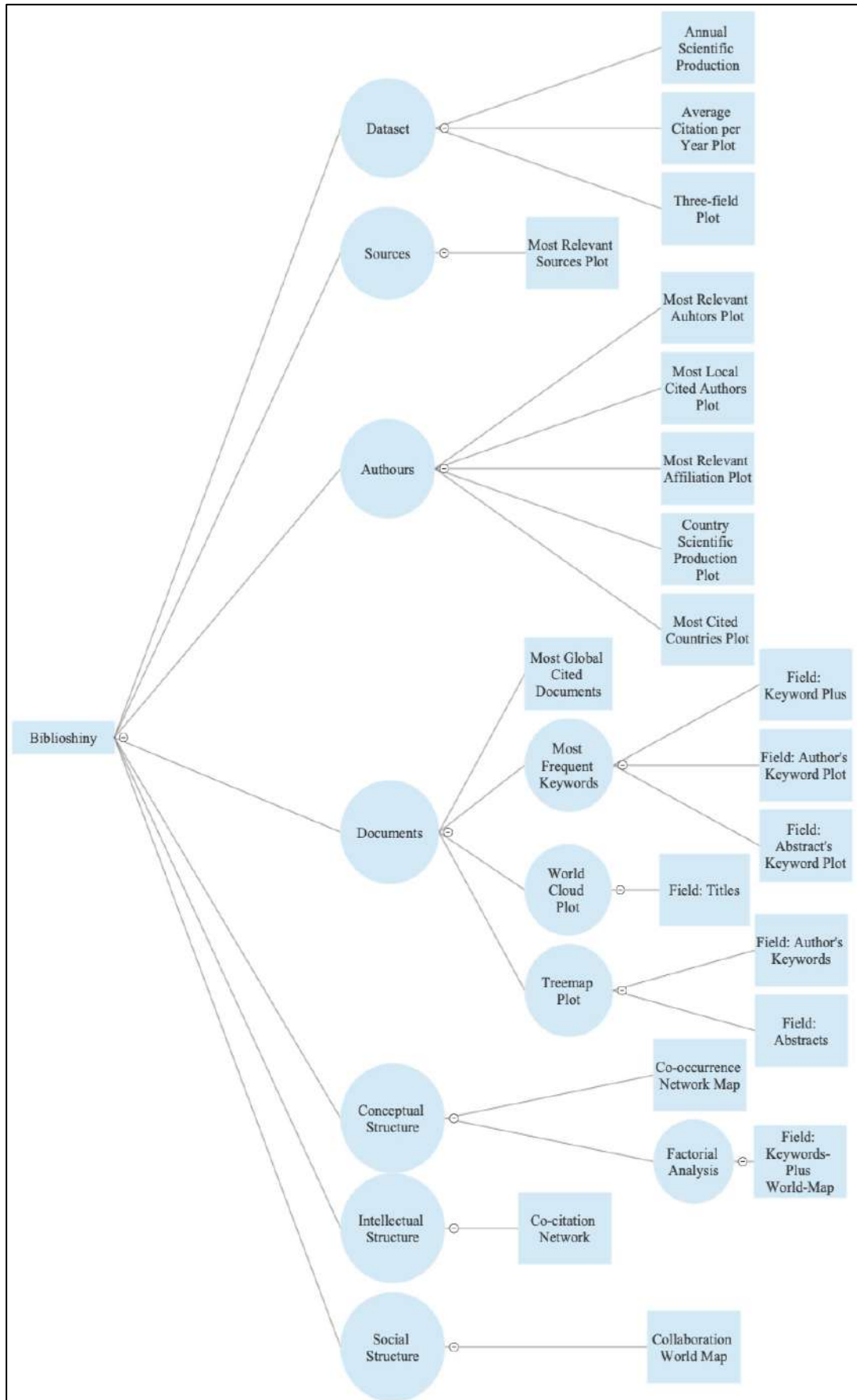
Appendix 42: The 20 Biblioshiny Parameters

Parameter #	Final Analysis Design Parameters
1	Annual Scientric Production Plot
2	Average Citation Per Year Plot
3	Three Field Plot
4	Most Relevant Sources Plot
5	Most Relevant Authors Plot
6	Most Local Cited Authors Plot
7	Most Relevant Affiliations Plot
8	Country Scientific Production Plot
9	Most Cited Countries Plot
10	Most Global Cited Documents
11	Keyword Plus Plot
12	Author's Keywords Plot
13	Abstract's Keywords Plot
14	WorldCloud Most Frequent Words in Titles
15	TreeMap of Author's Keywords
16	TreeMap of Abstract's Keywords
17	Co-occurrence Network Map
18	Factorial Analysis Word Map
19	Co-Citation Network Graph
20	Collaboration World Map Graph

Appendix 43: Parameters of Era Analysis

Description
MAIN INFORMATION ABOUT DATA
Timespan
Sources (Journals, Books, etc)
Documents
Average years from publication
Average citations per documents
Average citations per year per doc
References
DOCUMENT TYPES
Articles
DOCUMENT CONTENTS
Keywords Plus (ID)
Author's Keywords (DE)
AUTHORS
Authors
Author Appearances
Authors of single-authored documents
Authors of multi-authored documents
AUTHORS COLLABORATION
Single-authored documents
Documents per Author
Authors per Document
Co-Authors per Documents
Collaboration Index

Appendix 44: Annual Scientific Production
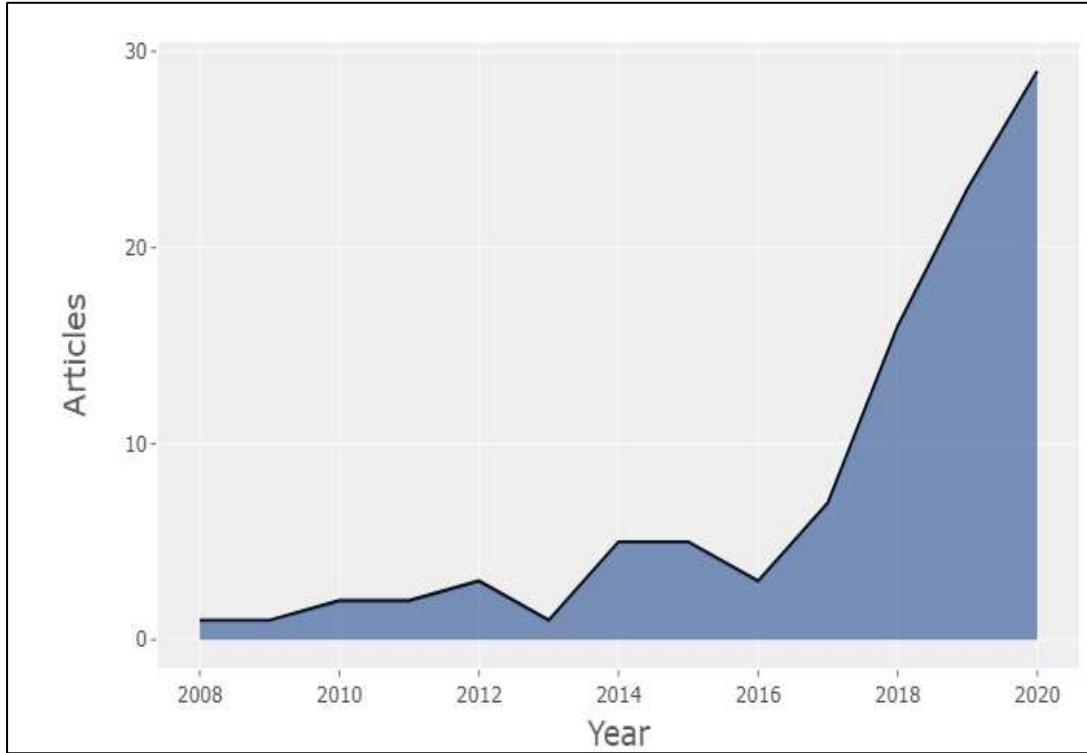
Publishing Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Number of Articles Published	1	1	2	2	3	1	5	5	3	7	16	23	29

Appendix 45: Average Article Citations per Year
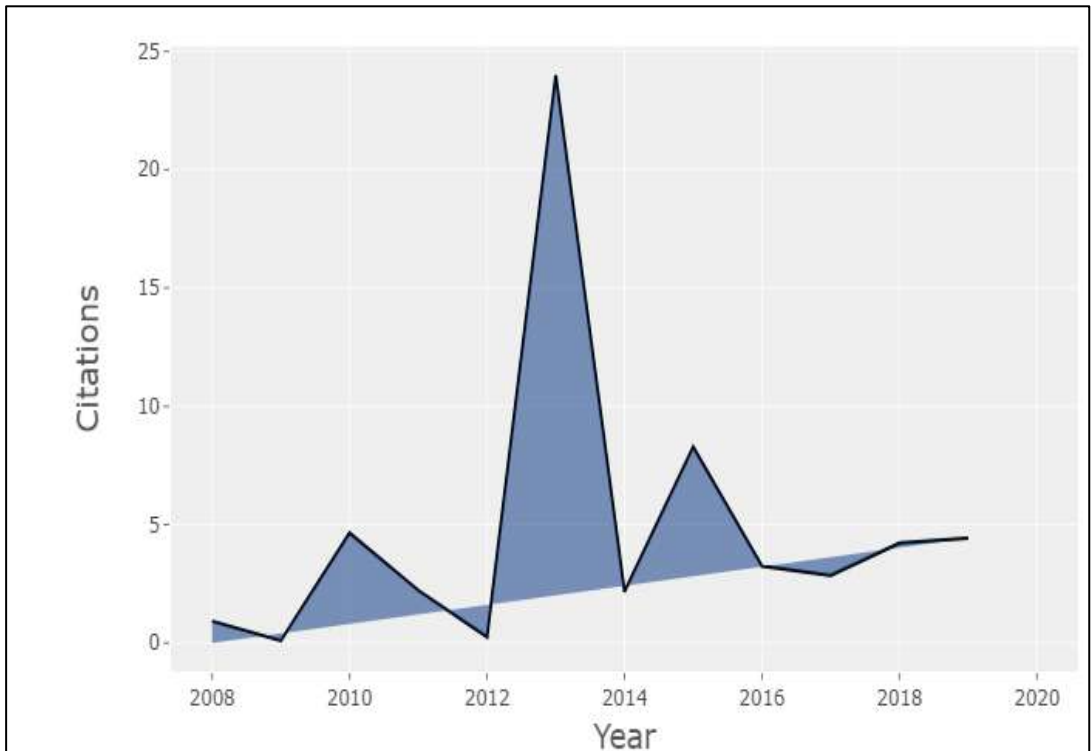
Appendix 46: Three Field Plot
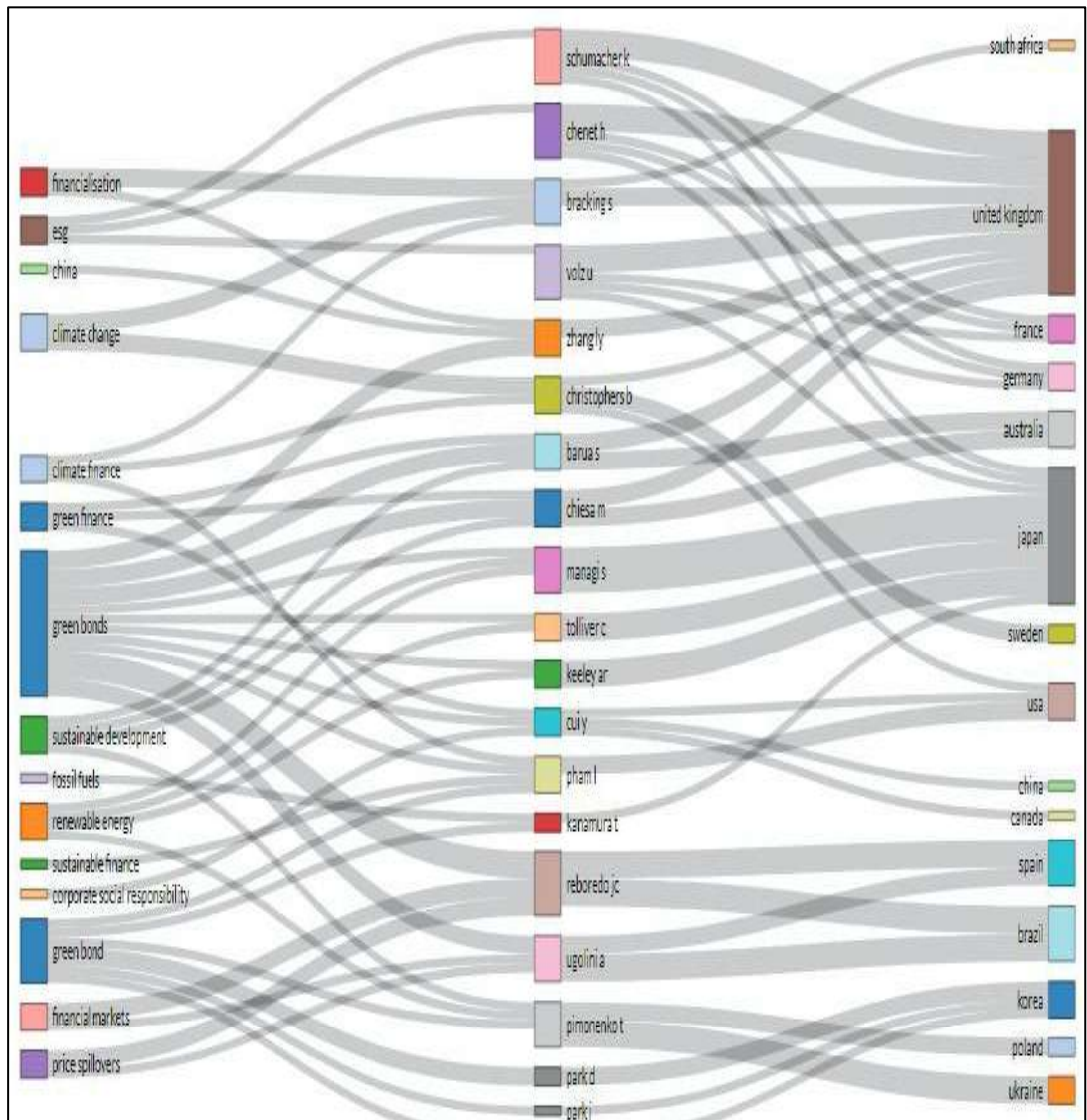
Appendix 47: Most Relevant Sources
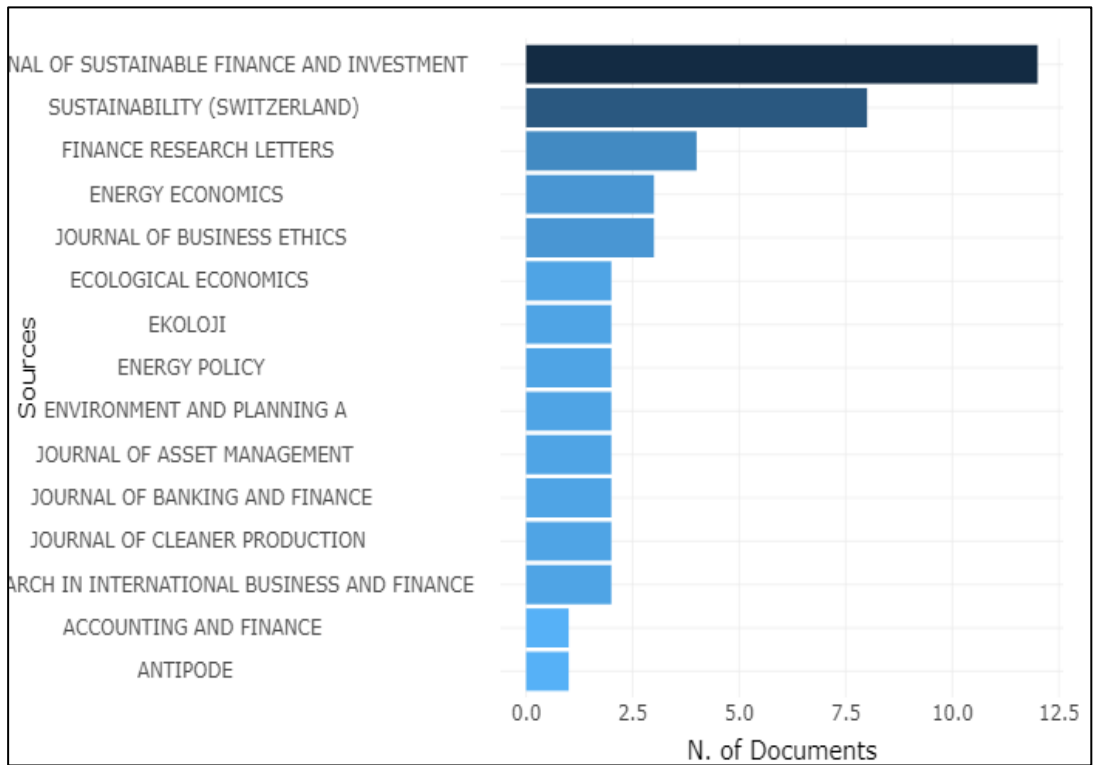
Appendix 48: Most Relevant Authors
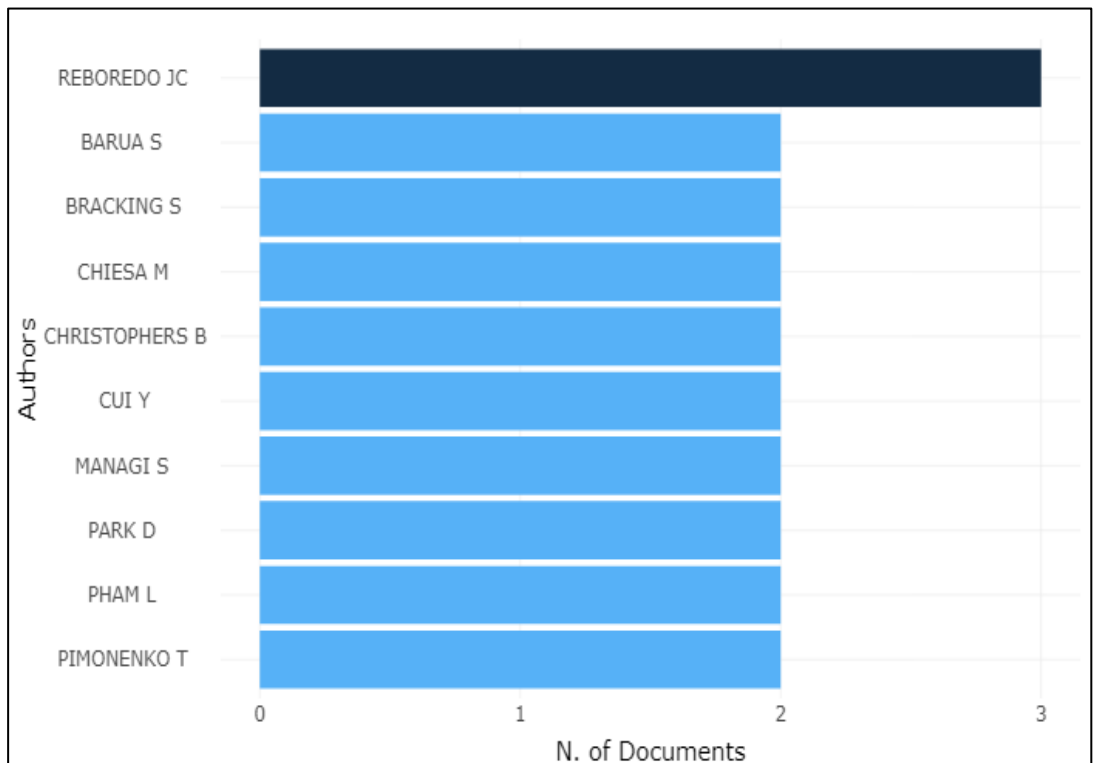
Appendix 49: Most Local Cited Author
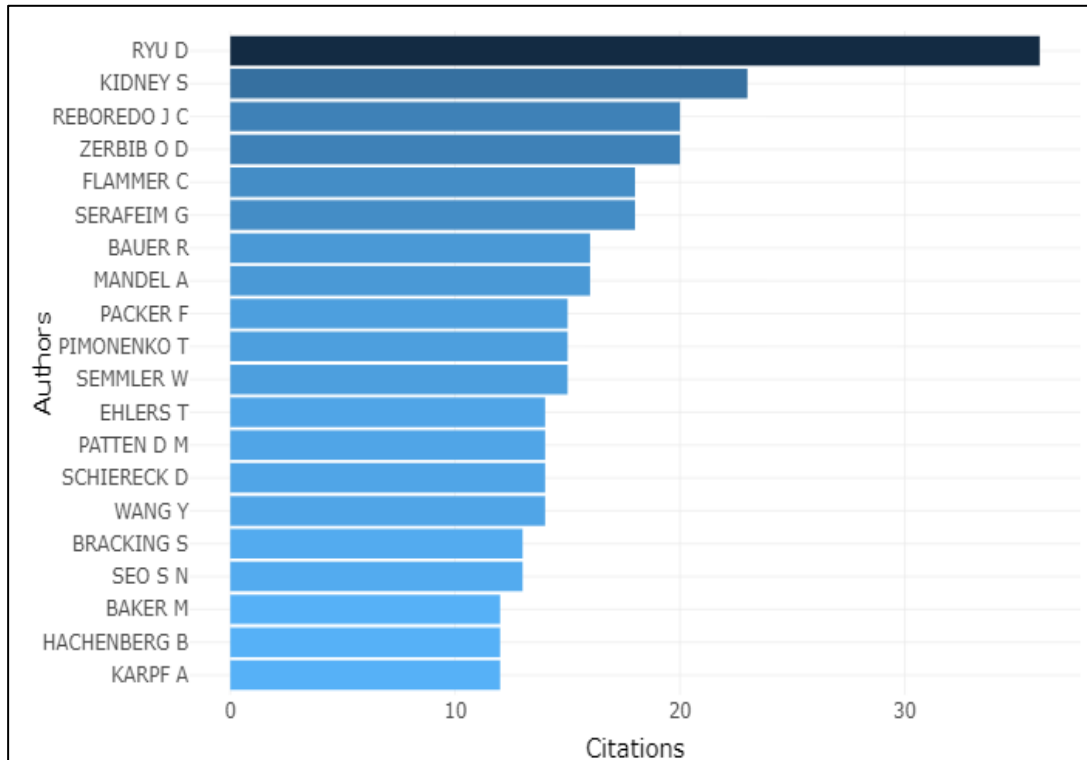
Appendix 50: Most Relevant Affiliations
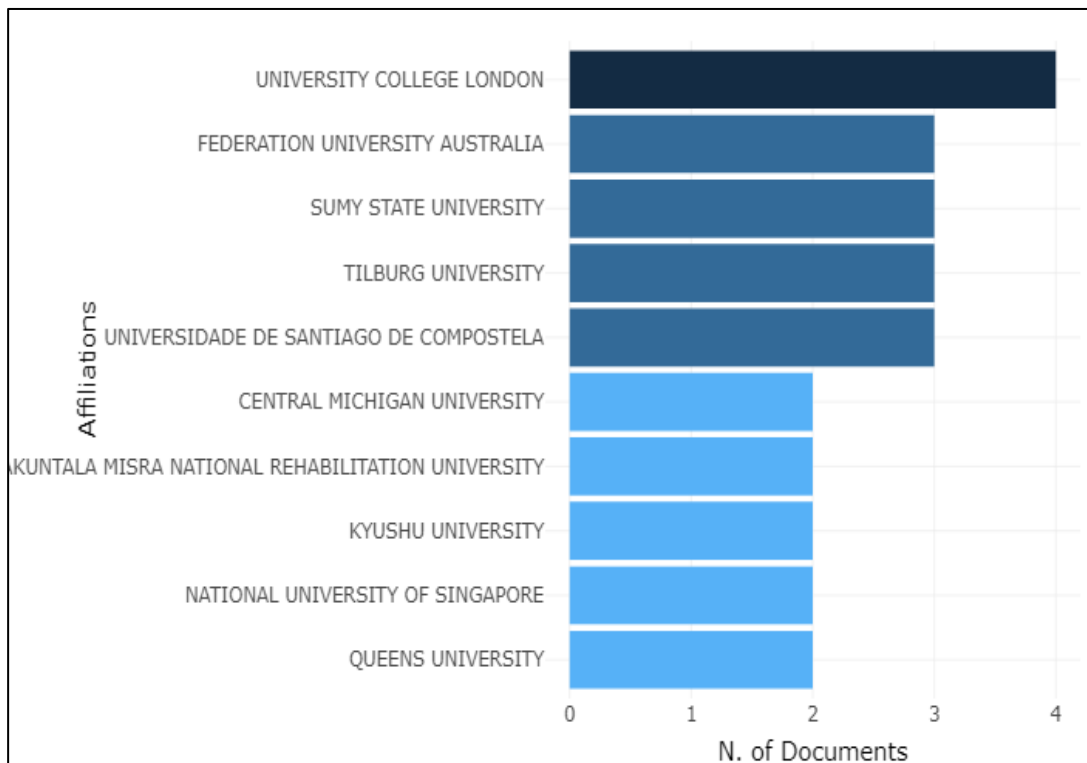
Appendix 51: Country of Scientific Production
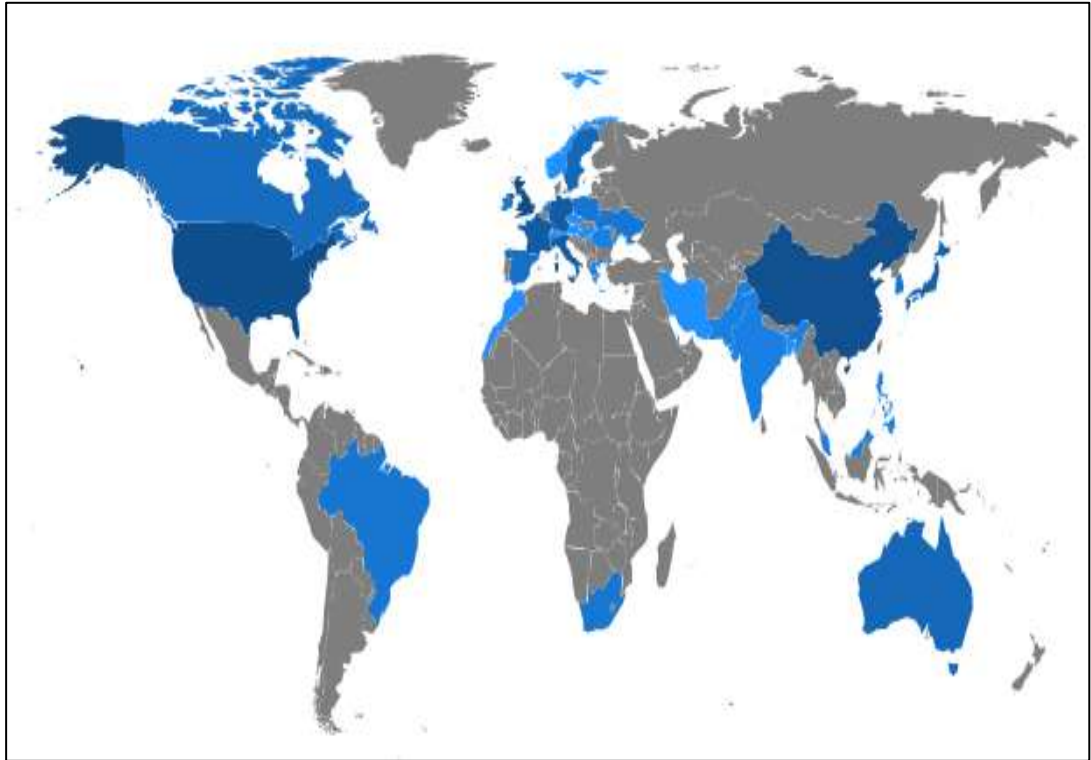
Appendix 52: Most Cited Countries
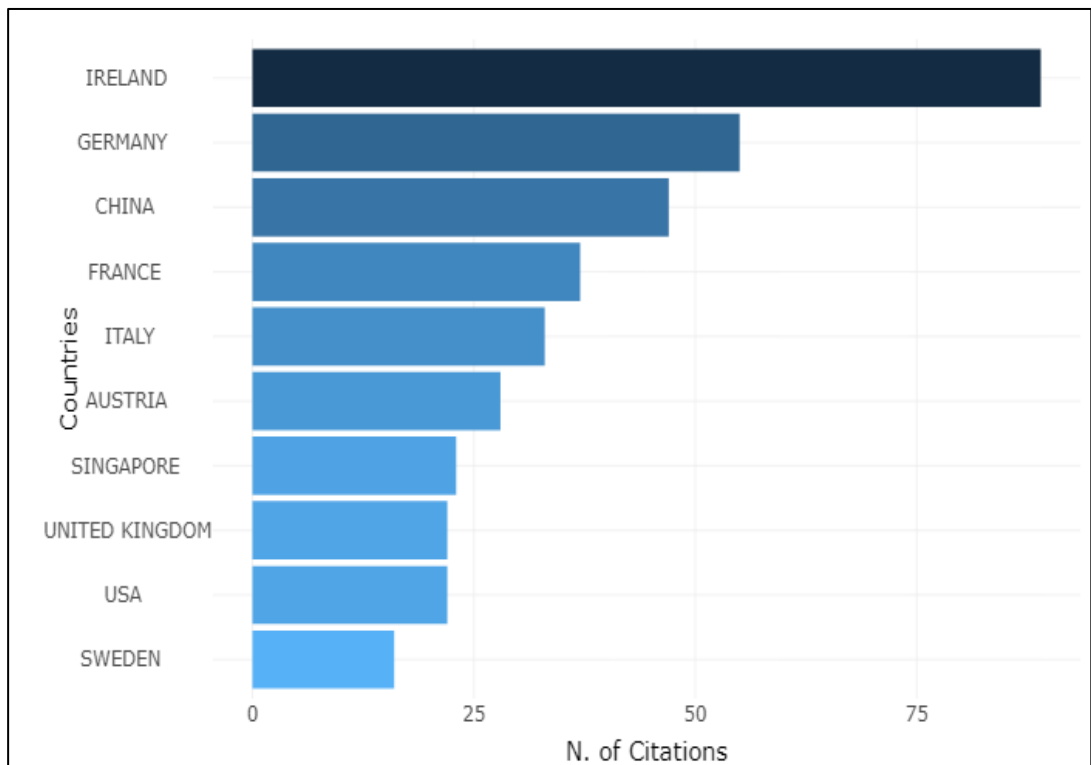
Appendix 53: Most Global Cited Documents
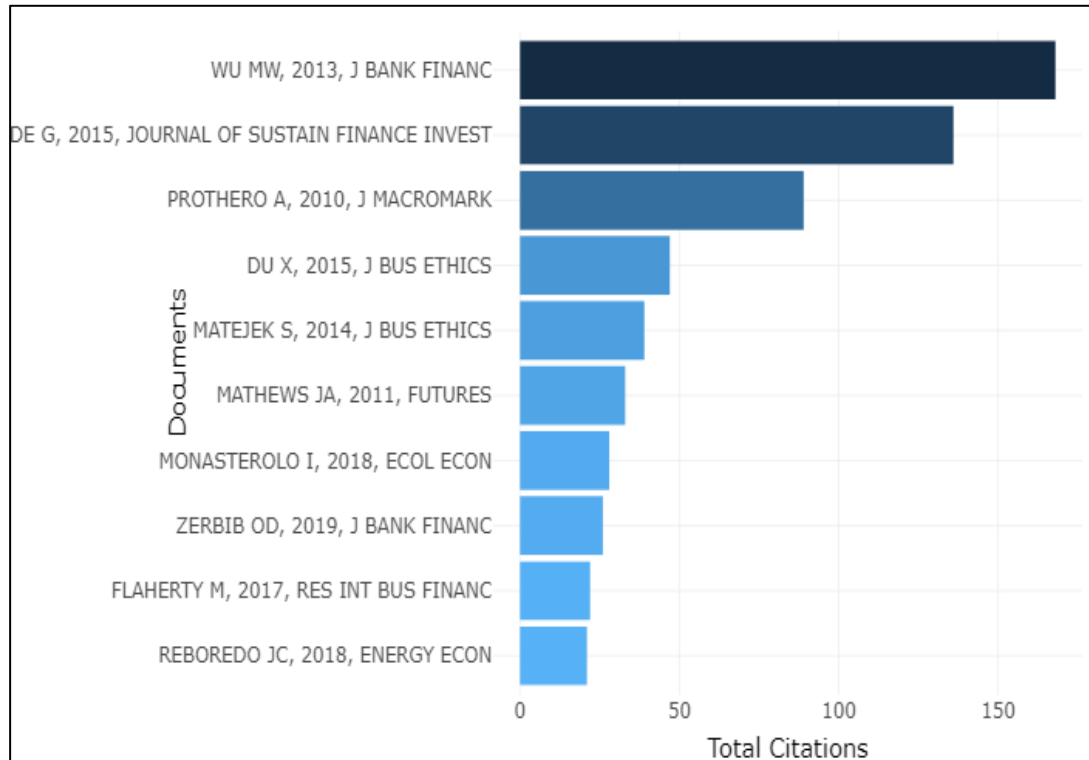
Paper	Total Ci-tations	TC per Year
WU MW, 2013, J BANK FINANC	168	21
FRIEDE G, 2015, JOURNAL OF SUSTAIN FINANCE INVEST	136	22.6667
PROTHERO A, 2010, J MACROMARK	89	8.0909
DU X, 2015, J BUS ETHICS	47	7.8333
MATEJEK S, 2014, J BUS ETHICS	39	5.5714
MATHEWS JA, 2011, FUTURES	33	3.3
MONASTEROLO I, 2018, ECOL ECON	28	9.3333
ZERBIB OD, 2019, J BANK FINANC	26	13
FLAHERTY M, 2017, RES INT BUS FINANC	22	5.5
REBOREDO JC, 2018, ENERGY ECON	21	7

Appendix 54: Keyword-Plus (Most Relevant Words)
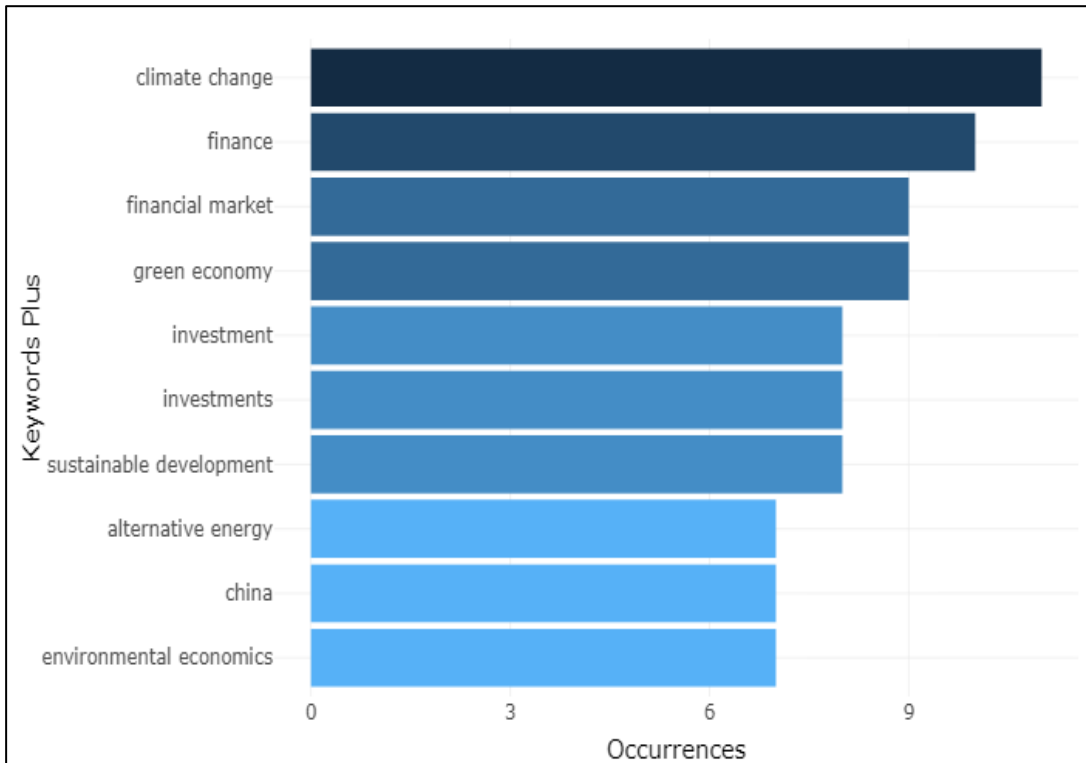
Appendix 55: Author(s)' Keywords (Most Relevant Words)
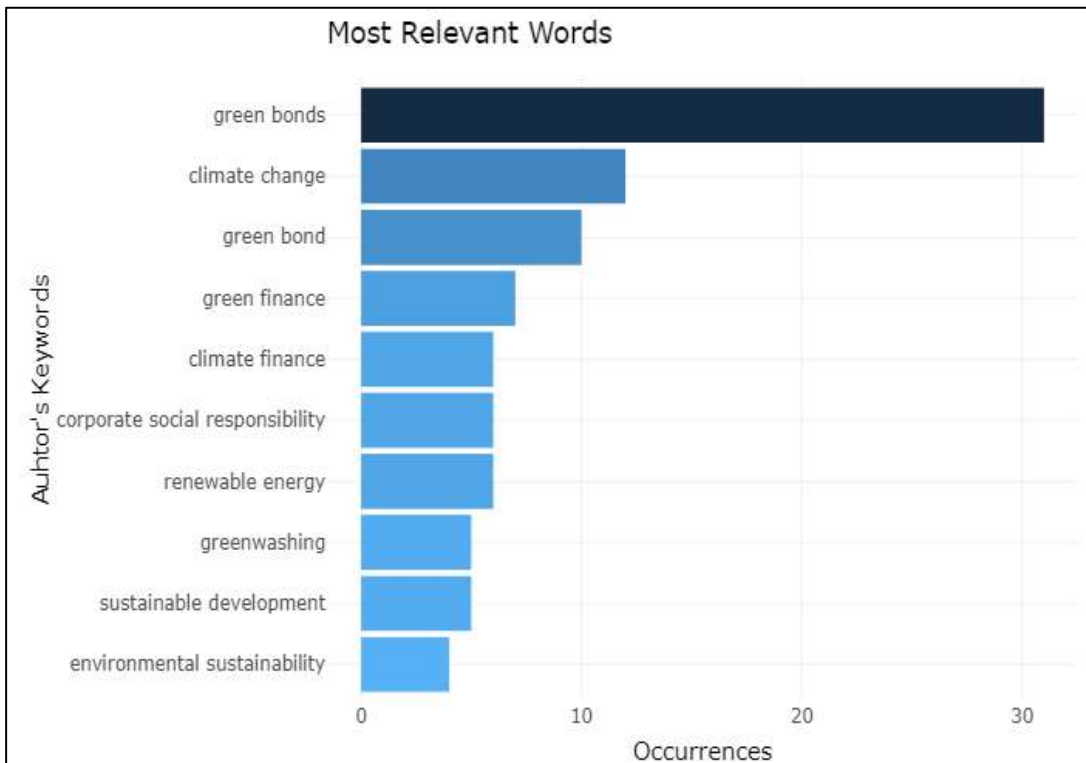
Appendix 56: Abstract's Keywords (Most Relevant Words)
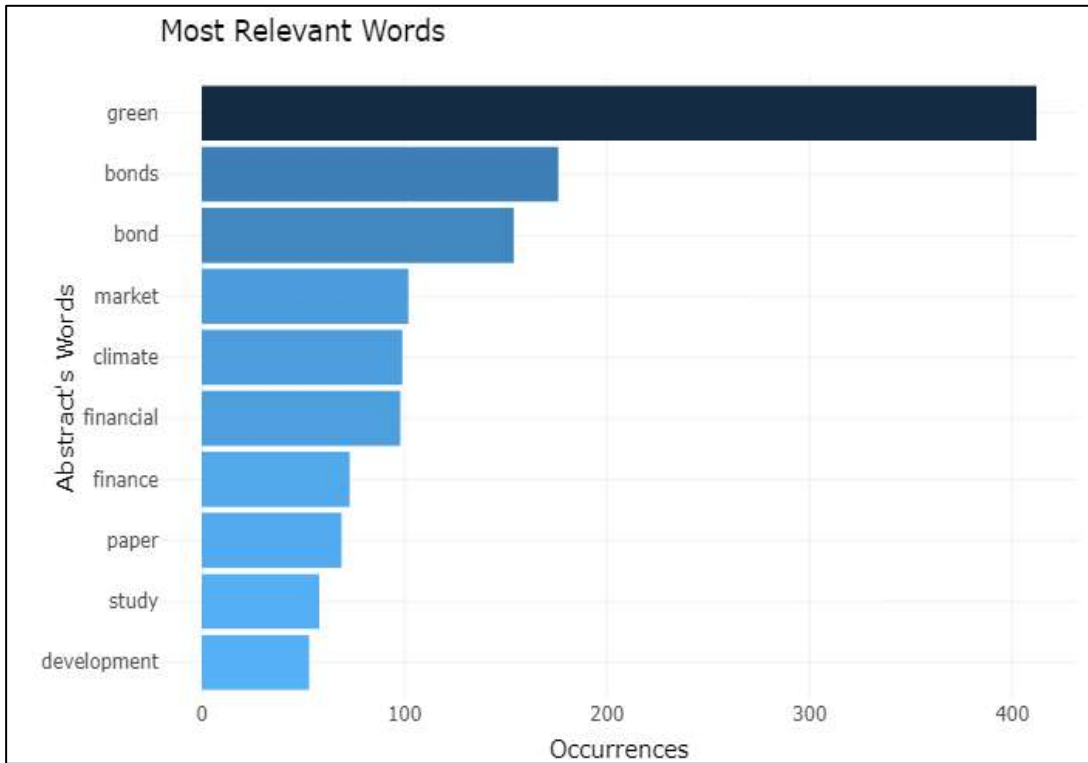
Appendix 57: WorldCloud of Most Frequent Words in Titles

Appendix 58: TreeMap of Author(s)' Keywords
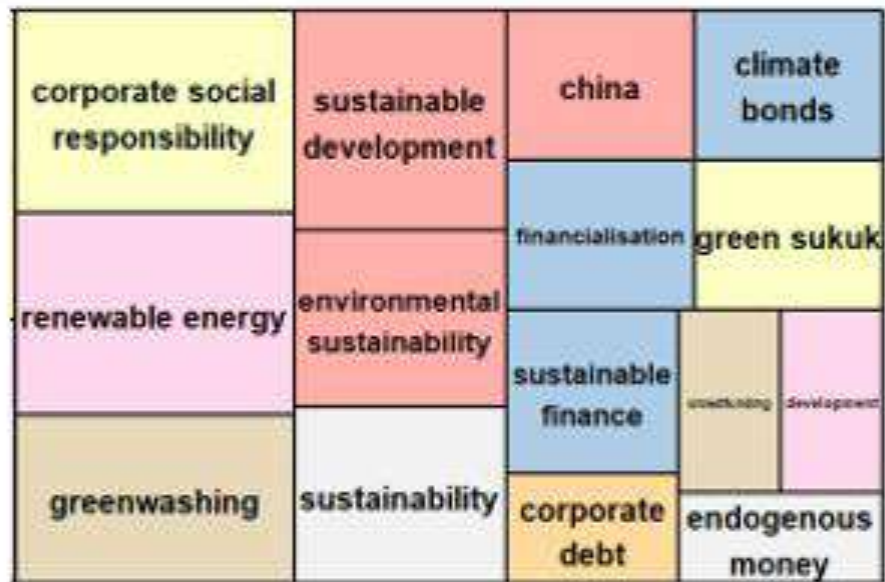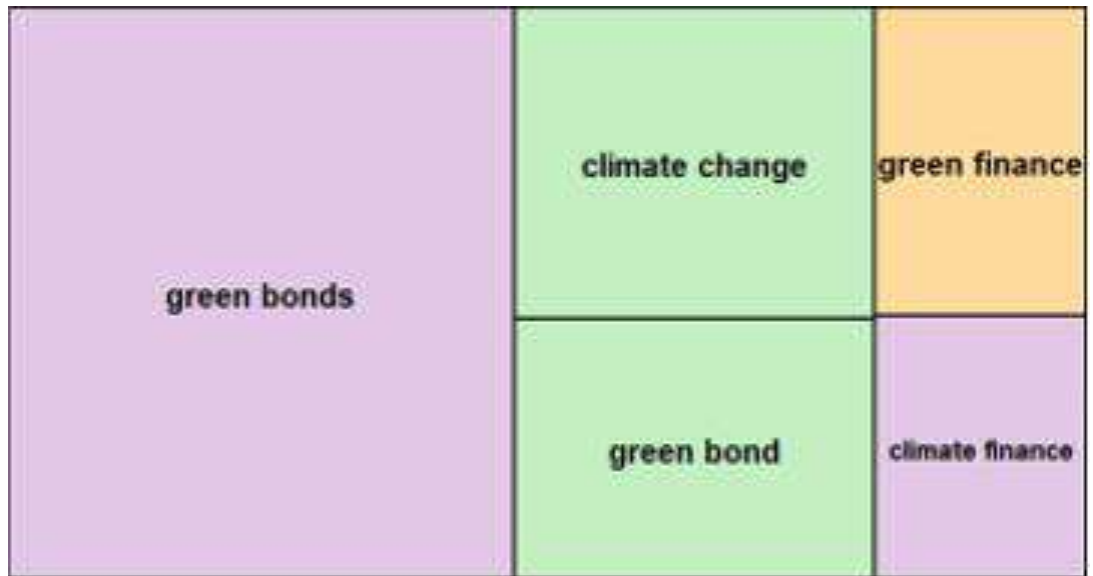
Appendix 59: TreeMap of the Abstract's Keywords
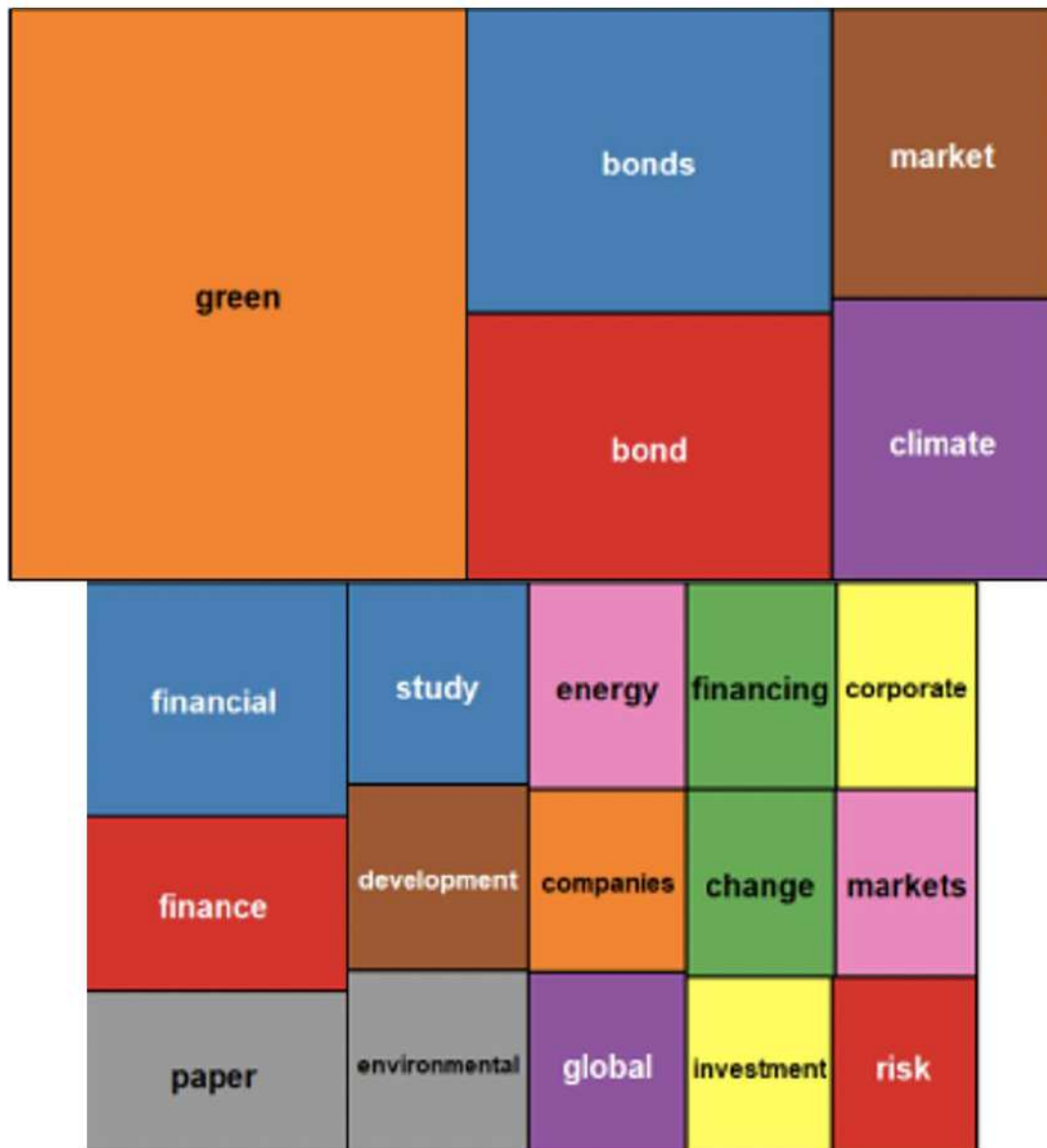
Appendix 60: Co-occurrence Network Map
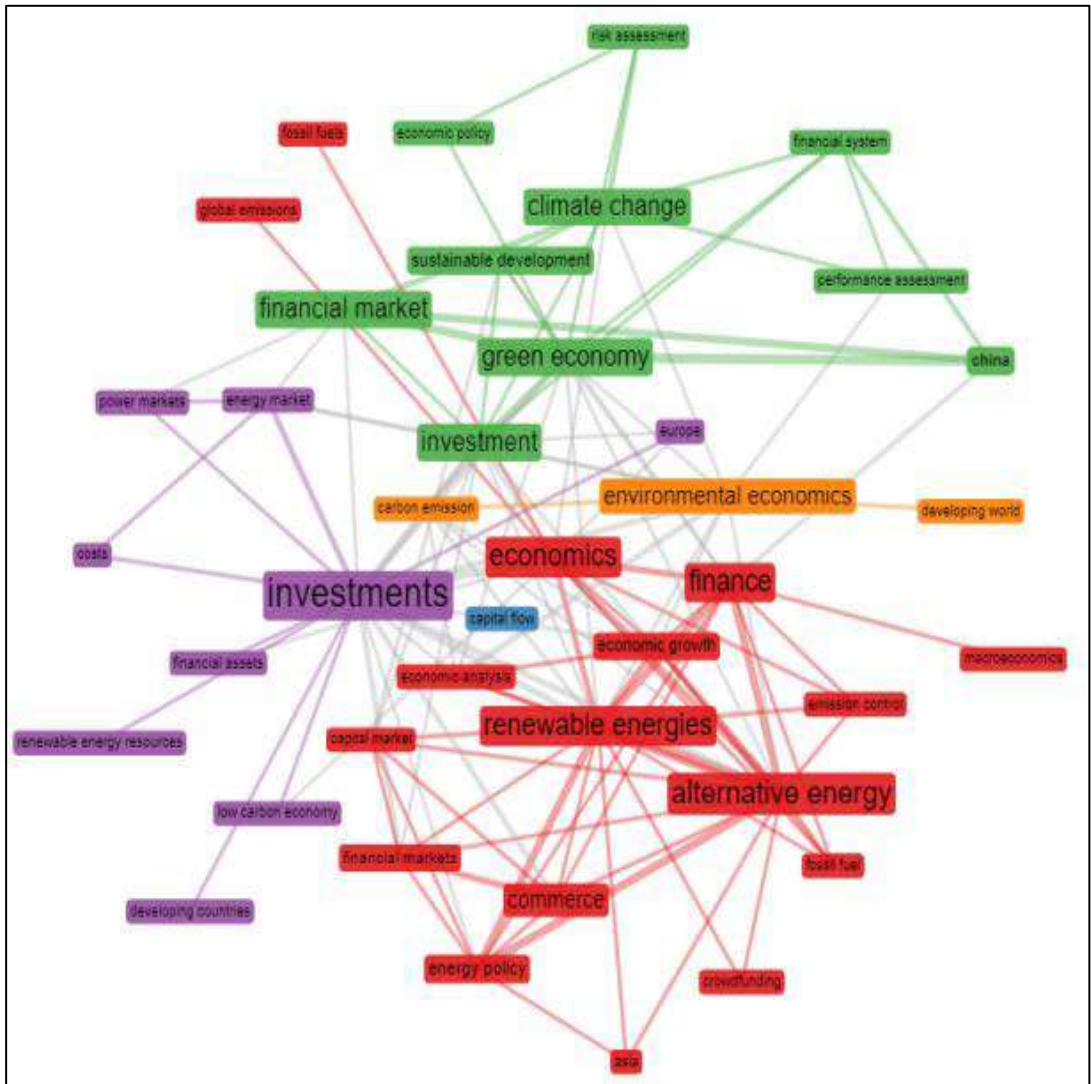
Appendix 61: Factorial Analysis Word Map
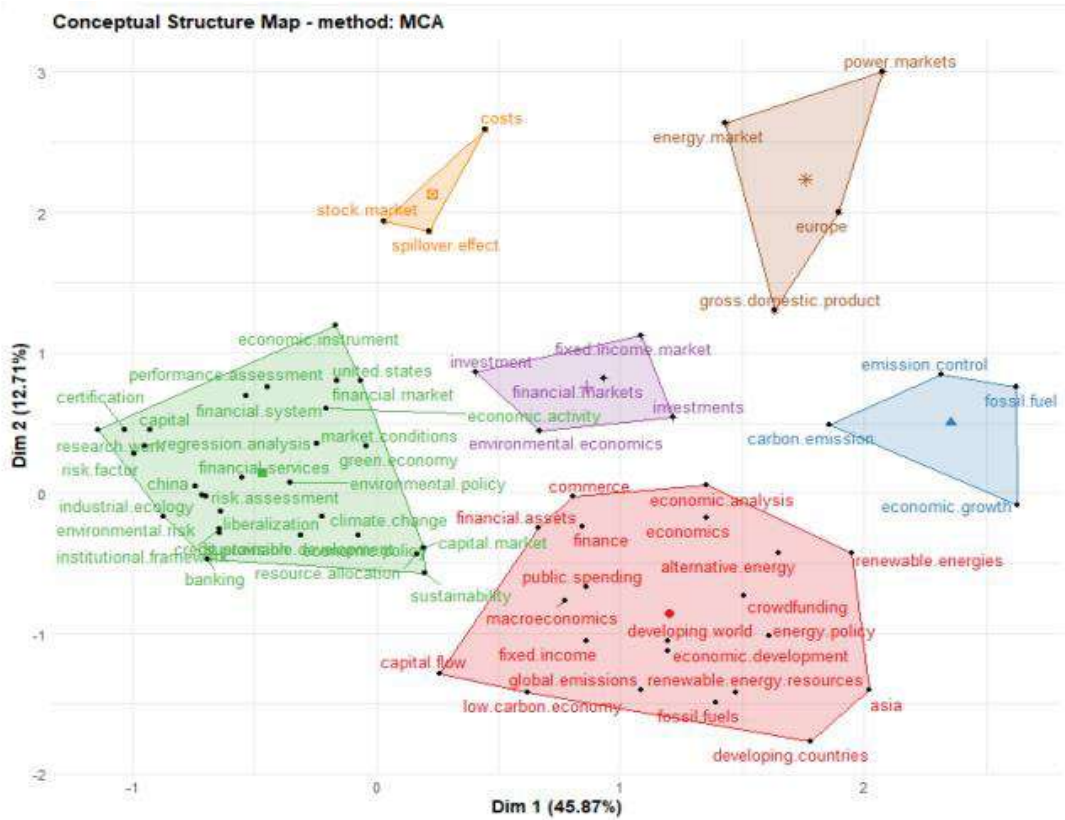
Appendix 62: Co-Citation Network Graph
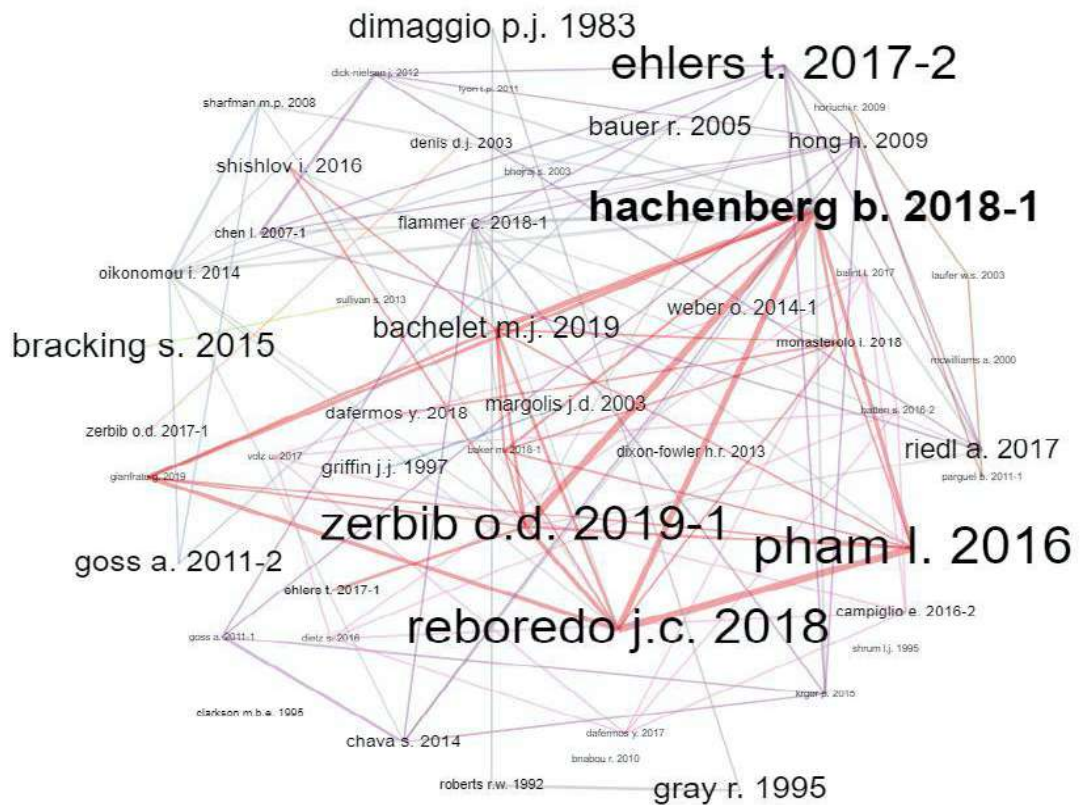
Appendix 63: Collaboration World Map Graph
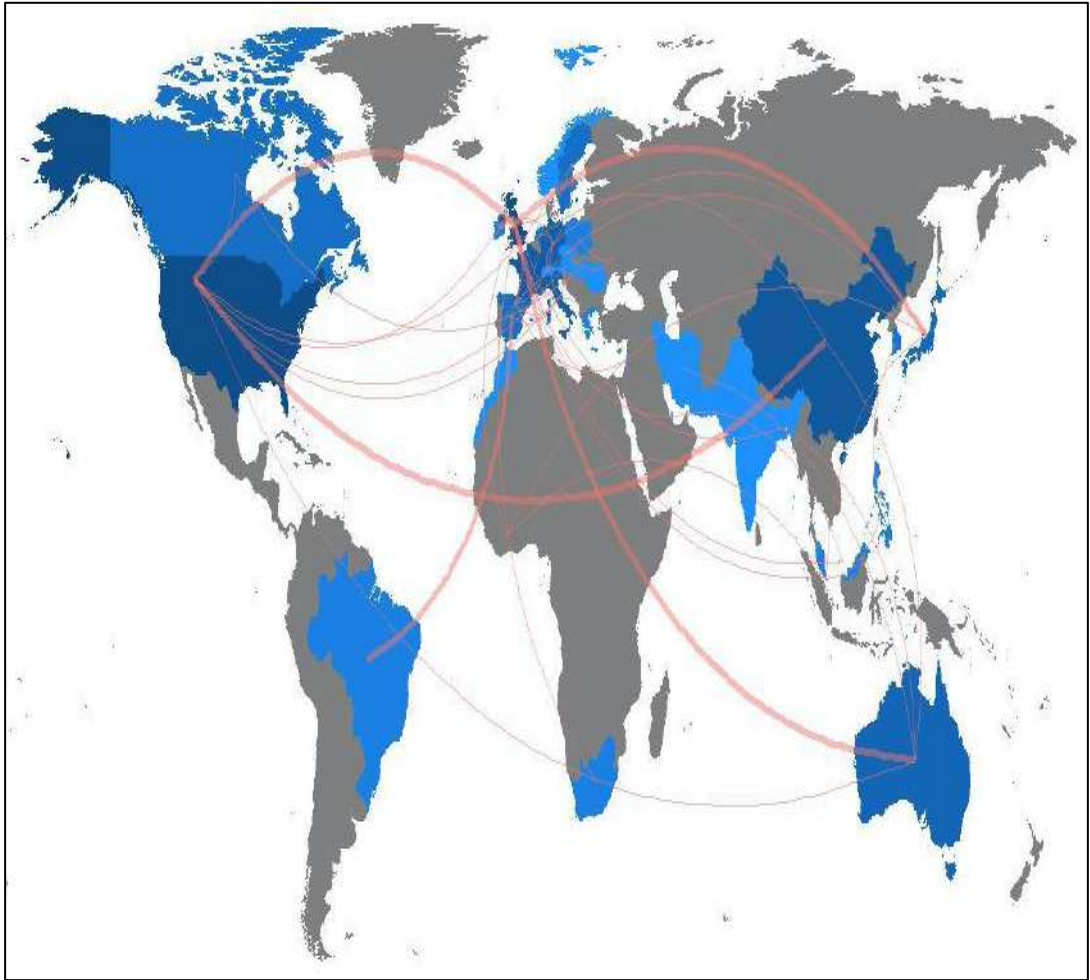
Appendix 64: Summary and Bundle of GBDTs for Era 1

ERA 1:

Baby Green Bond Market

Description	Results
MAIN INFORMATION ABOUT DATA	
Timespan	2008:2013
Sources (Journals, Books, etc)	10
Documents	10
Average years from publication	9.2
Average citations per documents	31.9
Average citations per year per doc	3.505
References	476
DOCUMENT TYPES	
Articles	10
DOCUMENT CONTENTS	
Keywords Plus (ID)	44
Author's Keywords (DE)	27
AUTHORS	
Authors	16
Author Appearances	16
Authors of single-authored documents	6
Authors of multi-authored documents	10
AUTHORS COLLABORATION	
Single-authored documents	6
Documents per Author	0.625
Authors per Document	1.6
Co-Authors per Documents	1.6
Collaboration Index	2.5

Panel 1

1 · Friedel.T · **Era 1** · **2008**

(NOT SO) CRUDE TEXT AND IMAGES: STAGING NATIVE IN BIG OIL ADVERTISING

DOI: 10.1080/147 2586080248 9908

Absence of data		CSR (2)	Green Marketing (2)	Altruistic Motive (2)
Journal of Business Ethics (10)	Journal of Banking & Finance (8) · Journal of Macro Marketing (6)	Green (25)	Corporate (9)	Global / Social (8)

Flag: USA

Global Citations: 11

Pie chart — Environmental Friendly, Culture, Greenwashing: 11, 22, 47

Variable	S
A. Credibility	4
B. SDG's	1
C. Psychology	4
D. Performance	1
E. Bond Sector	1
F- International Regulations	3
G. Company Focus	1
H. Digital Transformation	1

Panel 2

2 · Marciniak A · **Era 1** · **2009**

GREENWASHING AS AN EXAMPLE OF ECOLOGICAL MARKETING MISLEADING PRACTICES

DOI: D10.2478/v 10103-009- 0003-x

Absence of Data		CSR (2)	Green Marketing (2)	Altruistic Motive (2)
Journal of Business Ethics (10)	Journal of Banking & Finance (8) · Journal of Macro Marketing (6)	Green (25)	Corporate (9)	Global / Social (8)

Flag: Ireland

Global Citations: 1

Pie chart — Environmental, Marketing, Greenwashing: 28, 36, 32

Variable	S
A. Credibility	4
B. SDG's	1
C. Psychology	4
D. Performance	1
E. Bond Sector	1
F- International Regulations	1
G. Company Focus	1
H. Digital Transformation	2

Panel 3

3 · Gemarc Y · **Era 1** · **2010**

FINANCING THE TRANSITION TO A LOW-CARBON SOCIETY

DOI: 10.1063/1.3 459135

Absence of Data		CSR (2)	Green Marketing (2)	Altruistic Motive (2)
Journal of Business Ethics (10)	Journal of Banking & Finance (8) · Journal of Macro Marketing (6)	Green (25)	Corporate (9)	Global / Social (8)

Flag: USA

Global Citations: 4

Pie chart — Sustainable, Instrument, Environmental: 9, 26, 16

Variable	S
A. Credibility	2
B. SDG's	2
C. Psychology	3
D. Performance	2
E. Bond Sector	2
F- International Regulations	3
G. Company Focus	1
H. Digital Transformation	1

Panel 1

4
Prothero A
Era 1
2010

IS GREEN THE NEW BLACK? REFLECTIONS ON A GREEN COMMODITY DISCOURSE

10.1177/0276146710361922

DOMINANT SOCIAL PARADIGM; GREEN COMMODITY; GREEN MARKETING; SUSTAINABILITY

CSR (2) | Authors | Altruistic Motive (2)

| Journal of Business Ethics (10) | Journal of Banking & Finance (8) | Journal of Macro Marketing (6) | Green (25) | Corporate (9) | Global / Social (8) | Global Citations: 89 |

Environment | Sustainable | Marketing
20 / 41 / 72

Variable	S
A. Credibility	2
B. SDG's	1
C. Psychology	4
D. Performance	2
E. Bond Sector	2
F- International Regulations	3
G. Company Focus	1
H. Digital Transformation	1

Panel 2

5
Sabbaghi O
Era 1
2011

THE BEHAVIOR OF GREEN EXCHANGE-TRADED FUNDS

10.1108/0307435111126915

CORPORATE SOCIAL RESPONSIBILITY; ETHICAL INVESTMENT; INVESTMENT FUNDS

CSR (2) | Green Marketing (2) | Altruistic Motive (2)

| Journal of Business Ethics (10) | Journal of Banking & Finance (8) | Journal of Macro Marketing (6) | Green (25) | Corporate (9) | Global / Social (8) | Global Citations: 7 |

Volatility | Investment | Sustainable
18 / 4 / 79

Variable	S
A. Credibility	2
B. SDG's	1
C. Psychology	2
D. Performance	4
E. Bond Sector	2
F- International Regulations	2
G. Company Focus	1
H. Digital Transformation	1

Panel 3

6
Mathews JA
Era 1
2011

NATURALIZING CAPITALISM: THE NEXT GREAT TRANSFORMATION

10.1016/j.futures.2011.06.011

CIRCULAR ECONOMY; CLIMATE BONDS; CLIMATE CAPITALISM; FOSSIL-FUEL ECONOMY; GROWTH OF GREEN ECONOMY WITHIN THE OLD; INDUSTRIAL CAPITALISM; INTENSIVE VS. EXTENSIVE GROWTH

CSR (2) | Green Marketing (2) | Altruistic Motive (2)

| Journal of Business Ethics (10) | Journal of Banking & Finance (8) | Journal of Macro marketing (6) | Green (25) | Corporate (9) | Global / Social (8) | Global Citations: 33 |

Investment | Bonds | Sustainable
5 / 14 / 27

Variable	S
A. Credibility	3
B. SDG's	1
C. Psychology	2
D. Performance	2
E. Bond Sector	3
F- International Regulations	2
G. Company Focus	1
H. Digital Transformation	1

GREENWASHING: A CONSUMER PERSPECTIVE

NO DOI

7

Nyilasy G

Era 1

2012

ATTRIBUTION THEORY; CONSUMER ATTITUDES; CORPORATE ADVERTISING; GREEN ADVERTISING; GREEN MARKETING; GREENWASHING

| CSR (2) | Green Marketing (2) | Altruistic Motive (2) |

| Journal of Business Ethics (10) | Journal of Banking & Finance (8) | Journal of Macro Marketing (6) | Green (25) | Corporate (9) | Global / Social (8) | Global Citations: 5 |

Variable	S
A. Credibility	4
B. SDG's	1
C. Psychology	4
D. Performance	4
E. Bond Sector	1
F- International Regulations	1
G. Company Focus	1
H. Digital Transformation	1

Pie chart: 16, 3, 35 — Performance, Greenwashing, Ethical

GREEN DOCUMENTS THROUGH ELECTRONIC DATA MANAGEMENT

NO DOI

8

Mares MD

Era 1

2012

DATA AND IMAGE MANAGEMENT; E-DEVELOPMENT OF ECONOMIC ACTIVITY; NEW ECONOMY BASED ON KNOWLEDGE; PRIVATE DATA; RESOURCE CONSERVATION

| CSR (2) | Green Marketing (2) | Altruistic Motive (2) |

| Journal of Business Ethics (10) | Journal of Banking & Finance (8) | Journal of Macro Marketing (6) | Green (25) | Corporate (9) | Global / Social (8) | Global Citations:0 |

Variable	S
A. Credibility	1
B. SDG's	1
C. Psychology	1
D. Performance	1
E. Bond Sector	1
F- International Regulations	2
G. Company Focus	1
H. Digital Transformation	4

Pie chart: 7, 6, 30 — Data, Environment, Digital

GREEN MARKETING GOES NEGATIVE: THE ADVENT OF REVERSE GREENWASHING

10.1017/S1867299X00002506

9

Lane EL

Era 1

2012

Absence of Data

| CSR (2) | Green Marketing (2) | Altruistic Motive (2) |

| Journal of Business Ethics (10) | Journal of Banking & Finance (8) | Journal of Macro Marketing (6) | Green (25) | Corporate (9) | Global / Social (8) | Global Citations: 1 |

Variable	S
A. Credibility	4
B. SDG's	1
C. Psychology	4
D. Performance	1
E. Bond Sector	1
F- International Regulations	1
G. Company Focus	1
H. Digital Transformation	1

Pie chart: 30, 67, 34 — Environment, Greenwashing, Marketing

Appendix 65: Summary and Bundle of GBDTs for Era 2

Description	Results
MAIN INFORMATION ABOUT DATA	
Timespan	2014:2016
Sources (Journals, Books, etc)	9
Documents	13
Average years from publication	5.15
Average citations per documents	23.92
Average citations per year per doc	3.968
References	729
DOCUMENT TYPES	
Articles	13
DOCUMENT CONTENTS	
Keywords Plus (ID)	38
Author's Keywords (DE)	56
AUTHORS	
Authors	26
Author Appearances	26
Authors of single-authored documents	6
Authors of multi-authored documents	20
AUTHORS COLLABORATION	
Single-authored documents	6
Documents per Author	0.5
Authors per Document	2
Co-Authors per Documents	2
Collaboration Index	2.86

ERA 2:

Green Bond Boom

Entry 11

BEYOND LEGITIMACY: A CASE STUDY IN BP'S "GREEN LASHING"

10.1007/s10551-013-2006-6

11

Matejek S

Era 2

2014

BP; CORPORATE COMMUNICATION; CORPORATE ENVIRONMENTAL RESPONSIBILITY; IMAGE CRISIS; IMPRESSION MANAGEMENT; NARRATIVE ANALYSIS

Climate Change (2)	Green-Washing (2)	British Petroleum (2)

Journal of Business Ethics (31)	Journal of Industrial Ecology (19)	Journal of Financial Economics (17)	Green (31)	Climate (27)	Market (16)	**Global Citations: 39**

Pie chart: Communication, Greening, Marketing — 7, 25, 47

Variable	S
A. Credibility	4
B. SDG's	1
C. Psychology	4
D. Performance	2
E. Bond Sector	1
F- International Regulations	1
G. Company Focus	1
H. Digital Transformation	1

Entry 12

ON PRICING OF CORPORATE SECURITIES IN THE CASE OF JUMP-DIFFUSION

10.1007/s11766-014-2978-8

12

Ren XM

Era 2

2014

CORPORATE BOND; DEFAULT RISK; JUMP DIFFUSION PROCESS; STOCHASTIC INTEREST RATE

Climate Change (2)	Green-Washing (2)	British Petroleum (2)

Journal of Business Ethics (31)	Journal of Industrial Ecology (19)	Journal of Financial Economics (17)	Green (31)	Climate (27)	Market (16)	**Global Citations: 0**

Pie chart: Pricing, Spread, Corporate — 11, 16, 16

Variable	S
A. Credibility	4
B. SDG's	1
C. Psychology	4
D. Performance	1
E. Bond Sector	1
F- International Regulations	2
G. Company Focus	1
H. Digital Transformation	1

Entry 13

EXPLORING GREEN CONSUMERS' MIND-SET TOWARD GREEN PRODUCT DESIGN AND LIFE CYCLE ASSESSMENT: THE CASE OF SKEPTICAL BRAZILIAN AND PORTUGUESE GREEN CONSUMERS LEMKE AND LUZIO EXPLORING GREEN CONSUMERS' MIND-SET TOWARD DESIGN AND LCA

10.1111/jiec.12123

13

Lemke F

Era 2

2014

CONSUMER SKEPTICISM; GREEN CONSUMERS; GREEN PRODUCTION; GREENWASHING; INDUSTRIAL ECOLOGY; MARKET-ORIENTED SUSTAINABILITY

Climate Change (2)	Green-Washing (2)	British Petroleum (2)

Journal of Business Ethics (31)	Journal of Industrial Ecology (19)	Journal of Financial Economics (17)	Green (31)	Climate (27)	Market (16)	**Global Citations: 18**

Pie chart: Environment, Marketing, Credibility — 14, 15, 65

Variable	S
A. Credibility	4
B. SDG's	1
C. Psychology	4
D. Performance	1
E. Bond Sector	1
F- International Regulations	2
G. Company Focus	1
H. Digital Transformation	1

GREEN BONDS: SPRING IN THE AIR

NO DOI

14

Na Na

Era 2

2014

Absence of data			Climate Change (2)	Green-Washing (2)	British Petroleum (2)
Journal of Business Ethics (31)	Journal of Industrial Ecology (19)	Journal of Financial Economics (17)	Green (31)	Climate (27)	Market (16)

Global Citations: 0

Variable	S
A. Credibility	3
B. SDG's	1
C. Psychology	2
D. Performance	1
E. Bond Sector	3
F- International Regulations	1
G. Company Focus	4
H. Digital Transformation	1

Environment ■ Corporate Bond ■ Proceeds

FINANCIAL EFFECTS OF CORPORATE SOCIAL RESPONSIBILITY: A LITERATURE REVIEW

10.1080/204 30795.2014. 971096

15

Schrder M

Era 2

2014

CORPORATE FINANCE; CORPORATE RESPONSIBILITY; SRIS			Climate Change (2)	Green-Washing (2)	British Petroleum (2)
Journal of Business Ethics (31)	Journal of Industrial Ecology (19)	Journal of Financial Economics (17)	Green (31)	Climate (27)	Market (16)

Global Citations: 8

Variable	S
A. Credibility	1
B. SDG's	1
C. Psychology	1
D. Performance	4
E. Bond Sector	2
F- International Regulations	2
G. Company Focus	1
H. Digital Transformation	1

Environment ■ Corporate Bond ■ Green Real Estate

RESTARTING EUROPEAN LONG-TERM INVESTMENT FINANCE: A GREEN PAPER DISCUSSION DOCUMENT

NO DOI

16

Giovanni A

Era 2

2015

Absence of data			Climate Change (2)	Green-Washing (2)	British Petroleum (2)
Journal of Business Ethics (31)	Journal of Industrial Ecology (19)	Journal of Financial Economics (17)	Green (31)	Climate (27)	Market (16)

Global Citations: 0

Variable	S
A. Credibility	1
B. SDG's	1
C. Psychology	3
D. Performance	4
E. Bond Sector	3
F- International Regulations	2
G. Company Focus	1
H. Digital Transformation	1

Long term ■ Standard ■ Corporate Bond

Entry 17

17

Szumilo N

Era 2

2015

WHO CAPTURES THE GREEN VALUE IN THE US OFFICE MARKET?

10.1080/204
30795.2015.
1054336

COMMERCIAL REAL ESTATE; ECO-CERTIFICATION; GREEN BUILDINGS; PRICING OF ENERGY EFFICIENCY	Climate Change (2)	Green-Washing (2)	British Petroleum (2)

Journal of Business Ethics (31)	Journal of Industrial Ecology (19)	Journal of Financial Economics (17)	Green (31)	Climate (27)	Market (16)	Global Citations: 4

Pie chart: Sustainable, Premium, Performance — 7, 33, 32

Variable	S
A. Credibility	2
B. SDG's	1
C. Psychology	2
D. Performance	4
E. Bond Sector	1
F- International Regulations	1
G. Company Focus	1
H. Digital Transformation	1

Entry 18

18

Du X

Era 2

2015

HOW THE MARKET VALUES GREENWASHING? EVIDENCE FROM CHINA

10.1007/s10
551-014-
2122-y

CHINA; CORPORATE ENVIRONMENTAL PERFORMANCE; CUMULATIVE ABNORMAL RETURNS (CAR); ENVIRONMENTAL WRONGDOER; GREENWASHING; MEDIA COVERAGE; THE COMPETITIVE EFFECT; THE CONTAGIOUS EFFECT; THE GLOBAL REPORTING INITIATIVE (GRI)	Climate Change (2)	Green-Washing (2)	British Petroleum (2)

Journal of Business Ethics (31)	Journal of Industrial Ecology (19)	Journal of Financial Economics (17)	Green (31)	Climate (27)	Market (16)	Global Citations: 47

Pie chart: Performance, Measure, Sustainable — 18, 28, 113

Variable	S
A. Credibility	4
B. SDG's	1
C. Psychology	2
D. Performance	4
E. Bond Sector	1
F- International Regulations	1
G. Company Focus	1
H. Digital Transformation	1

Entry 19

19

Friede G

Era 2

2015

ESG AND FINANCIAL PERFORMANCE: AGGREGATED EVIDENCE FROM MORE THAN 2000 EMPIRICAL STUDIES

10.1080/204
30795.2015.
1118917

BUSINESS CASE; ESG CRITERIA; FINANCIAL PERFORMANCE; SECOND-ORDER META-ANALYSIS; VOTE-COUNT STUDIES	Climate Change (2)	Green-Washing (2)	British Petroleum (2)

Journal of Business Ethics (31)	Journal of Industrial Ecology (19)	Journal of Financial Economics (17)	Green (31)	Climate (27)	Market (16)	Global Citations: 136

Pie chart: Investment, Environment, Psychology — 8, 7, 20

Variable	S
A. Credibility	1
B. SDG's	1
C. Psychology	3
D. Performance	4
E. Bond Sector	1
F- International Regulations	1
G. Company Focus	1
H. Digital Transformation	1

Panel 1

20

Bracking s

Era 2

2015

PERFORMATIVITY IN THE GREEN ECONOMY: HOW FAR DOES CLIMATE FINANCE CREATE A FICTIVE ECONOMY?

10.1080/01436597.2015.1086263

CLEAN DEVELOPMENT MECHANISM; CLIMATE CHANGE; FINANCIALISATION; GREEN ECONOMY; PERFORMATIVITY; SOUTH AFRICA

Climate Change (2)	Green-Washing (2)	British Petroleum (2)

Journal of Business Ethics (31)	Journal of Industrial Ecology (19)	Journal of Financial Economics (17)	Green (31)	Climate (27)	Market (16)	Global Citations: 20

Pie chart: 4, 13, 30 — ■ Environment ■ Proceeds ■ Classification

Variable	S
A. Credibility	2
B. SDG's	1
C. Psychology	3
D. Performance	4
E. Bond Sector	3
F- International Regulations	2
G. Company Focus	1
H. Digital Transformation	1

Panel 2

21

NG TH

Era 2

2016

BOND FINANCING FOR RENEWABLE ENERGY IN ASIA

10.1016/j.enpol.2016.03.015

FIXED INCOME; GREEN BOND; RENEWABLE ENERGY BONDS; RENEWABLE ENERGY FINANCING

Climate Change (2)	Green-Washing (2)	British Petroleum (2)

Journal of Business Ethics (31)	Journal of Industrial Ecology (19)	Journal of Financial Economics (17)	Green (31)	Climate (27)	Market (16)	Global Citations: 21

Pie chart: 2, 7, 11 — ■ Instrument ■ Corporate Bond ■ ASEAN

Variable	S
A. Credibility	3
B. SDG's	1
C. Psychology	2
D. Performance	3
E. Bond Sector	4
F- International Regulations	4
G. Company Focus	1
H. Digital Transformation	1

Panel 3

22

Pham L

Era 2

2016

IS IT RISKY TO GO GREEN? A VOLATILITY ANALYSIS OF THE GREEN BOND MARKET

10.1080/20430795.2016.1237244

GARCH MODELING; GREEN BONDS; GREEN FINANCIAL INVESTMENTS

Climate Change (2)	Green-Washing (2)	British Petroleum (2)

Journal of Business Ethics (31)	Journal of Industrial Ecology (19)	Journal of Financial Economics (17)	Green (31)	Climate (27)	Market (16)	Global Citations: 16

Pie chart: 12, 22, 79 — ■ Volatility ■ Environment ■ Performance

Variable	S
A. Credibility	3
B. SDG's	1
C. Psychology	2
D. Performance	4
E. Bond Sector	3
F- International Regulations	4
G. Company Focus	1
H. Digital Transformation	1

23

Puaschunder JM

Era 2

2016

MAPPING CLIMATE IN THE TWENTY-FIRST CENTURY

10.1057/s41301-017-0110-0

CLIMATE CHANGE; CLIMATE CHANGE GAINS AND LOSSES; CLIMATE JUSTICE; DEVELOPMENT; FAIRNESS; GLOBAL WARMING; INTERGENERATIONAL RESPONSIBILITY; INTERNATIONAL LAW

| Climate Change (2) | Green-Washing (2) | British Petroleum (2) |

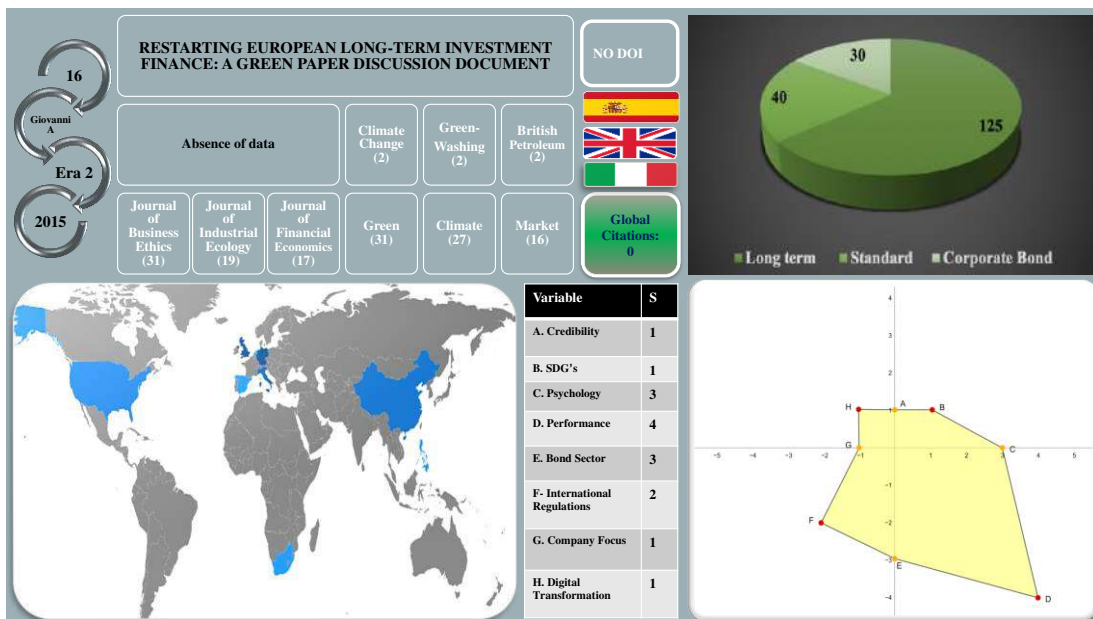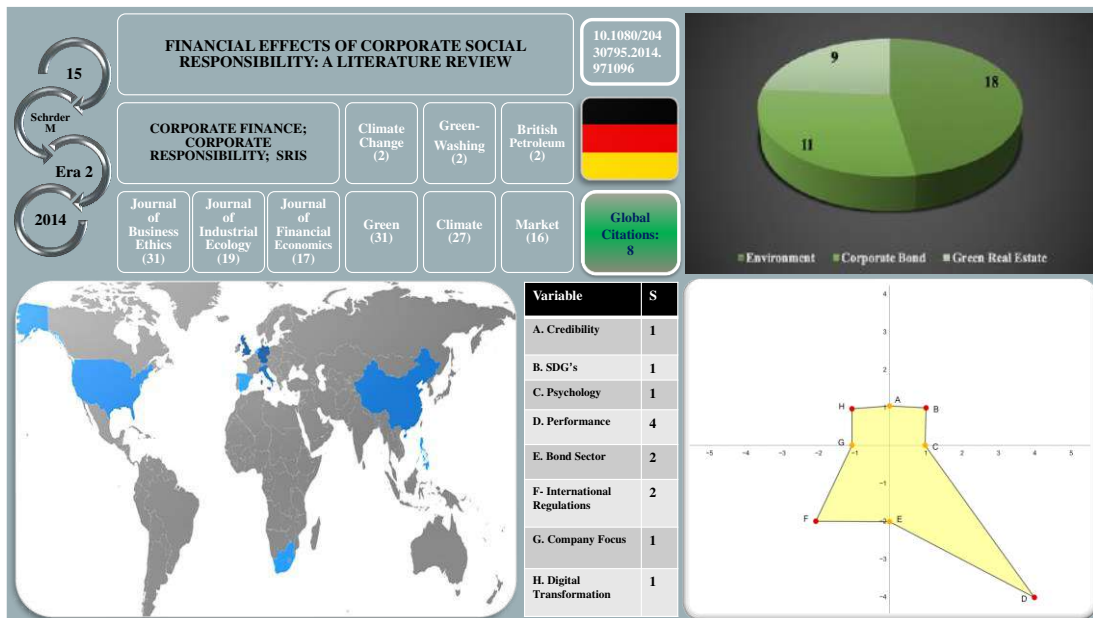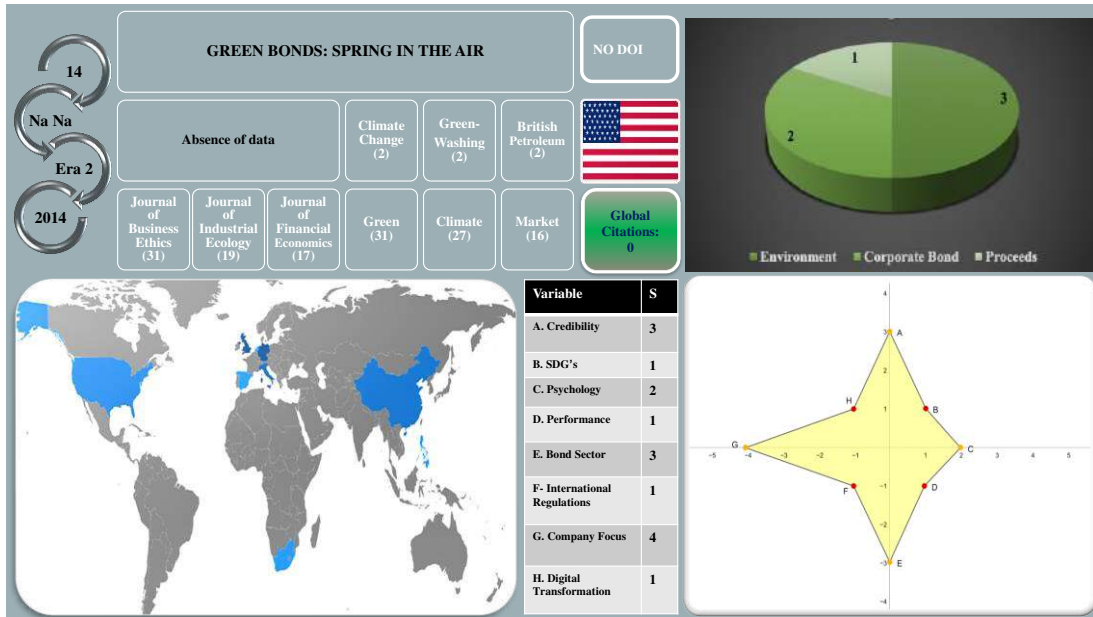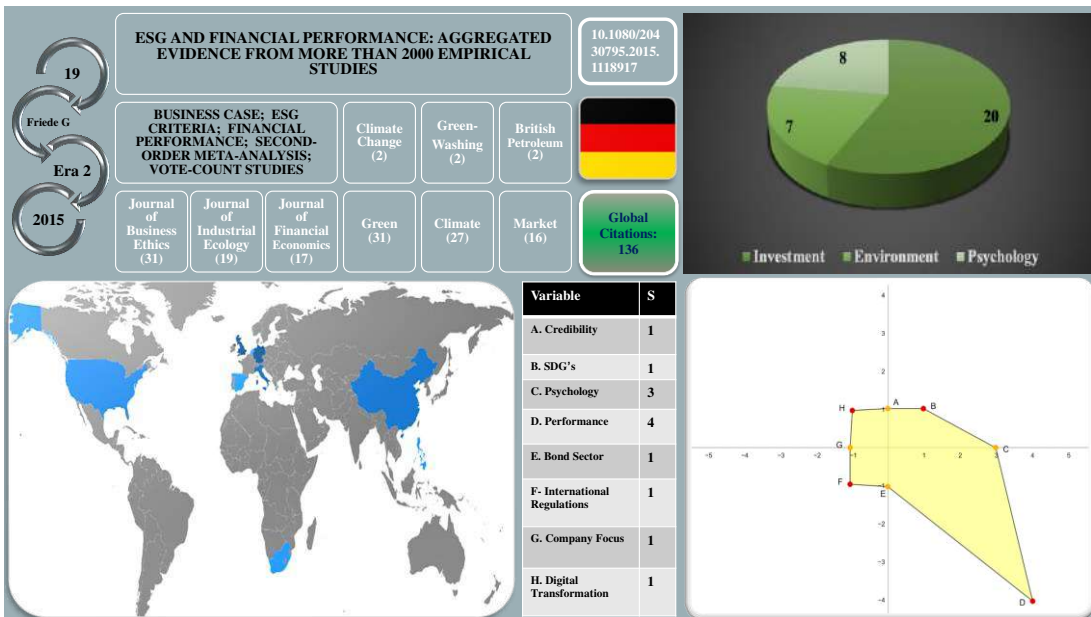| Journal of Business Ethics (31) | Journal of Industrial Ecology (19) | Journal of Financial Economics (17) | Green (31) | Climate (27) | Market (16) | Global Citations: 2 |

3 | 5 | 12

■ Environment ■ Invest ■ Climate Bond

Variable	S
A. Credibility	2
B. SDG's	1
C. Psychology	1
D. Performance	1
E. Bond Sector	3
F- International Regulations	2
G. Company Focus	1
H. Digital Transformation	1

Appendix 66: Summary and Bundle of GBDTs for Era 3

Description	Results
MAIN INFORMATION ABOUT DATA	
Timespan	2017:2020(May)
Sources (Journals, Books, etc)	50
Documents	75
Average years from publication	1.01
Average citations per documents	4.293
Average citations per year per doc	1.813
References	3642
DOCUMENT TYPES	
Articles	75
DOCUMENT CONTENTS	
Keywords Plus (ID)	214
Author's Keywords (DE)	286
AUTHORS	
Authors	156
Author Appearances	167
Authors of single-authored documents	18
Authors of multi-authored documents	138
AUTHORS COLLABORATION	
Single-authored documents	18
Documents per Author	0.481
Authors per Document	2.08
Co-Authors per Documents	2.23
Collaboration Index	2.42

ERA 3:

THE GREEN LEAP FORWARD

24

Morea D

Era 3

2017

AN INNOVATIVE MODEL FOR THE SUSTAINABILITY OF INVESTMENTS IN THE WIND ENERGY SECTOR: THE USE OF GREEN SUKUK IN AN ITALIAN CASE STUDY

NO DOI

GREEN SUKUK; GRID PARITY; WIND ENERGY

| Green Bond(s) (39) | Climate Change (10) | Green Finance (7) |

| Journal of Business Ethics (41) | Journal of Applied Accounting (35) | Journal of Finance & Economics (35) | Green (356) | Bond (305) | Financial (83) | Global Citations: 7 |

Variable	S
A. Credibility	3
B. SDG's	4
C. Psychology	1
D. Performance	1
E. Bond Sector	1
F- International Regulations	2
G. Company Focus	1
H. Digital Transformation	1

25

Khalil S

Era 3

2017

CORPORATE SOCIAL RESPONSIBILITY: INTERNET SOCIAL AND ENVIRONMENTAL REPORTING BY BANKS

10.1108/MEDAR-10-2016-0082

BANKS; CORPORATE SOCIAL RESPONSIBILITY; INTERNET SOCIAL AND ENVIRONMENTAL REPORTING; LEBANON; SOCIAL DISCLOSURES

| Green Bond(s) (39) | Climate Change (10) | Green Finance (7) |

| Journal of Business Ethics (41) | Journal of Applied Accounting (35) | Journal of Finance & Economics (35) | Green (356) | Bond (305) | Financial (83) | Global Citations: 8 |

Variable	S
A. Credibility	4
B. SDG's	1
C. Psychology	2
D. Performance	3
E. Bond Sector	1
F- International Regulations	3
G. Company Focus	1
H. Digital Transformation	3

26

Hassan A

Era 3

2017

THE RELATIONSHIPS BETWEEN REPORTING FORMAT, ENVIRONMENTAL DISCLOSURE AND ENVIRONMENTAL PERFORMANCE AN EMPIRICAL STUDY

10.1108/JAAR-06-2015-0056

ENVIRONMENTAL DISCLOSURE; ENVIRONMENTAL PERFORMANCE; GREENWASHING; INDUSTRY MEMBERSHIP; LEGITIMACY THEORY; REPORTING FORMAT

| Green Bond(s) (39) | Climate Change (10) | Green Finance (7) |

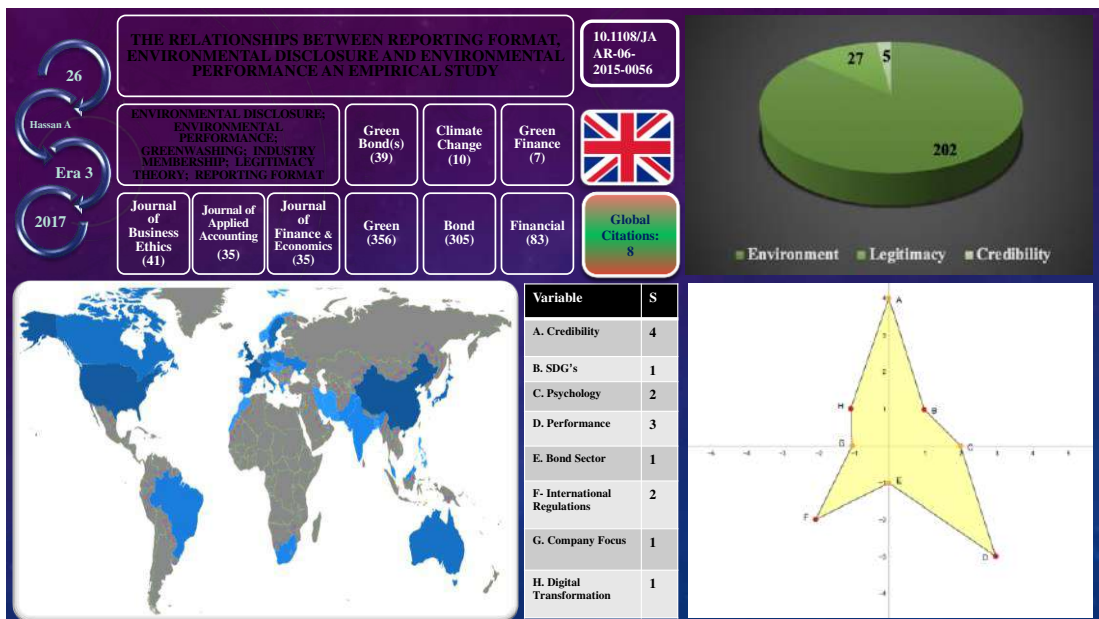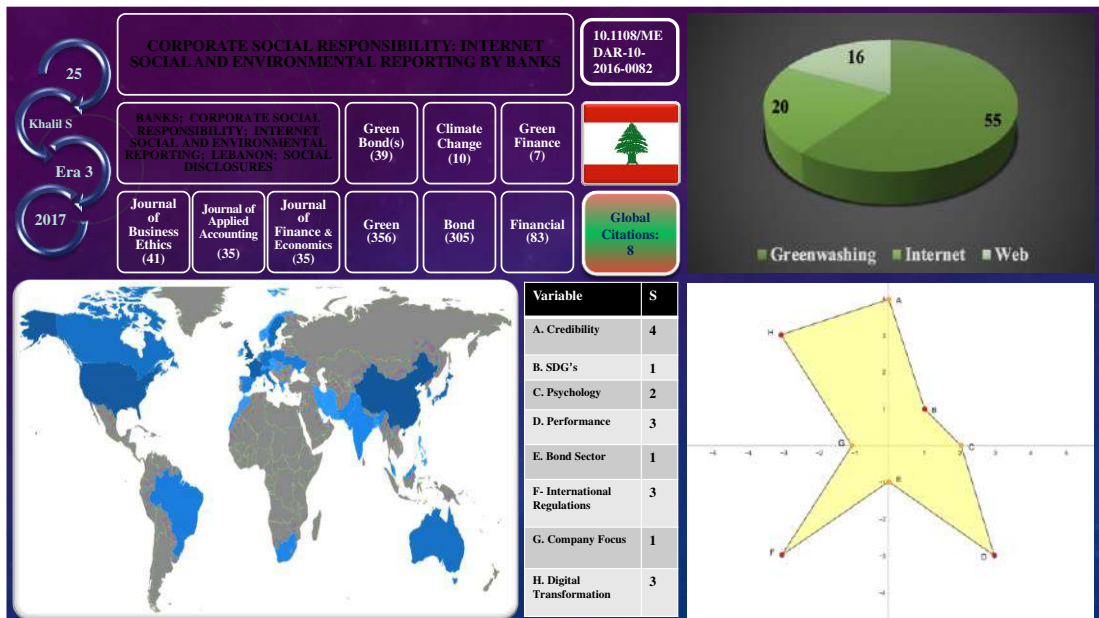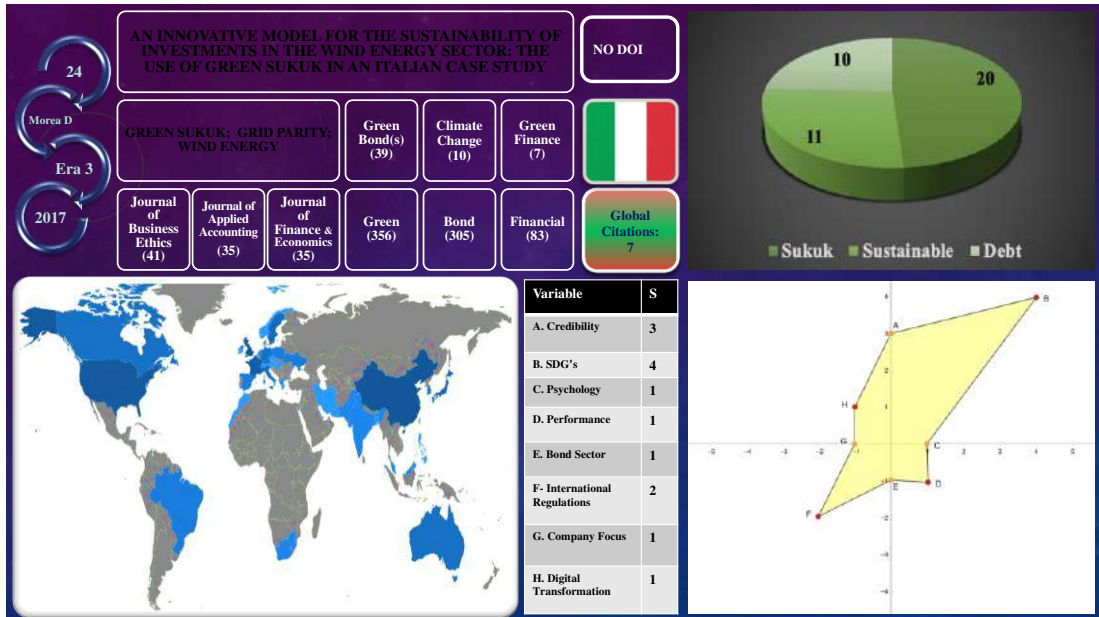| Journal of Business Ethics (41) | Journal of Applied Accounting (35) | Journal of Finance & Economics (35) | Green (356) | Bond (305) | Financial (83) | Global Citations: 8 |

Variable	S
A. Credibility	4
B. SDG's	1
C. Psychology	2
D. Performance	3
E. Bond Sector	1
F- International Regulations	2
G. Company Focus	1
H. Digital Transformation	1

33

Liu J

Era 3

2018

ANALYSIS ON THE ROLE AND EFFECT OF INCLUSIVE FINANCE IN THE DEVELOPMENT OF GREEN ECOLOGICAL INDUSTRY UNDER THE BACKGROUND OF POVERTY ALLEVIATION

NO DOI

INCLUSIVE FINANCE; POVERTY ALLEVIATION; POVERTY REDUCTION

| Green Bond(s) (39) | Climate Change (10) | Green Finance (7) |

| Journal of Business Ethics (41) | Journal of Applied Accounting (35) | Journal of Finance & Economics (35) | Green (356) | Bond (305) | Financial (83) | Global Citations: 1 |

Pie chart: Ecological 50, China 18, Green Finance 7

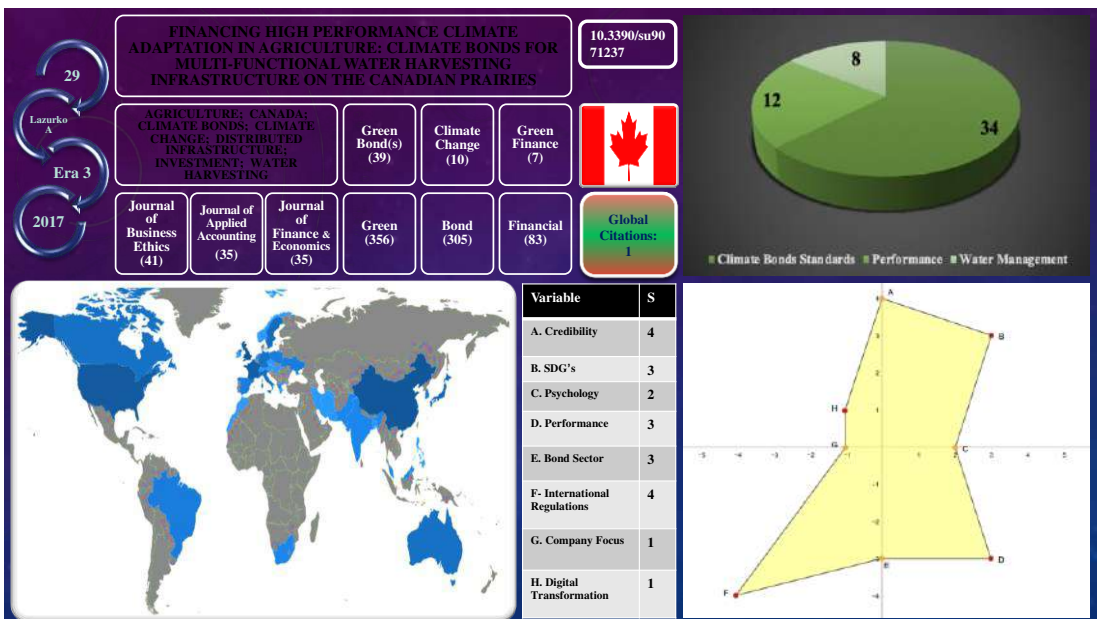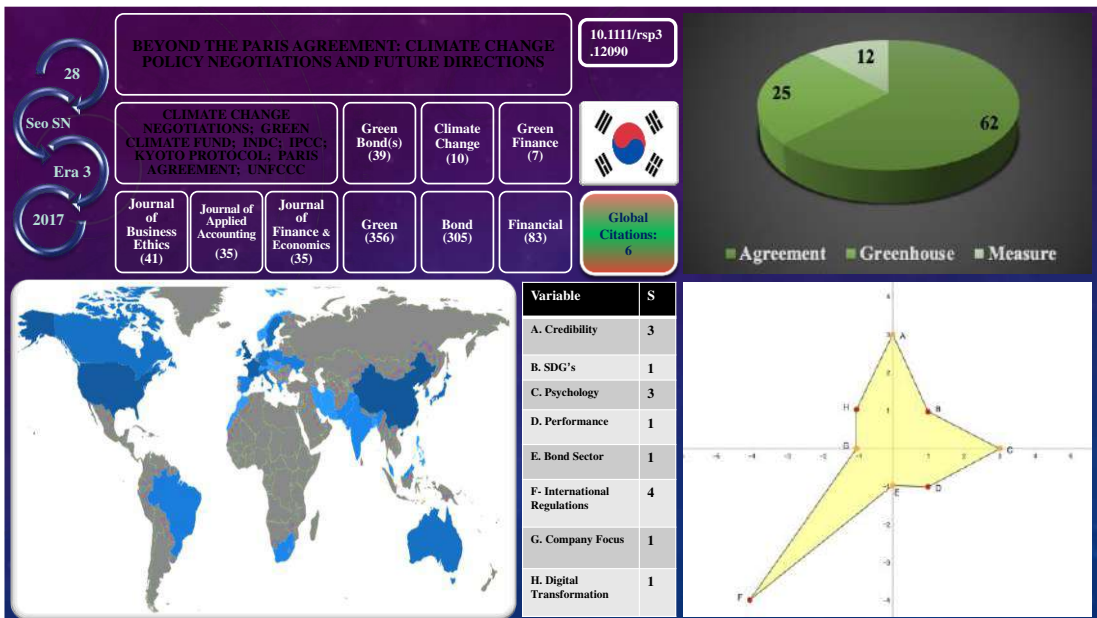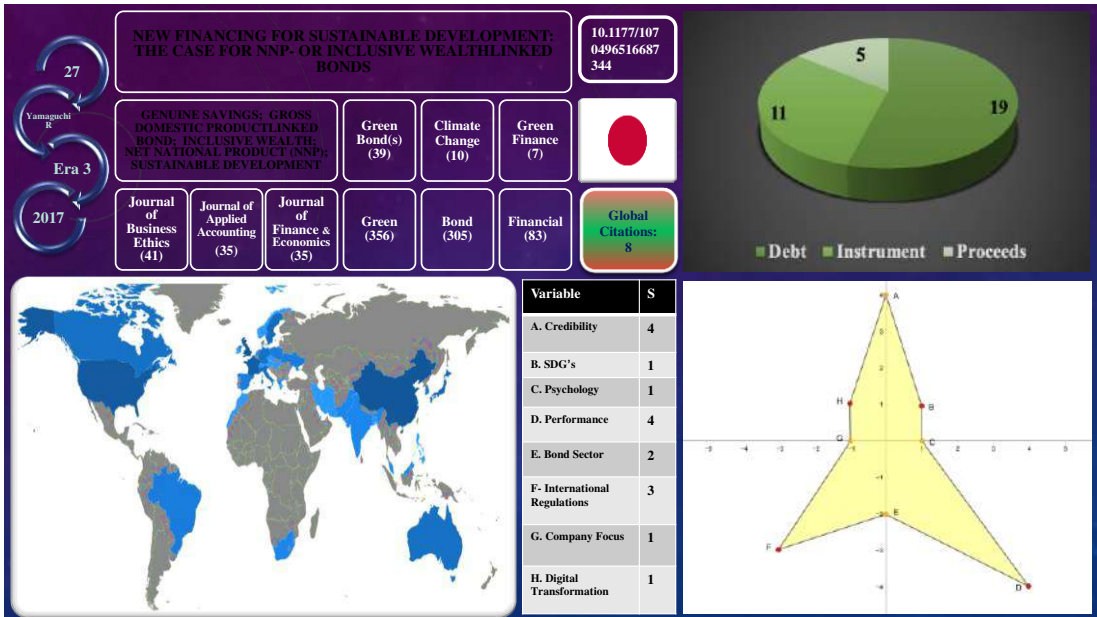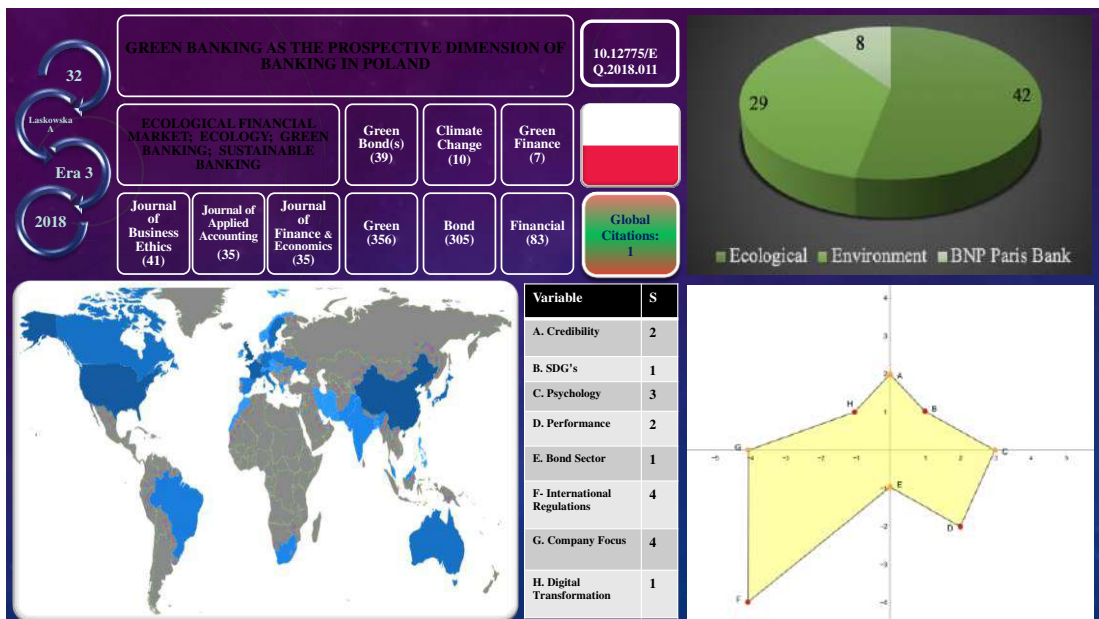| Variable	S
A. Credibility	2
B. SDG's	1
C. Psychology	2
D. Performance	2
E. Bond Sector	2
F- International Regulations	4
G. Company Focus	1
H. Digital Transformation	1

34

Shayduro va A

Era 3

2018

INVESTMENT ATTRACTIVENESS OF "GREEN" FINANCIAL INSTRUMENTS

10.6000/192 97092.2018. 07.65

GREEN BONDS; GREEN INDICES; ESG PRINCIPLES; SUSTAINABLE DEVELOPMENT; SUSTAINABLE INVESTING

| Green Bond(s) (39) | Climate Change (10) | Green Finance (7) |

| Journal of Business Ethics (41) | Journal of Applied Accounting (35) | Journal of Finance & Economics (35) | Green (356) | Bond (305) | Financial (83) | Global Citations: 1 |

Pie chart: Index 28, Environment 11, Performance 8

Variable	S
A. Credibility	3
B. SDG's	1
C. Psychology	2
D. Performance	4
E. Bond Sector	2
F- International Regulations	4
G. Company Focus	4
H. Digital Transformation	1

35

Monaster olo I

Era 3

2018

THE EIRIN FLOW-OF-FUNDS BEHAVIOURAL MODEL OF GREEN FISCAL POLICIES AND GREEN SOVEREIGN BONDS

10.1016/j.ec olecon.2017. 07.029

DISTRIBUTIVE EFFECTS; ENDOGENOUS MONEY; FLOW-OF-FUNDS; GREEN FISCAL POLICIES; GREEN SOVEREIGN BONDS; STOCK-FLOW CONSISTENCY

| Green Bond(s) (39) | Climate Change (10) | Green Finance (7) |

| Journal of Business Ethics (41) | Journal of Applied Accounting (35) | Journal of Finance & Economics (35) | Green (356) | Bond (305) | Financial (83) | Global Citations: 28 |

Pie chart: Sovereign 23, Performance 9, Measure 9

Variable	S
A. Credibility	4
B. SDG's	1
C. Psychology	2
D. Performance	4
E. Bond Sector	4
F- International Regulations	3
G. Company Focus	1
H. Digital Transformation	1

Panel 36

THE CHANGING VALUE OF THE 'GREEN' LABEL ON THE US MUNICIPAL BOND MARKET

10.1038/s41558-017-0062-0

Karpf A — Era 3 — 2018

| Absence of Data | Green Bond(s) (39) | Climate Change (10) | Green Finance (7) |

| Journal of Business Ethics (41) | Journal of Applied Accounting (35) | Journal of Finance & Economics (35) | Green (356) | Bond (305) | Financial (83) | Global Citations: 11 |

Variable	S
A. Credibility	3
B. SDG's	1
C. Psychology	3
D. Performance	4
E. Bond Sector	4
F- International Regulations	3
G. Company Focus	1
H. Digital Transformation	1

Pie chart legend: Yield, Premium, Municipal Bond (values 23, 23, 82)

Panel 37

GREEN BONDS LIKE THE INCENTIVE INSTRUMENT FOR CLEANER PRODUCTION AT THE GOVERNMENT AND CORPORATE LEVELS: EXPERIENCE FROM EU TO UKRAINE

10.14505/jemt.v9.7(31).09

Chygryn O — Era 3 — 2018

| BENEFIT; BOND; FINANCIAL MARKET; GREEN BOND; INVESTOR; ISSUER; STOCK INDEX | Green Bond(s) (39) | Climate Change (10) | Green Finance (7) |

| Journal of Business Ethics (41) | Journal of Applied Accounting (35) | Journal of Finance & Economics (35) | Green (356) | Bond (305) | Financial (83) | Global Citations: 4 |

Variable	S
A. Credibility	
B. SDG's	
C. Psychology	
D. Performance	
E. Bond Sector	
F- International Regulations	
G. Company Focus	
H. Digital Transformation	

NO DATA

Panel 38

BUSINESS AS UNUSUAL: THE IMPLICATIONS OF FOSSIL DIVESTMENT AND GREEN BONDS FOR FINANCIAL FLOWS, ECONOMIC GROWTH AND ENERGY MARKET

10.1016/j.esd.2018.02.005

Glomsrød S — Era 3 — 2018

| CGE MODELING; CLIMATE MITIGATION; DIVESTMENT; GREEN FINANCE; LOW CARBON; RENEWABLE ENERGY | Green Bond(s) (39) | Climate Change (10) | Green Finance (7) |

| Journal of Business Ethics (41) | Journal of Applied Accounting (35) | Journal of Finance & Economics (35) | Green (356) | Bond (305) | Financial (83) | Global Citations: 5 |

Variable	S
A. Credibility	4
B. SDG's	1
C. Psychology	2
D. Performance	2
E. Bond Sector	2
F- International Regulations	4
G. Company Focus	1
H. Digital Transformation	1

Pie chart legend: Regional, Emissions, Label (values 16, 28, 17)

153

Panel 42

GREEN BOND AND FINANCIAL MARKETS: CO-MOVEMENT, DIVERSIFICATION AND PRICE SPILLOVER EFFECTS

10.1016/j.eneco.2018.05.030

CO-MOVEMENTS; DEPENDENCE; FINANCIAL MARKETS; GREEN BONDS; PRICE SPILLOVERS

| Green Bond(s) (39) | Climate Change (10) | Green Finance (7) |

Reboredo JC — Era 3 — 2018

| Journal of Business Ethics (41) | Journal of Applied Accounting (35) | Journal of Finance & Economics (35) | Green (356) | Bond (305) | Financial (83) |

Global Citations: 21

Pie: Index, Diversification Benefits, Performance — 7, 30, 24

Variable	S
A. Credibility	2
B. SDG's	1
C. Psychology	3
D. Performance	4
E. Bond Sector	4
F- International Regulations	4
G. Company Focus	2
H. Digital Transformation	1

Panel 43

FROM SUSTAINABILITY ACCOUNTING TO A GREEN FINANCING SYSTEM: INSTITUTIONAL LEGITIMACY AND MARKET HETEROGENEITY IN A GLOBAL FINANCIAL CENTRE

10.1016/j.jclepro.2018.05.250

GLOBAL FINANCE CENTRE OF CHINA; GREEN BOND; GREEN FINANCING SYSTEM; SUSTAINABILITY ACCOUNTING; SUSTAINABILITY CONTROL AND ASSURANCE

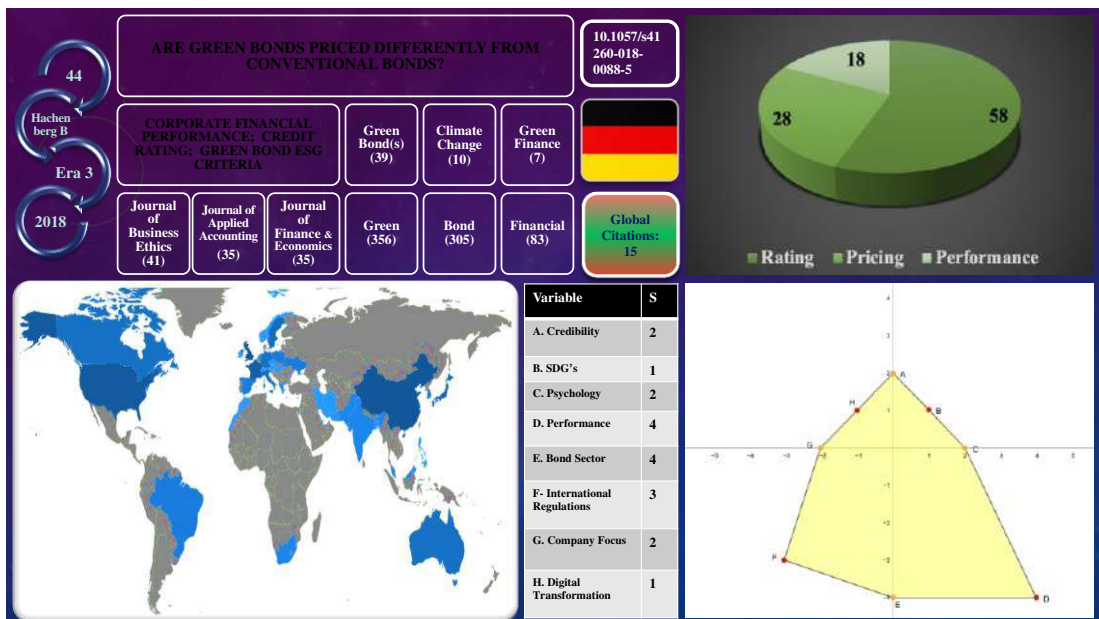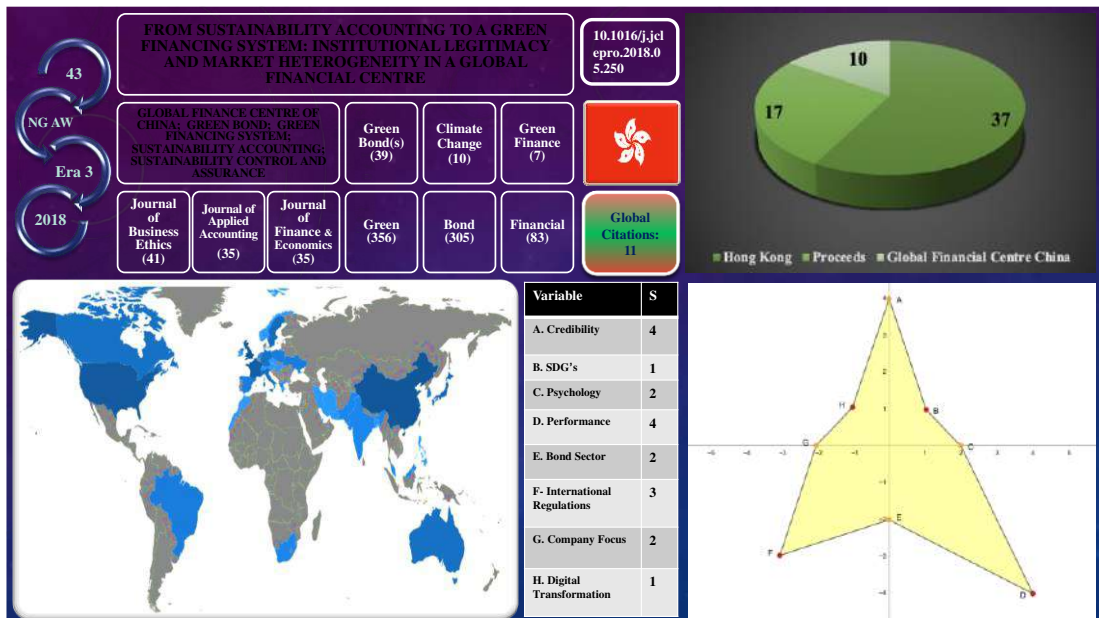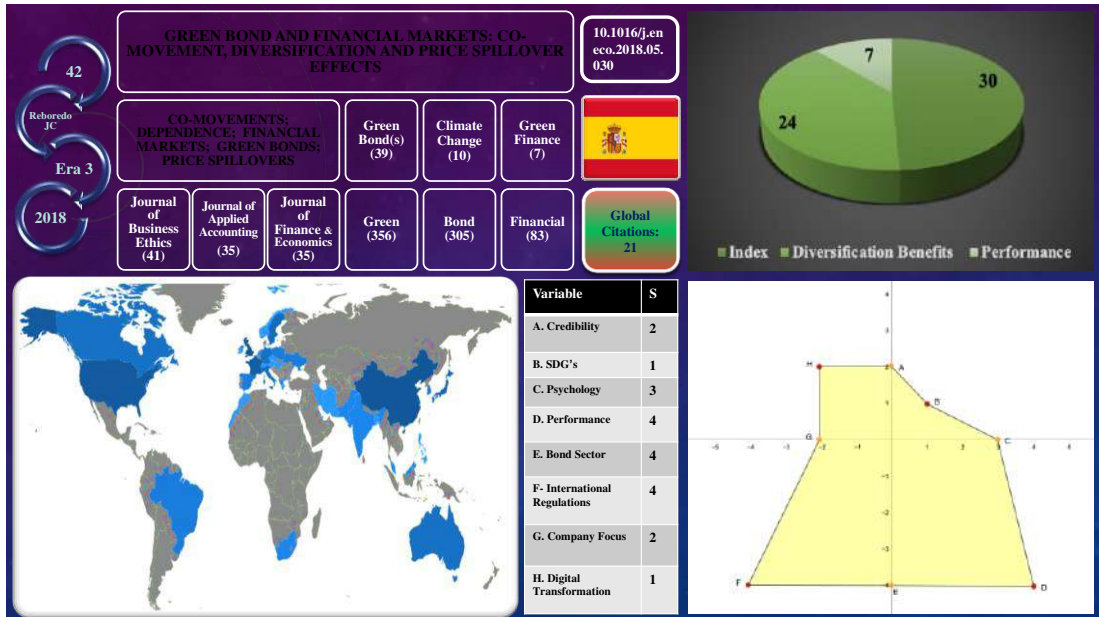| Green Bond(s) (39) | Climate Change (10) | Green Finance (7) |

NG AW — Era 3 — 2018

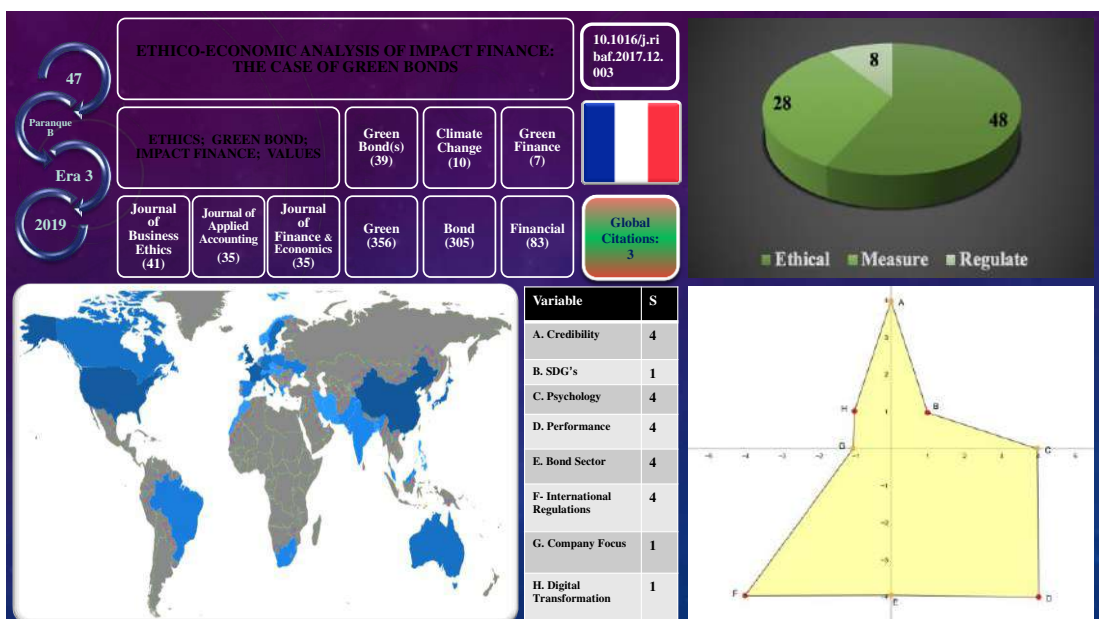| Journal of Business Ethics (41) | Journal of Applied Accounting (35) | Journal of Finance & Economics (35) | Green (356) | Bond (305) | Financial (83) |

Global Citations: 11

Pie: Hong Kong, Proceeds, Global Financial Centre China — 10, 37, 17

Variable	S
A. Credibility	4
B. SDG's	1
C. Psychology	2
D. Performance	4
E. Bond Sector	2
F- International Regulations	3
G. Company Focus	2
H. Digital Transformation	1

Panel 44

ARE GREEN BONDS PRICED DIFFERENTLY FROM CONVENTIONAL BONDS?

10.1057/s41260-018-0088-5

CORPORATE FINANCIAL PERFORMANCE; CREDIT RATING; GREEN BOND ESG CRITERIA

| Green Bond(s) (39) | Climate Change (10) | Green Finance (7) |

Hachenberg B — Era 3 — 2018

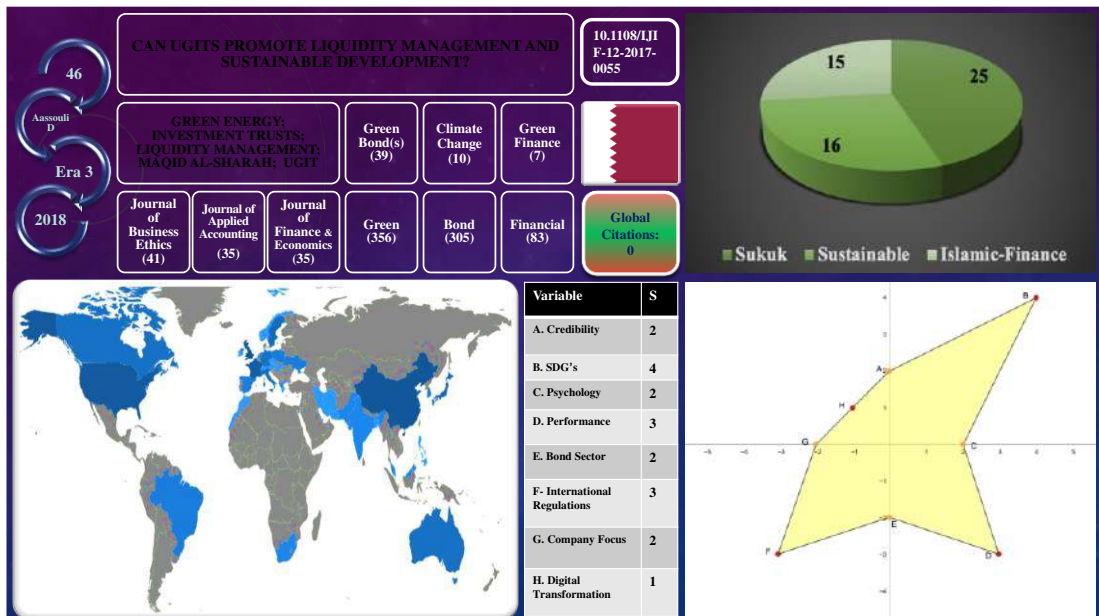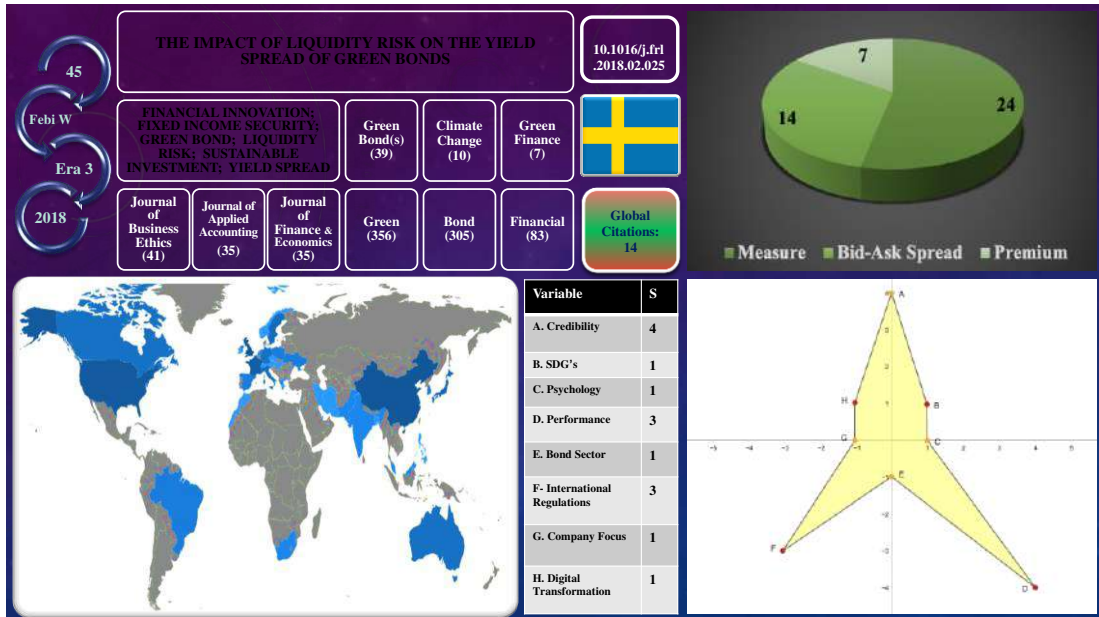| Journal of Business Ethics (41) | Journal of Applied Accounting (35) | Journal of Finance & Economics (35) | Green (356) | Bond (305) | Financial (83) |

Global Citations: 15

Pie: Rating, Pricing, Performance — 18, 58, 28

Variable	S
A. Credibility	2
B. SDG's	1
C. Psychology	2
D. Performance	4
E. Bond Sector	4
F- International Regulations	3
G. Company Focus	2
H. Digital Transformation	1

THE EFFECT OF PRO-ENVIRONMENTAL PREFERENCES ON BOND PRICES: EVIDENCE FROM GREEN BONDS

48 — Zerbib OD — Era 3 — 2019

10.1016/j.jbankfin.2018.10.012

THE EFFECT OF PRO-ENVIRONMENTAL PREFERENCES ON BOND PRICES: EVIDENCE FROM GREEN BONDS

| Green Bond(s) (39) | Climate Change (10) | Green Finance (7) |

| Journal of Business Ethics (41) | Journal of Applied Accounting (35) | Journal of Finance & Economics (35) | Green (356) | Bond (305) | Financial (83) | Global Citations: 26 |

Pie chart: Premium 35, Performance 21, Pro-Environmental 104

Variable	S
A. Credibility	2
B. SDG's	1
C. Psychology	4
D. Performance	4
E. Bond Sector	4
F- International Regulations	4
G. Company Focus	1
H. Digital Transformation	1

CHANGE OF CHINAS GREEN FINANCIAL POLICY AND ITS ALLOCATION EFFICIENCY--AN EMPIRICAL STUDY BASED ON THE LISTED COMPANIES OF CHINAS ECO-INDUSTRY

49 — Liu Z — Era 3 — 2019

No Doi

ALLOCATION EFFICIENCY; ECO-INDUSTRY; EMPIRICAL RESEARCH; LISTED COMPANIES; POLICY CHANGE; GREEN FINANCE

| Green Bond(s) (39) | Climate Change (10) | Green Finance (7) |

| Journal of Business Ethics (41) | Journal of Applied Accounting (35) | Journal of Finance & Economics (35) | Green (356) | Bond (305) | Financial (83) | Global Citations: 2 |

Pie chart: Policy 70, Environment 46, Policy 125

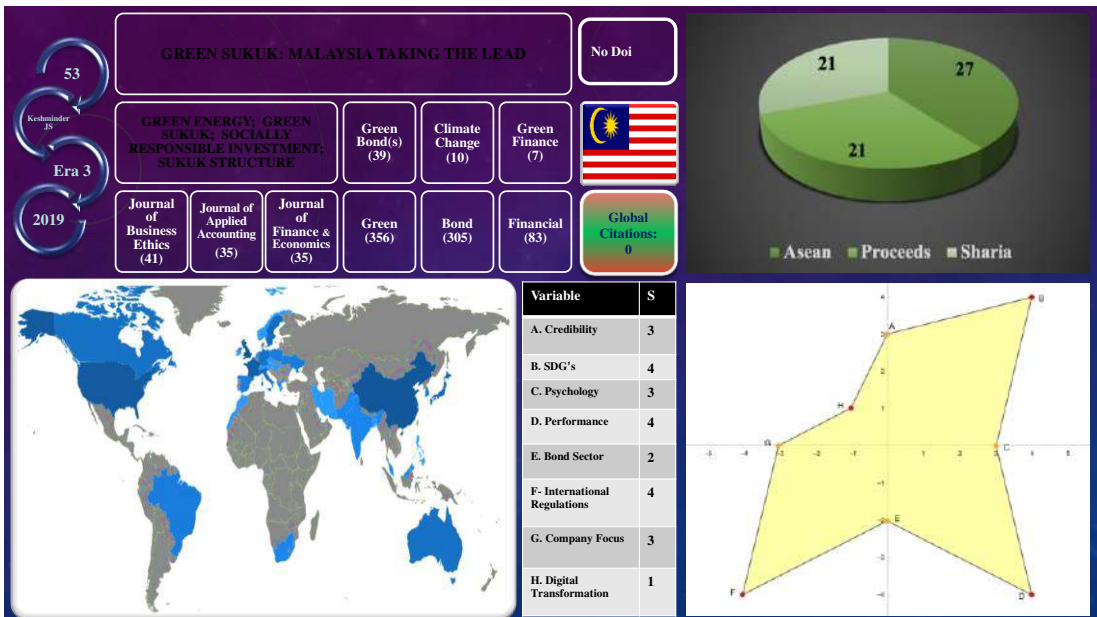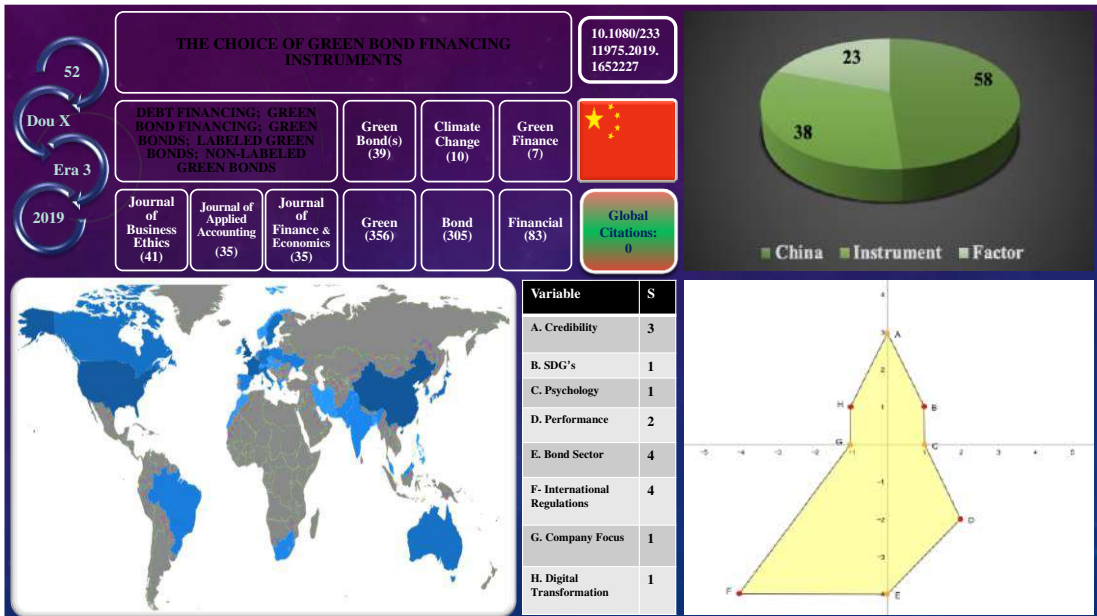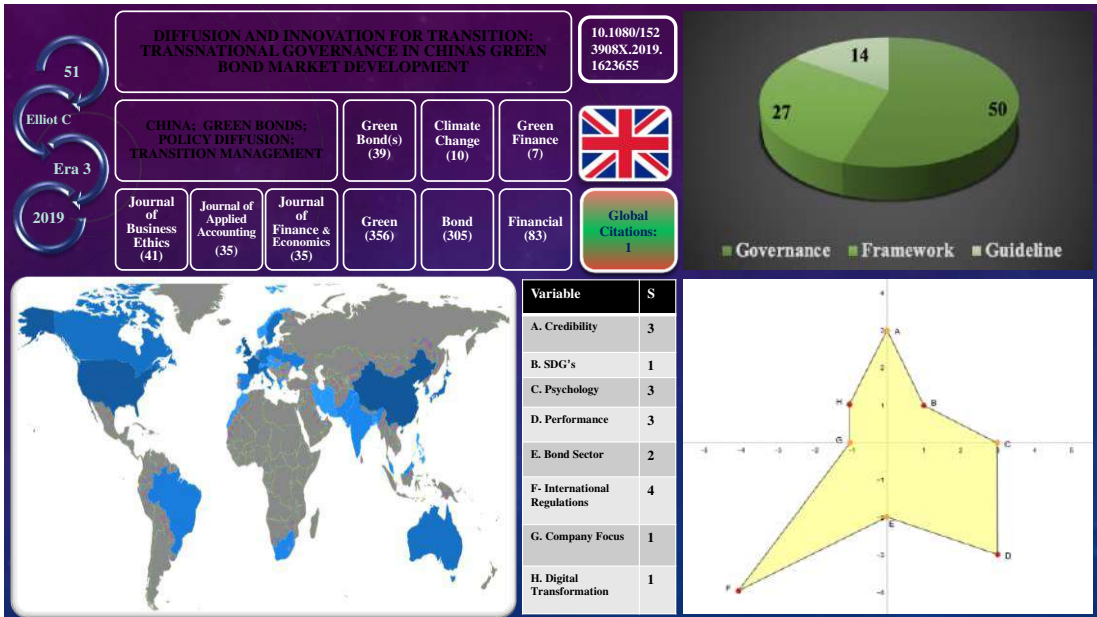| Variable	S
A. Credibility	3
B. SDG's	1
C. Psychology	2
D. Performance	3
E. Bond Sector	2
F- International Regulations	3
G. Company Focus	1
H. Digital Transformation	1

GREEN ECONOMY: ROLE OF SOVEREIGN FUNDS

50 — Chebanov SV — Era 3 — 2019

10.20542/013122272019633512

AGENDA FOR SUSTAINABLE DEVELOPMENT; INTERNATIONAL FORUM OF SOVEREIGN INVESTMENT FUNDS; LOW-CARBON (GREEN) ECONOMY; ONE PLANET SWF WORKING GROUP FRAMEWORK; SOVEREIGN WEALTH FUNDS (SWFS); SUSTAINABLE DEVELOPMENT GOALS; UN; GREEN FINANCING

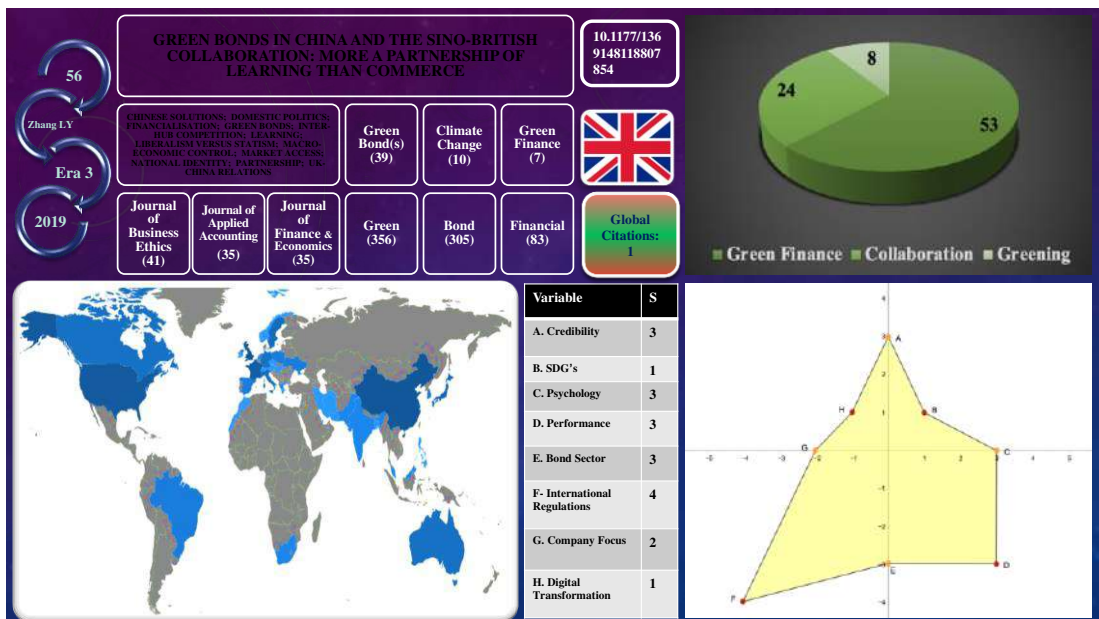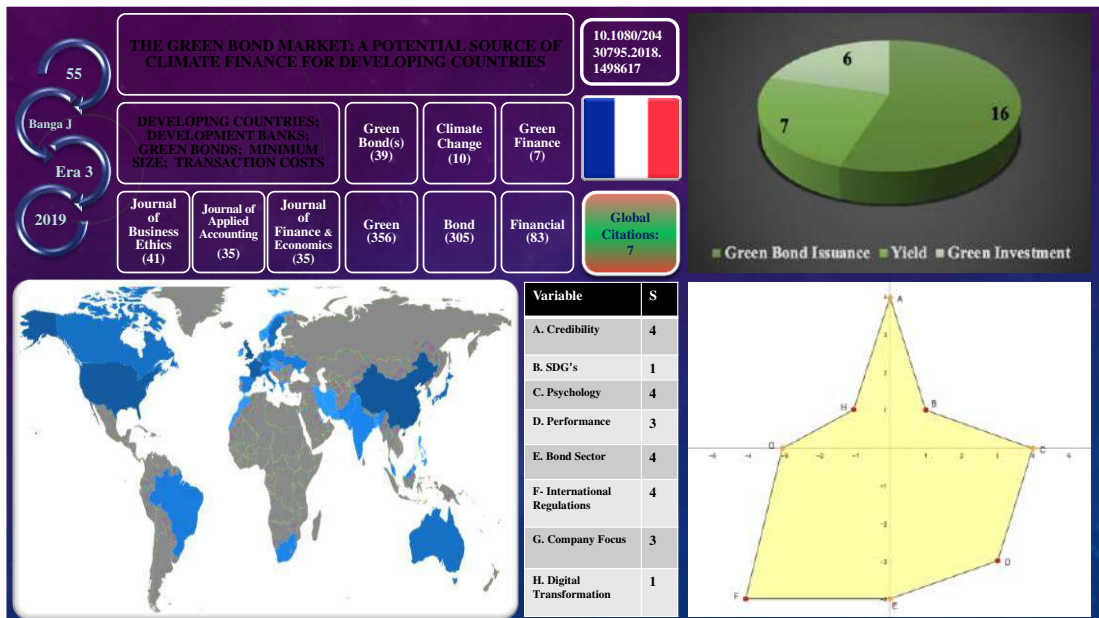| Green Bond(s) (39) | Climate Change (10) | Green Finance (7) |

| Journal of Business Ethics (41) | Journal of Applied Accounting (35) | Journal of Finance & Economics (35) | Green (356) | Bond (305) | Financial (83) | Global Citations: 0 |

NO DATA

Variable	S
A. Credibility	
B. SDG's	
C. Psychology	
D. Performance	
E. Bond Sector	
F- International Regulations	
G. Company Focus	
H. Digital Transformation	

DIFFUSION AND INNOVATION FOR TRANSITION: TRANSNATIONAL GOVERNANCE IN CHINAS GREEN BOND MARKET DEVELOPMENT

51 — Elliot C — Era 3 — 2019

10.1080/1523908X.2019.1623655

CHINA; GREEN BONDS; POLICY DIFFUSION; TRANSITION MANAGEMENT

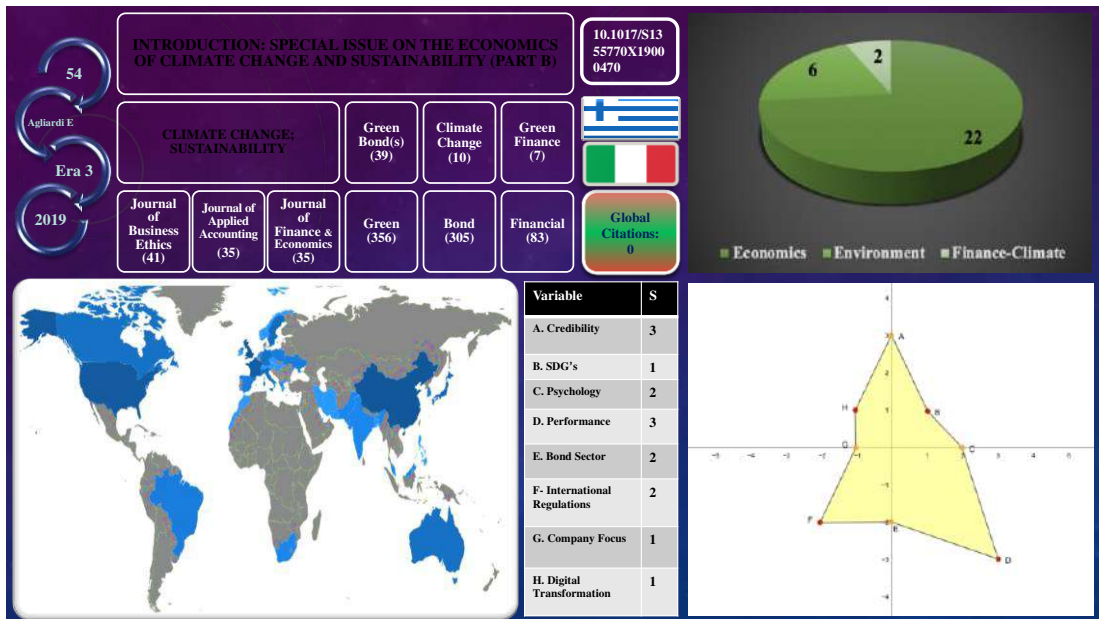Green Bond(s) (39) | Climate Change (10) | Green Finance (7)

Journal of Business Ethics (41) | Journal of Applied Accounting (35) | Journal of Finance & Economics (35) | Green (356) | Bond (305) | Financial (83)
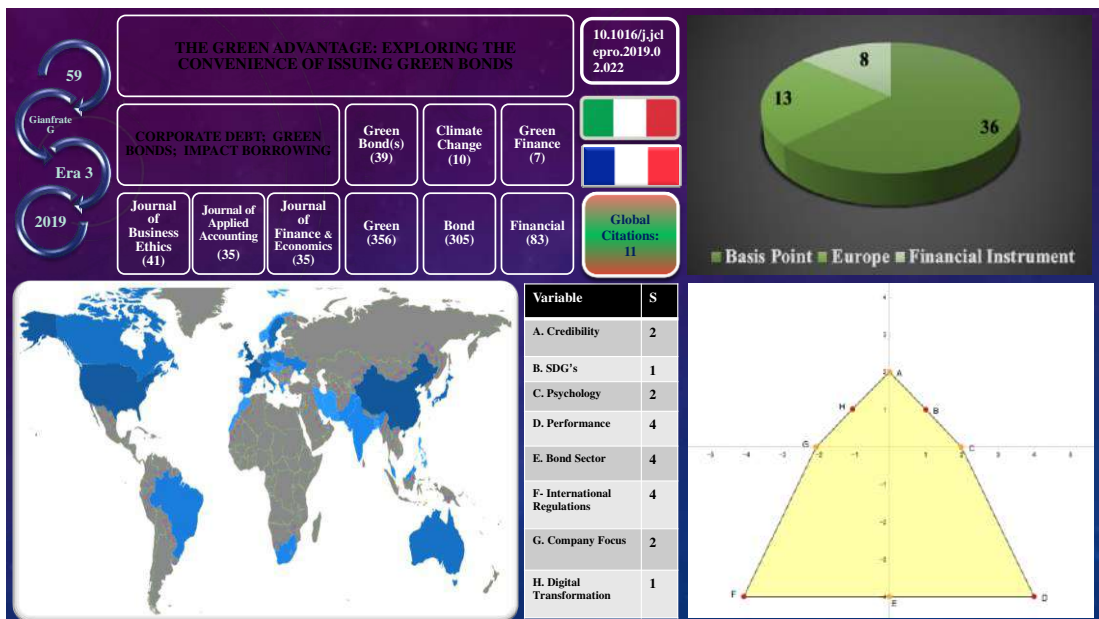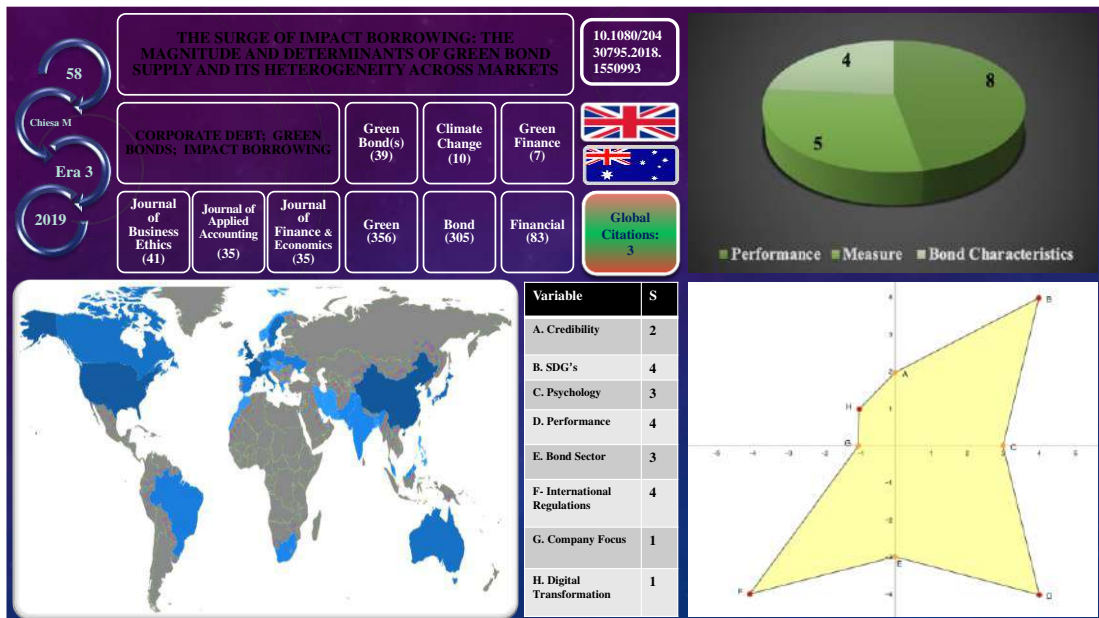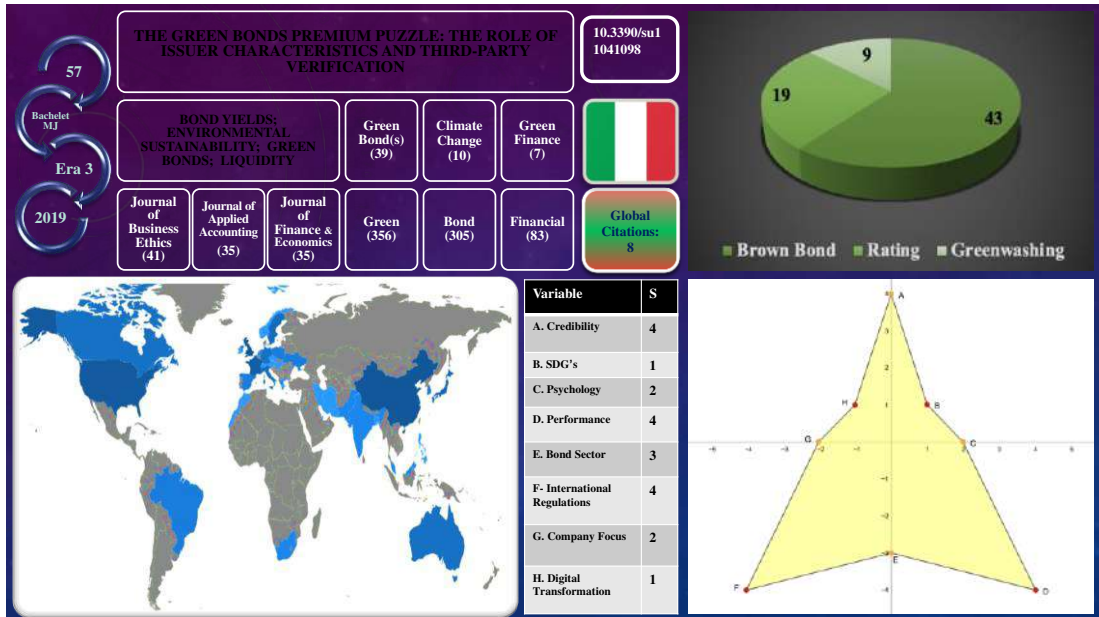
Global Citations: 1

Variable	S
A. Credibility	3
B. SDG's	1
C. Psychology	3
D. Performance	3
E. Bond Sector	2
F- International Regulations	4
G. Company Focus	1
H. Digital Transformation	1

THE CHOICE OF GREEN BOND FINANCING INSTRUMENTS

52 — Dou X — Era 3 — 2019

10.1080/23311975.2019.1652227

DEBT FINANCING; GREEN BOND FINANCING; GREEN BONDS; LABELED GREEN BONDS; NON-LABELED GREEN BONDS

Green Bond(s) (39) | Climate Change (10) | Green Finance (7)

Journal of Business Ethics (41) | Journal of Applied Accounting (35) | Journal of Finance & Economics (35) | Green (356) | Bond (305) | Financial (83)

Global Citations: 0

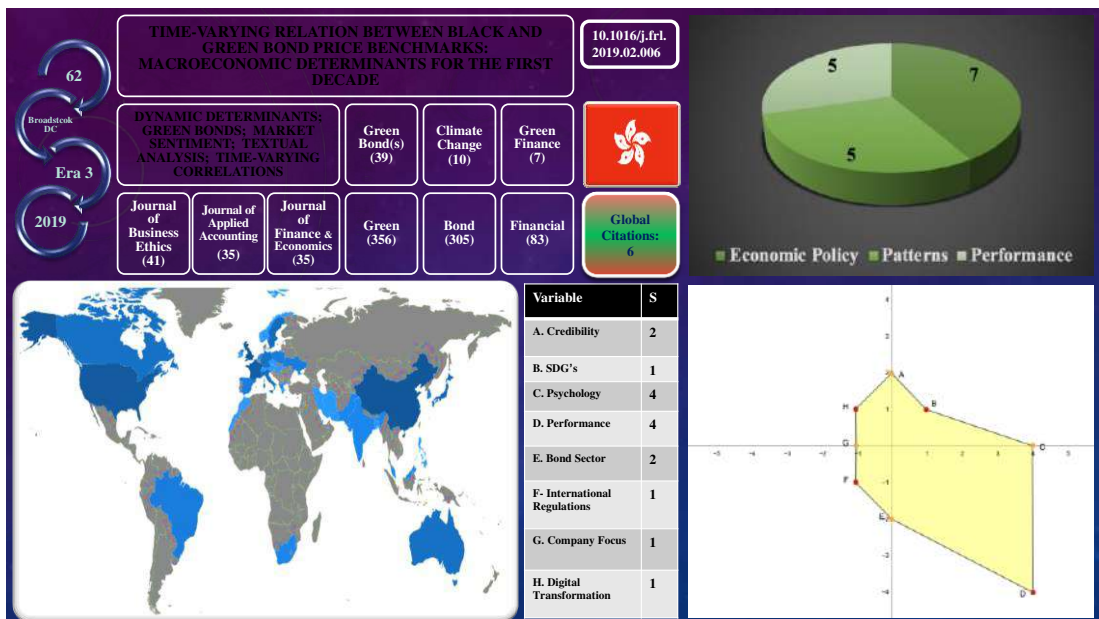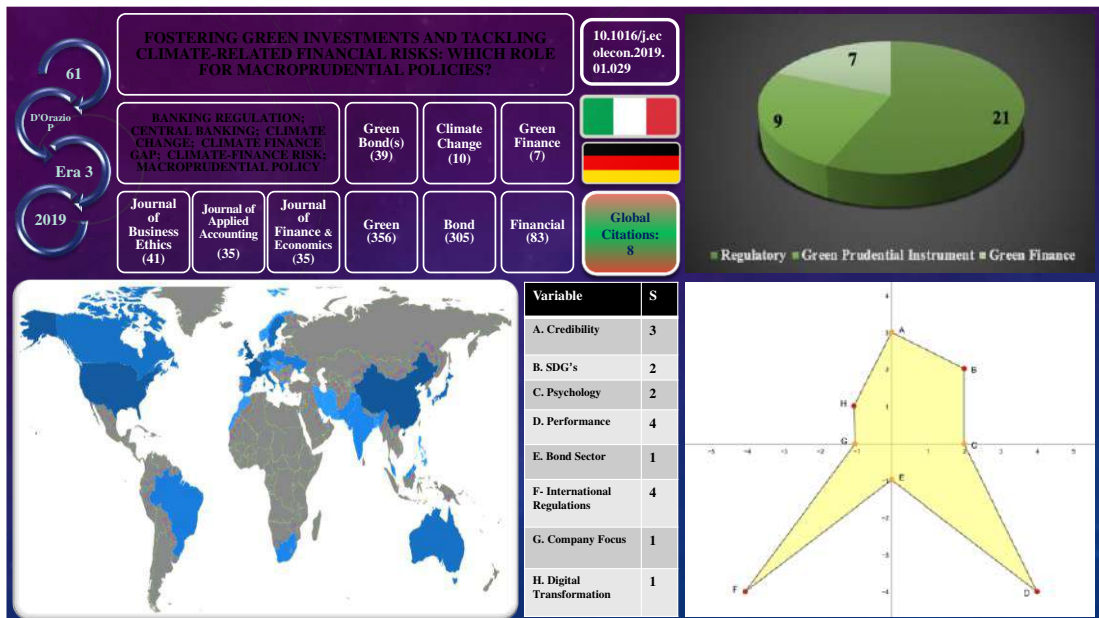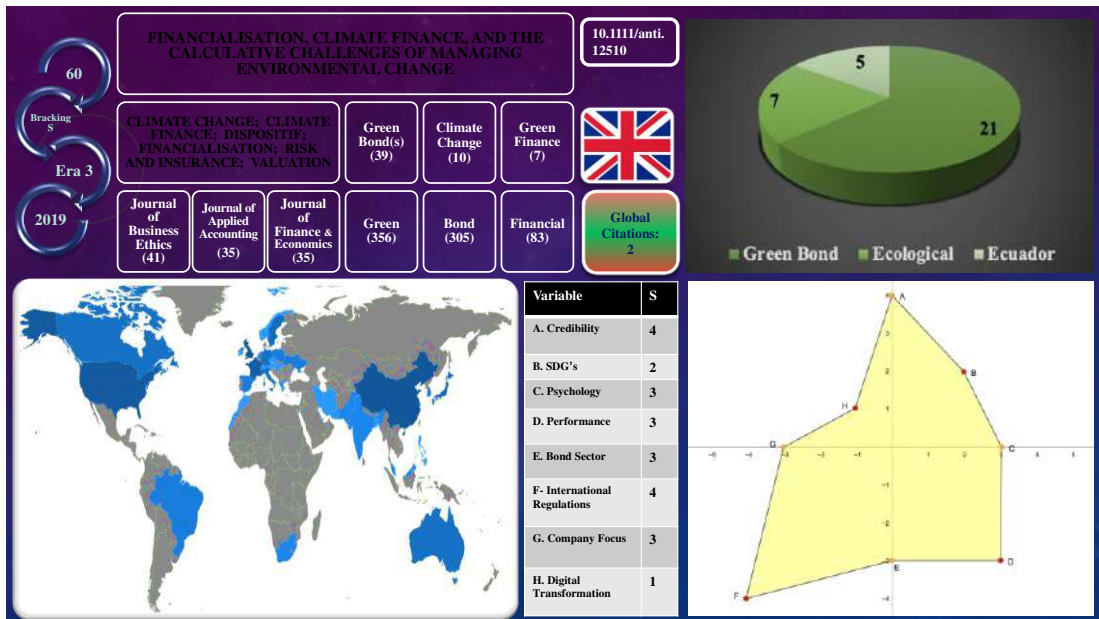| Variable	S
A. Credibility	3
B. SDG's	1
C. Psychology	1
D. Performance	2
E. Bond Sector	4
F- International Regulations	4
G. Company Focus	1
H. Digital Transformation	1

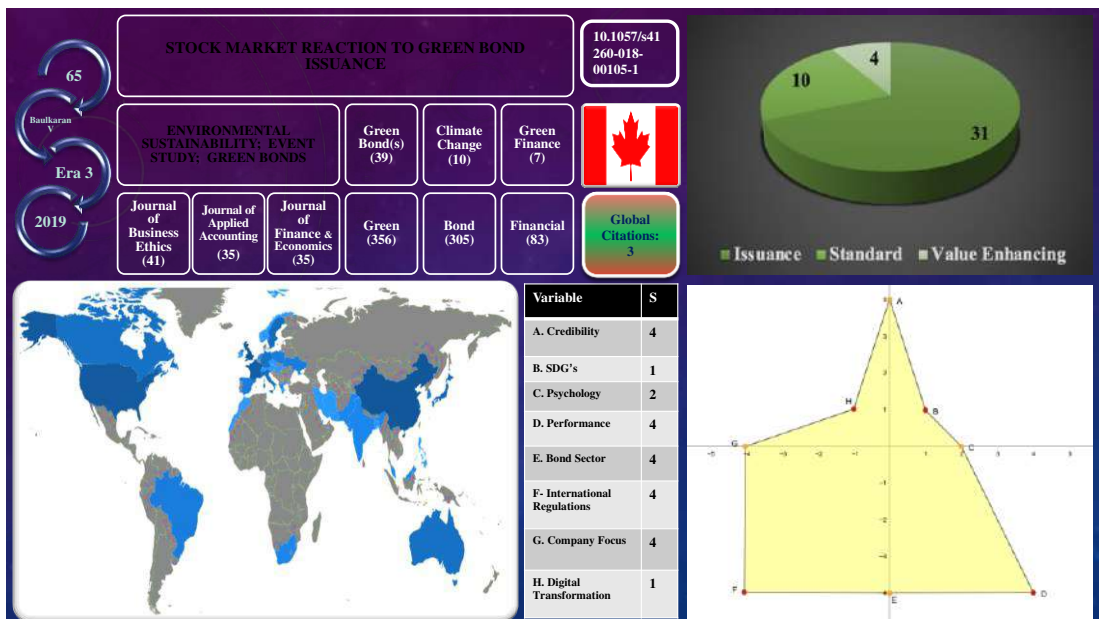**GREEN SUKUK: MALAYSIA TAKING THE LEAD**

53 — Keshminder JS — Era 3 — 2019

No Doi

GREEN ENERGY; GREEN SUKUK; SOCIALLY RESPONSIBLE INVESTMENT; SUKUK STRUCTURE

Green Bond(s) (39) | Climate Change (10) | Green Finance (7)

Journal of Business Ethics (41) | Journal of Applied Accounting (35) | Journal of Finance & Economics (35) | Green (356) | Bond (305) | Financial (83)

Global Citations: 0

Variable	S
A. Credibility	3
B. SDG's	4
C. Psychology	3
D. Performance	4
E. Bond Sector	2
F- International Regulations	4
G. Company Focus	3
H. Digital Transformation	1

Panel 60

FINANCIALISATION, CLIMATE FINANCE, AND THE CALCULATIVE CHALLENGES OF MANAGING ENVIRONMENTAL CHANGE

60 — BrackingS — Era 3 — 2019

DOI: 10.1111/anti.12510

CLIMATE CHANGE; CLIMATE FINANCE; DISPOSITIF; FINANCIALISATION; RISK AND INSURANCE; VALUATION

Green Bond(s) (39) | Climate Change (10) | Green Finance (7)

Journal of Business Ethics (41) | Journal of Applied Accounting (35) | Journal of Finance & Economics (35)

Green (356) | Bond (305) | Financial (83)

Global Citations: 2

Pie chart: Green Bond (21), Ecological (7), Ecuador (5)

Variable	S
A. Credibility	4
B. SDG's	2
C. Psychology	3
D. Performance	3
E. Bond Sector	3
F- International Regulations	4
G. Company Focus	3
H. Digital Transformation	1

Panel 61

FOSTERING GREEN INVESTMENTS AND TACKLING CLIMATE-RELATED FINANCIAL RISKS: WHICH ROLE FOR MACROPRUDENTIAL POLICIES?

61 — D'Orazio P — Era 3 — 2019

DOI: 10.1016/j.ecolecon.2019.01.029

BANKING REGULATION; CENTRAL BANKING; CLIMATE CHANGE; CLIMATE FINANCE GAP; CLIMATE-FINANCE RISK; MACROPRUDENTIAL POLICY

Green Bond(s) (39) | Climate Change (10) | Green Finance (7)

Journal of Business Ethics (41) | Journal of Applied Accounting (35) | Journal of Finance & Economics (35)

Green (356) | Bond (305) | Financial (83)

Global Citations: 8

Pie chart: Regulatory (21), Green Prudential Instrument (9), Green Finance (7)

Variable	S
A. Credibility	3
B. SDG's	2
C. Psychology	2
D. Performance	4
E. Bond Sector	1
F- International Regulations	4
G. Company Focus	1
H. Digital Transformation	1

Panel 62

TIME-VARYING RELATION BETWEEN BLACK AND GREEN BOND PRICE BENCHMARKS: MACROECONOMIC DETERMINANTS FOR THE FIRST DECADE

62 — Broadstcok DC — Era 3 — 2019

DOI: 10.1016/j.frl.2019.02.006

DYNAMIC DETERMINANTS; GREEN BONDS; MARKET SENTIMENT; TEXTUAL ANALYSIS; TIME-VARYING CORRELATIONS

Green Bond(s) (39) | Climate Change (10) | Green Finance (7)

Journal of Business Ethics (41) | Journal of Applied Accounting (35) | Journal of Finance & Economics (35)

Green (356) | Bond (305) | Financial (83)

Global Citations: 6

Pie chart: Economic Policy (7), Patterns (5), Performance (5)

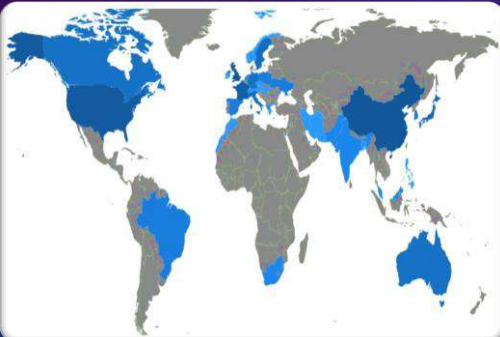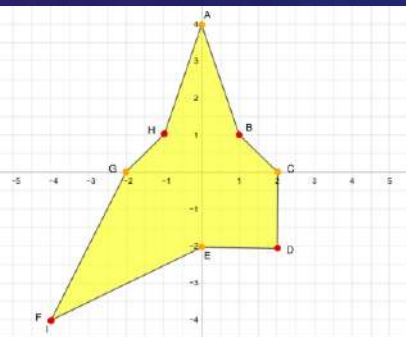| Variable	S
A. Credibility	2
B. SDG's	1
C. Psychology	4
D. Performance	4
E. Bond Sector	2
F- International Regulations	1
G. Company Focus	1
H. Digital Transformation	1

Panel 1

72

Maltais A

Era 3

2020

UNDERSTANDING THE ROLE OF GREEN BONDS IN ADVANCING SUSTAINABILITY

10.1080/20430795.2020.1724864

FINANCIAL INNOVATION; GREEN BONDS; IMPACTS; INCENTIVES; SUSTAINABLE FINANCE; SWEDEN

| Green Bond(s) (39) | Climate Change (10) | Green Finance (7) |

| Journal of Business Ethics (41) | Journal of Applied Accounting (35) | Journal of Finance & Economics (35) | Green (356) | Bond (305) | Financial (83) |

Global Citations: 1

Pie chart: 13, 36, 19 — Green Bond Market, Legitimacy, Swedish

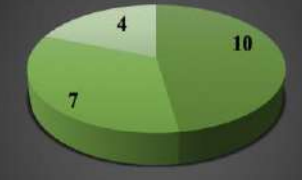| Variable	S
A. Credibility	4
B. SDG's	3
C. Psychology	4
D. Performance	4
E. Bond Sector	4
F- International Regulations	4
G. Company Focus	1
H. Digital Transformation	1

Panel 2

73

Tu Ca

Era 3

2020

INVESTIGATING SOLUTIONS FOR THE DEVELOPMENT OF A GREEN BOND MARKET: EVIDENCE FROM ANALYTIC HIERARCHY PROCESS

10.1016/j.frl.2020.101457

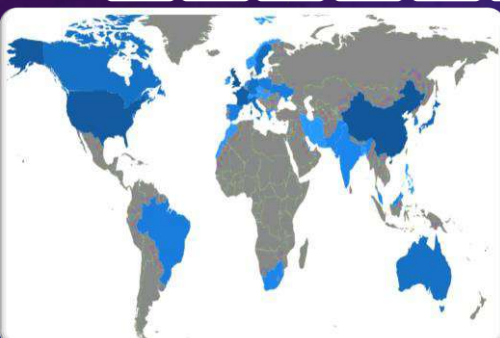ECO-FRIENDLY PROJECTS; GREEN BONDS; LOW-CARBON FINANCE

| Green Bond(s) (39) | Climate Change (10) | Green Finance (7) |

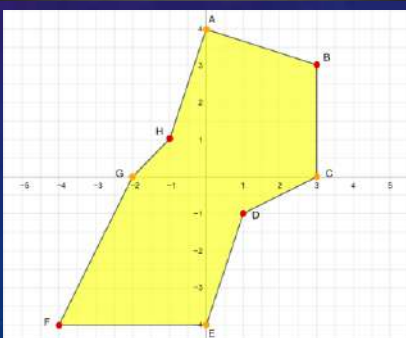| Journal of Business Ethics (41) | Journal of Applied Accounting (35) | Journal of Finance & Economics (35) | Green (356) | Bond (305) | Financial (83) |

Global Citations: 1

Pie chart: 6, 27, 10 — Vietnam, Policy, Legal Framework

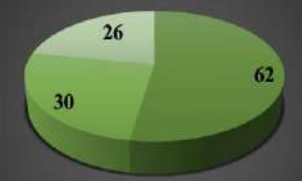| Variable	S
A. Credibility	3
B. SDG's	1
C. Psychology	4
D. Performance	4
E. Bond Sector	2
F- International Regulations	4
G. Company Focus	1
H. Digital Transformation	1

Panel 3

74

Szabo s

Era 3

2020

PERCEIVED GREENWASHING: THE EFFECTS OF GREEN MARKETING ON ENVIRONMENTAL AND PRODUCT PERCEPTIONS

10.1007/s10551-020-04461-0

BRAND ATTITUDES; ENVIRONMENTAL SUSTAINABILITY; FACIAL EXPRESSIONS; GREEN RISK; GREEN VALUE; INTERACTIVITY; MOUSE INTERACTIONS; PURCHASE INTENTIONS; WEBSITE DESIGN
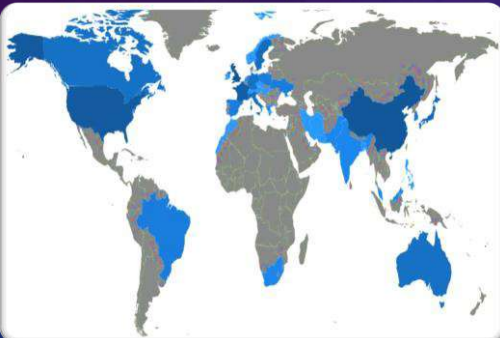
| Green Bond(s) (39) | Climate Change (10) | Green Finance (7) |

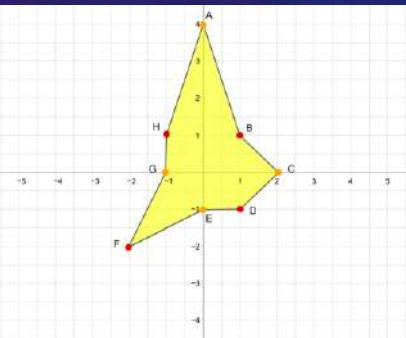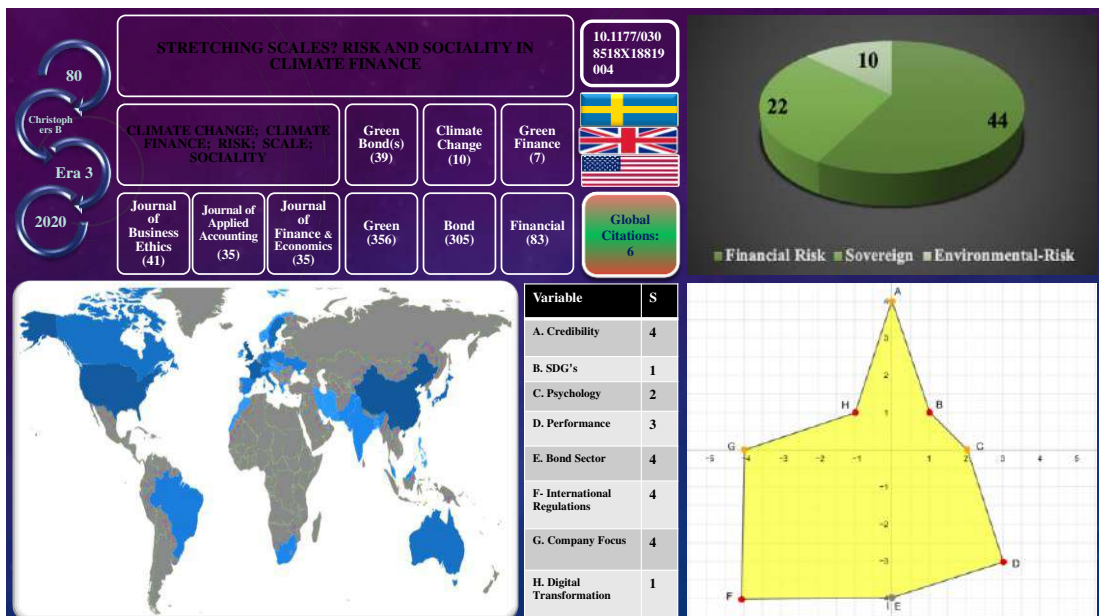| Journal of Business Ethics (41) | Journal of Applied Accounting (35) | Journal of Finance & Economics (35) | Green (356) | Bond (305) | Financial (83) |

Global Citations: 1

Pie chart: 66, 102, 74 — Greenwashing, Marketing, Website

Variable	S
A. Credibility	4
B. SDG's	2
C. Psychology	4
D. Performance	2
E. Bond Sector	1
F- International Regulations	2
G. Company Focus	1
H. Digital Transformation	1

UNBUNDLING OF THE GREEN BOND MARKET IN THE ECONOMIC HUBS OF AFRICA: CASE STUDY OF KENYA, NIGERIA AND SOUTH AFRICA

75 — Ngwenya N — Era 3 — 2020

10.1080/0376835X.2020.1725446

AFRICA; CLIMATE CHANGE; CLIMATE FINANCE; ECONOMIC HUBS; GREEN BONDS

| Green Bond(s) (39) | Climate Change (10) | Green Finance (7) |

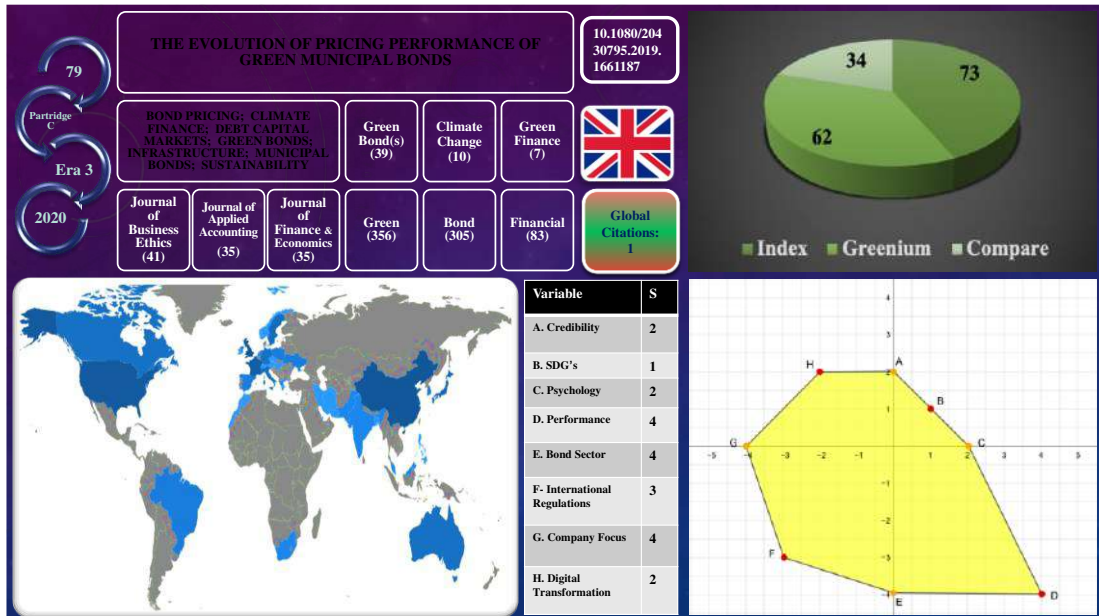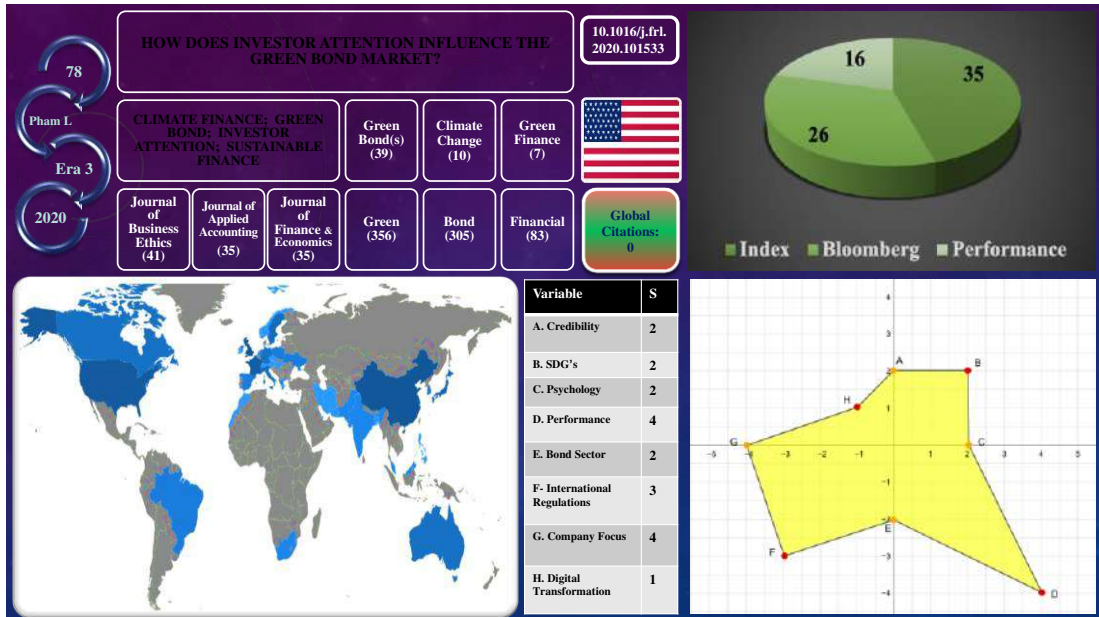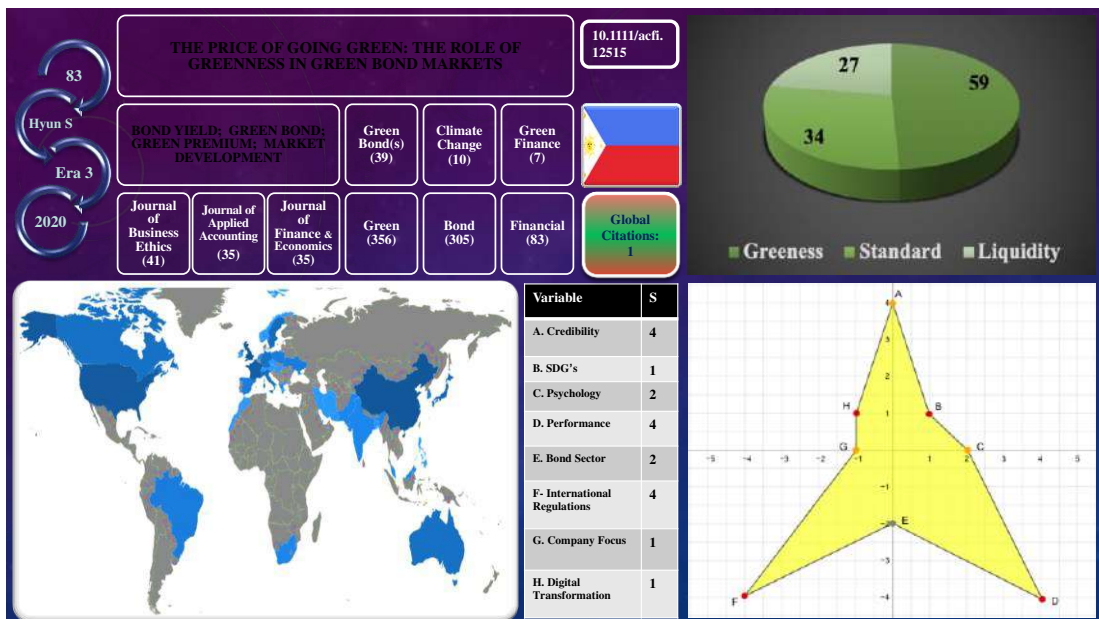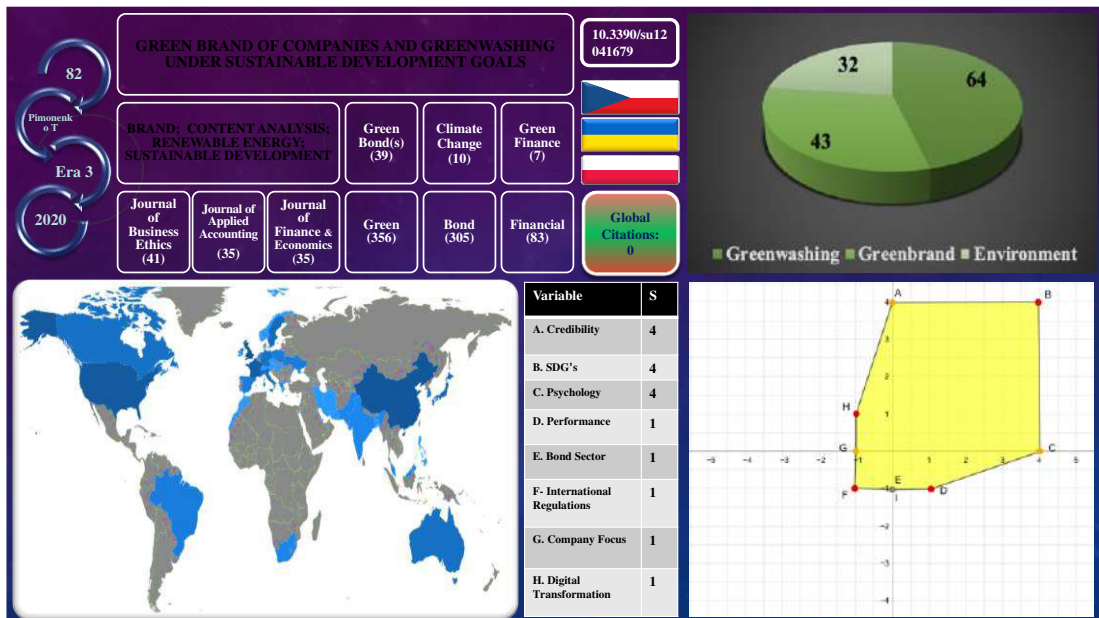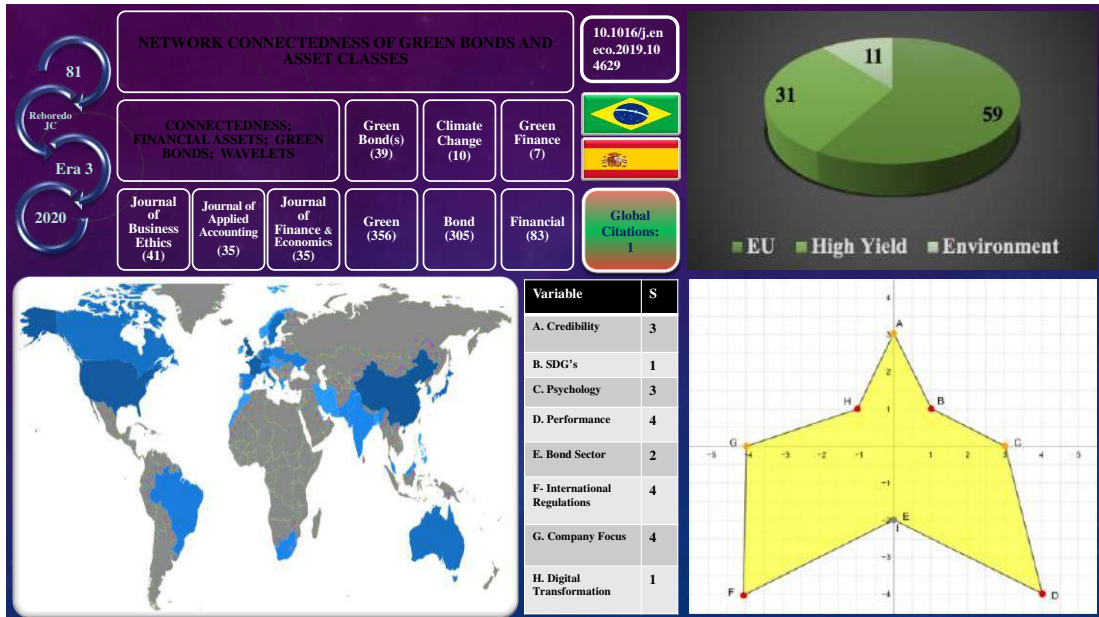| Journal of Business Ethics (41) | Journal of Applied Accounting (35) | Journal of Finance & Economics (35) | Green (356) | Bond (305) | Financial (83) |

Global Citations: 0

Variable	S
A. Credibility	4
B. SDG's	1
C. Psychology	2
D. Performance	2
E. Bond Sector	2
F- International Regulations	4
G. Company Focus	2
H. Digital Transformation	1

STANDARDS AND SSOS IN THE CONTESTED WIDENING AND DEEPENING OF FINANCIAL MARKETS: THE ARRIVAL OF GREEN MUNICIPAL BONDS IN MEXICO CITY

76 — Hildebrandt H — Era 3 — 2020

10.1177/0308518X20909391

DEVELOPMENT; FINANCIALIZATION; GREEN MUNICIPAL BONDS; MEXICO CITY; STANDARDS

| Green Bond(s) (39) | Climate Change (10) | Green Finance (7) |

| Journal of Business Ethics (41) | Journal of Applied Accounting (35) | Journal of Finance & Economics (35) | Green (356) | Bond (305) | Financial (83) |

Global Citations: 0

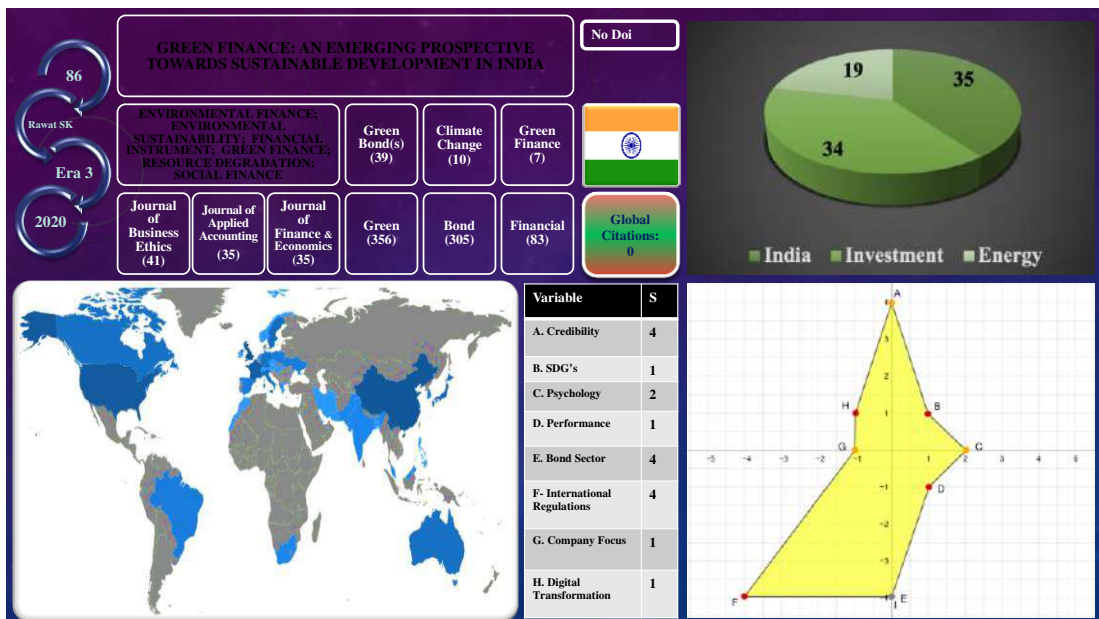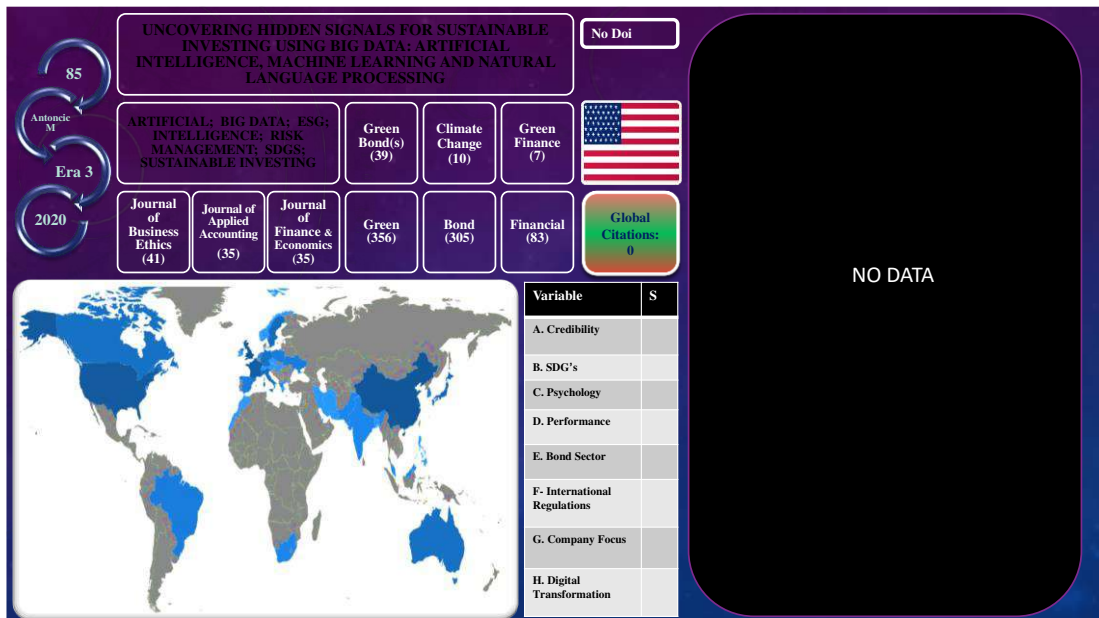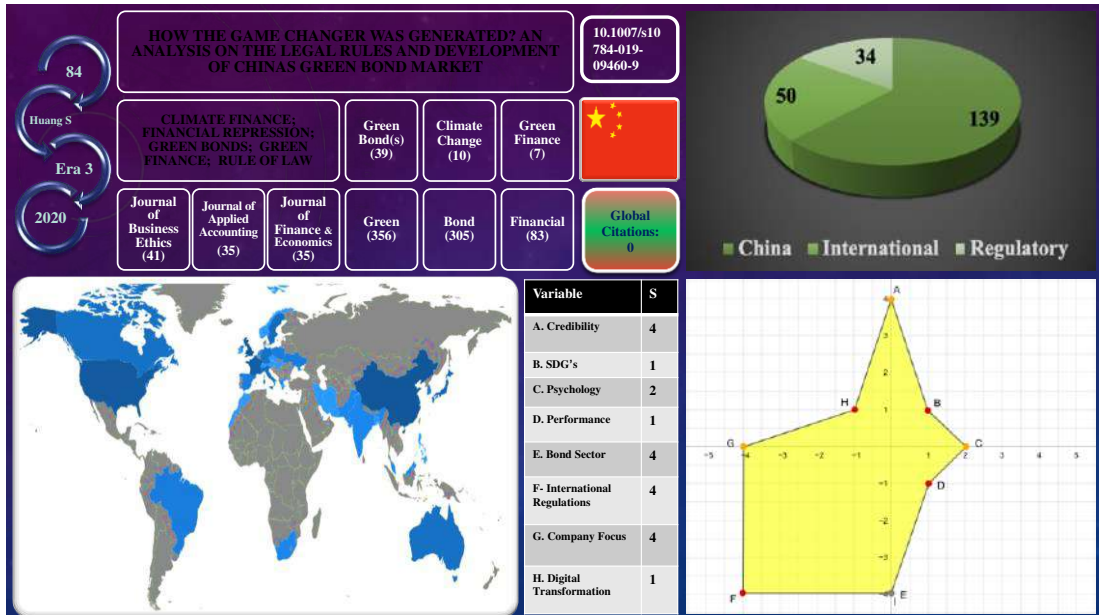| Variable	S
A. Credibility	4
B. SDG's	3
C. Psychology	3
D. Performance	1
E. Bond Sector	4
F- International Regulations	4
G. Company Focus	2
H. Digital Transformation	1

CHINAS GREEN WATCH PROGRAM: BEYOND GREENWASHING

77 — Miller VV — Era 3 — 2020

10.1108/CMS-11-2018-0736

CHINA; GREEN WATCH PROGRAM; GREENWASHING; IMPRESSION MANAGEMENT; TRANSACTION COST THEORY

| Green Bond(s) (39) | Climate Change (10) | Green Finance (7) |

| Journal of Business Ethics (41) | Journal of Applied Accounting (35) | Journal of Finance & Economics (35) | Green (356) | Bond (305) | Financial (83) |

Global Citations: 0

Variable	S
A. Credibility	4
B. SDG's	1
C. Psychology	2
D. Performance	1
E. Bond Sector	1
F- International Regulations	2
G. Company Focus	1
H. Digital Transformation	1

84

Huang S

Era 3

2020

HOW THE GAME CHANGER WAS GENERATED? AN ANALYSIS ON THE LEGAL RULES AND DEVELOPMENT OF CHINAS GREEN BOND MARKET

10.1007/s10784-019-09460-9

CLIMATE FINANCE; FINANCIAL REPRESSION; GREEN BONDS; GREEN FINANCE; RULE OF LAW

Green Bond(s) (39) | Climate Change (10) | Green Finance (7)

Journal of Business Ethics (41) | Journal of Applied Accounting (35) | Journal of Finance & Economics (35) | Green (356) | Bond (305) | Financial (83)

Global Citations: 0

Variable	S
A. Credibility	4
B. SDG's	1
C. Psychology	2
D. Performance	1
E. Bond Sector	4
F- International Regulations	4
G. Company Focus	4
H. Digital Transformation	1

China International Regulatory

85

Antoncic M

Era 3

2020

UNCOVERING HIDDEN SIGNALS FOR SUSTAINABLE INVESTING USING BIG DATA: ARTIFICIAL INTELLIGENCE, MACHINE LEARNING AND NATURAL LANGUAGE PROCESSING

No Doi

ARTIFICIAL; BIG DATA; ESG; INTELLIGENCE; RISK MANAGEMENT; SDGS; SUSTAINABLE INVESTING
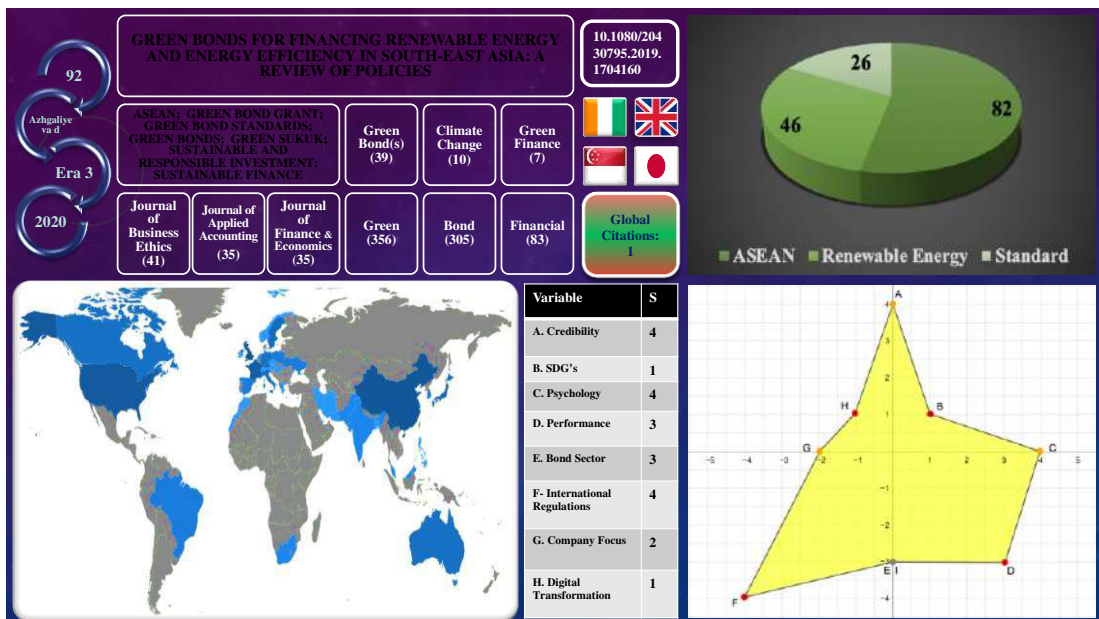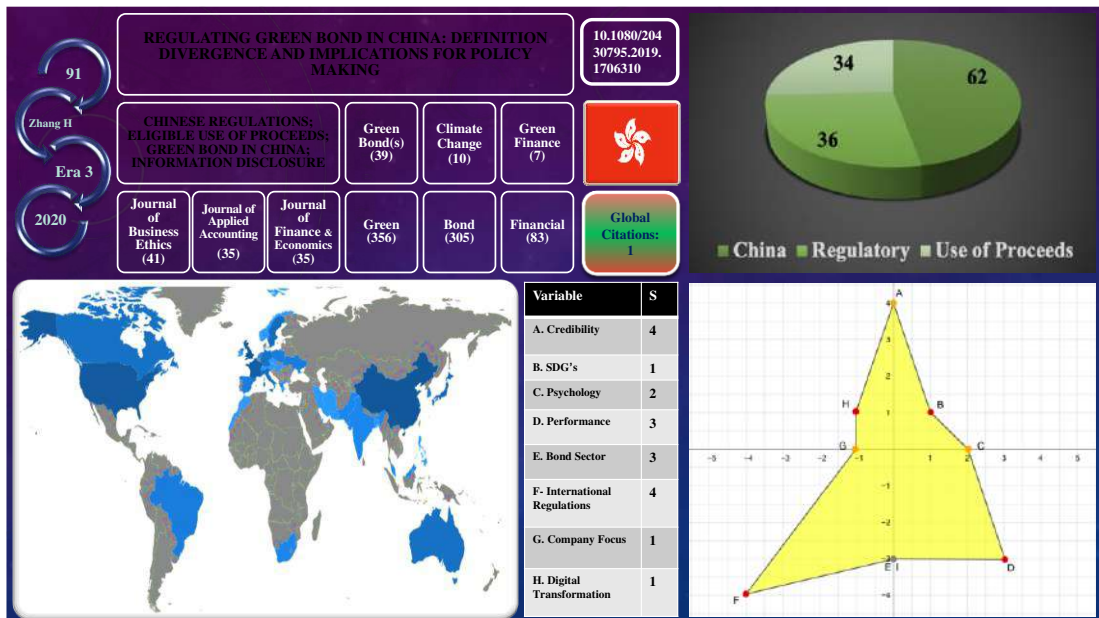
Green Bond(s) (39) | Climate Change (10) | Green Finance (7)

Journal of Business Ethics (41) | Journal of Applied Accounting (35) | Journal of Finance & Economics (35) | Green (356) | Bond (305) | Financial (83)

Global Citations: 0

Variable	S
A. Credibility	
B. SDG's	
C. Psychology	
D. Performance	
E. Bond Sector	
F- International Regulations	
G. Company Focus	
H. Digital Transformation	

NO DATA

86

Rawat SK

Era 3

2020

GREEN FINANCE: AN EMERGING PROSPECTIVE TOWARDS SUSTAINABLE DEVELOPMENT IN INDIA

No Doi

ENVIRONMENTAL FINANCE; ENVIRONMENTAL SUSTAINABILITY; FINANCIAL INSTRUMENT; GREEN FINANCE; RESOURCE DEGRADATION; SOCIAL FINANCE
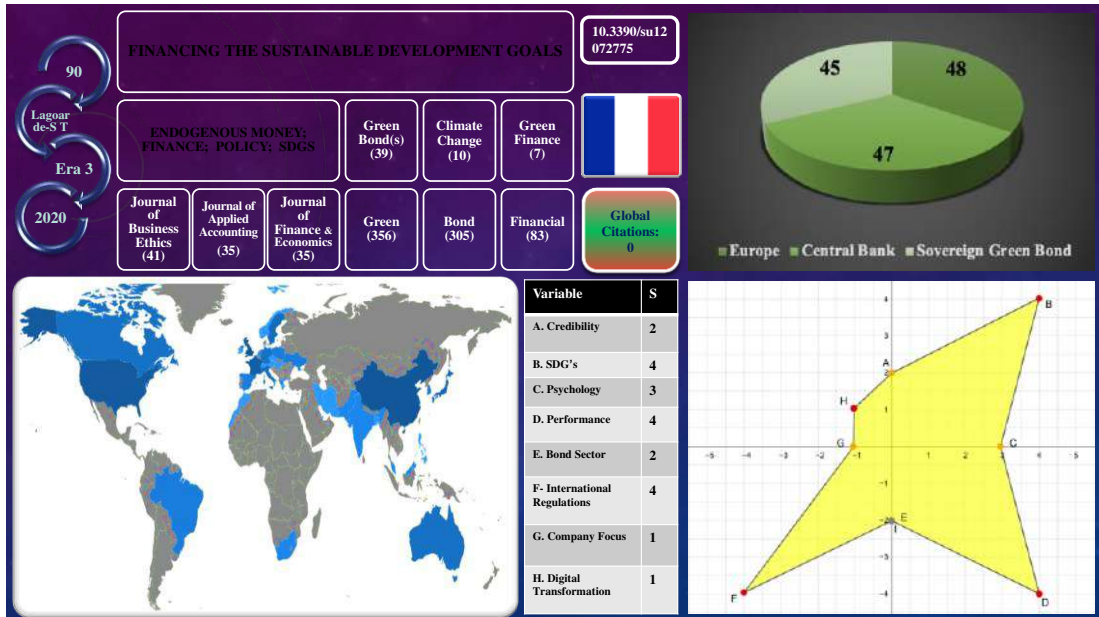
Green Bond(s) (39) | Climate Change (10) | Green Finance (7)

Journal of Business Ethics (41) | Journal of Applied Accounting (35) | Journal of Finance & Economics (35) | Green (356) | Bond (305) | Financial (83)
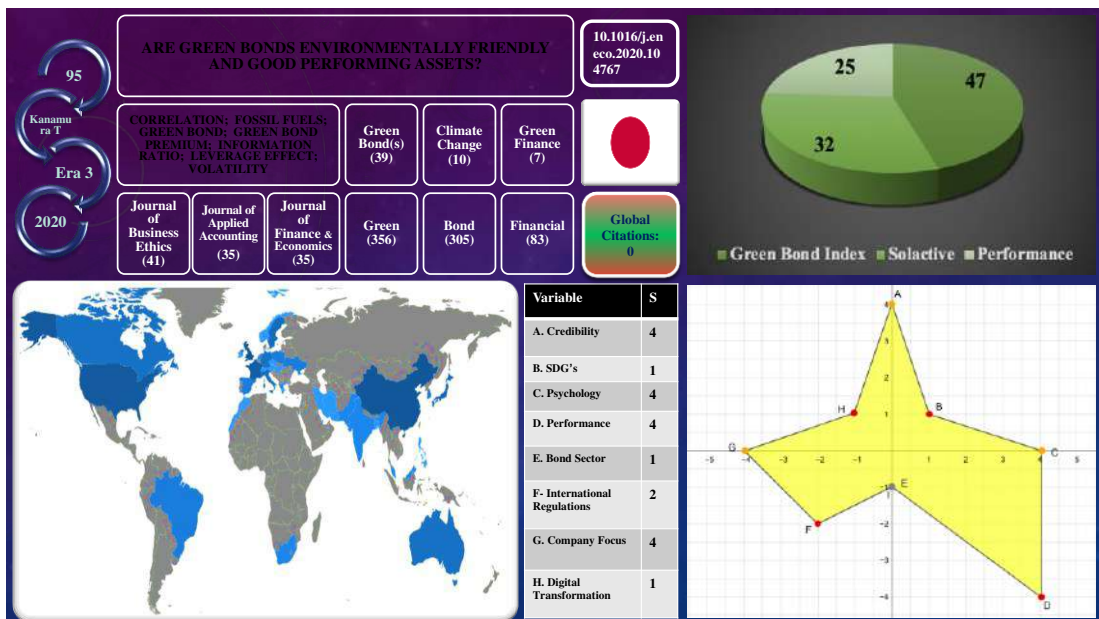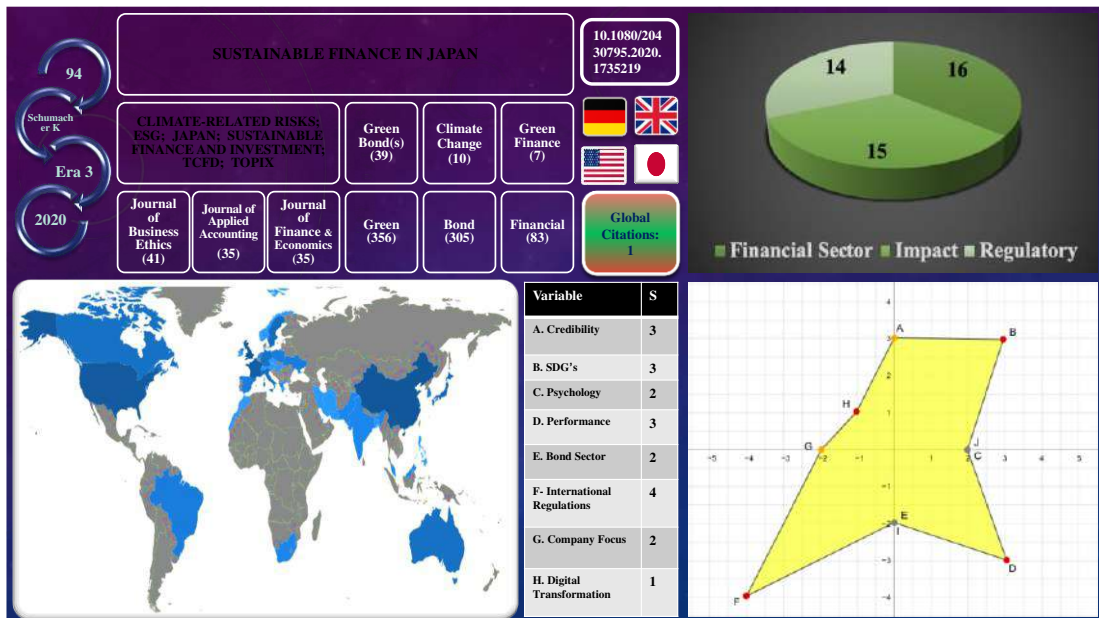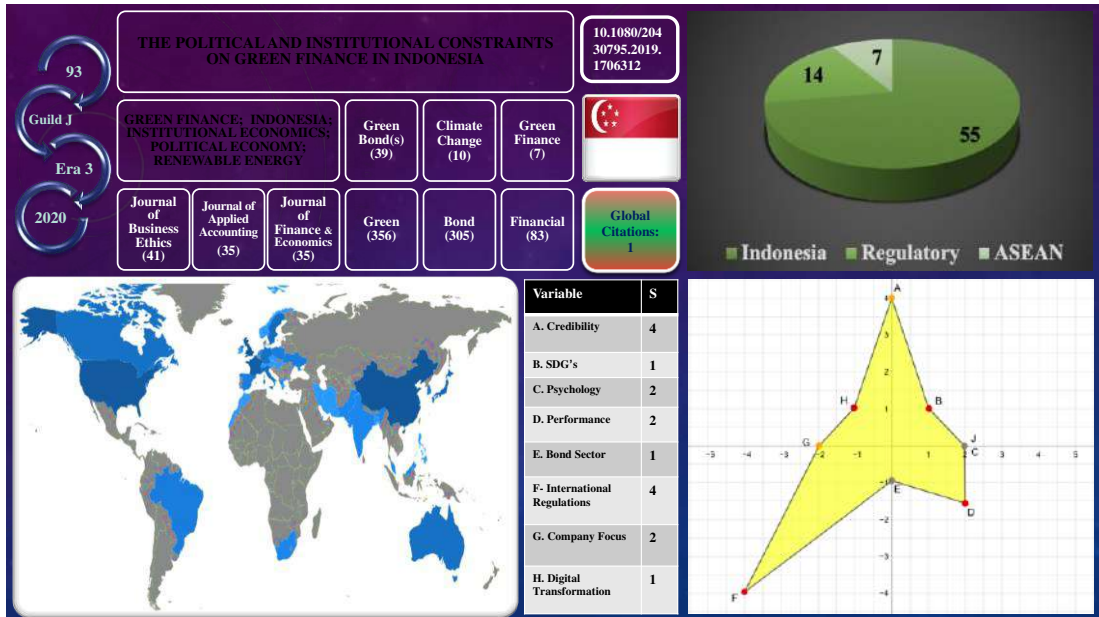
Global Citations: 0

Variable	S
A. Credibility	4
B. SDG's	1
C. Psychology	2
D. Performance	1
E. Bond Sector	4
F- International Regulations	4
G. Company Focus	1
H. Digital Transformation	1

India Investment Energy

FINANCING THE SUSTAINABLE DEVELOPMENT GOALS

90 | Lagoar de-S T | Era 3 | 2020

10.3390/su12072775

ENDOGENOUS MONEY; FINANCE; POLICY; SDGS

| Green Bond(s) (39) | Climate Change (10) | Green Finance (7) |

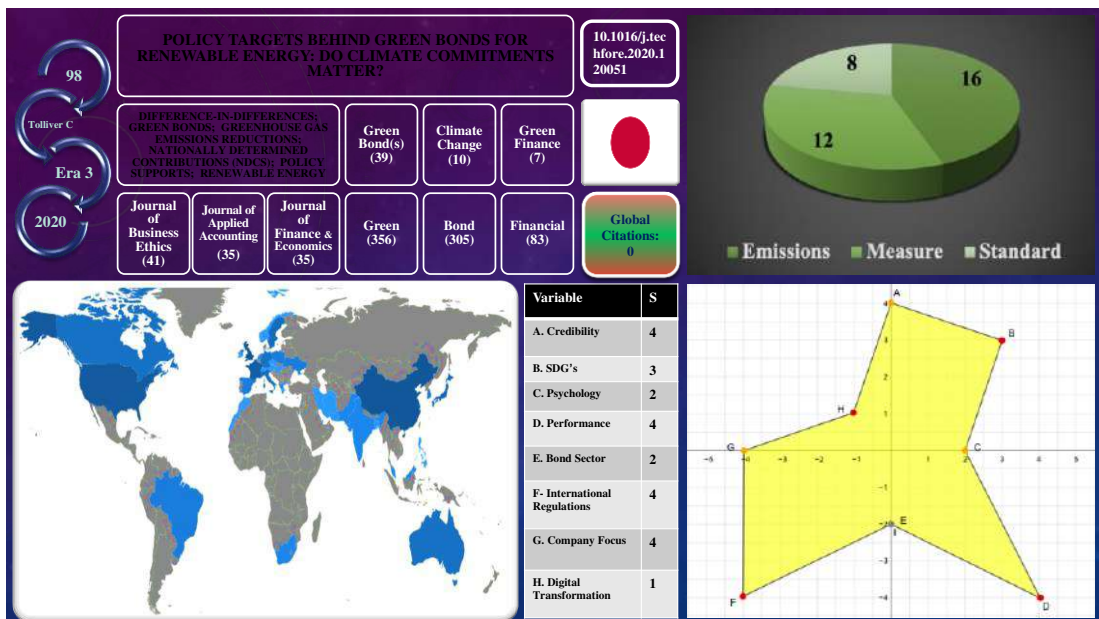| Journal of Business Ethics (41) | Journal of Applied Accounting (35) | Journal of Finance & Economics (35) | Green (356) | Bond (305) | Financial (83) |

Global Citations: 0
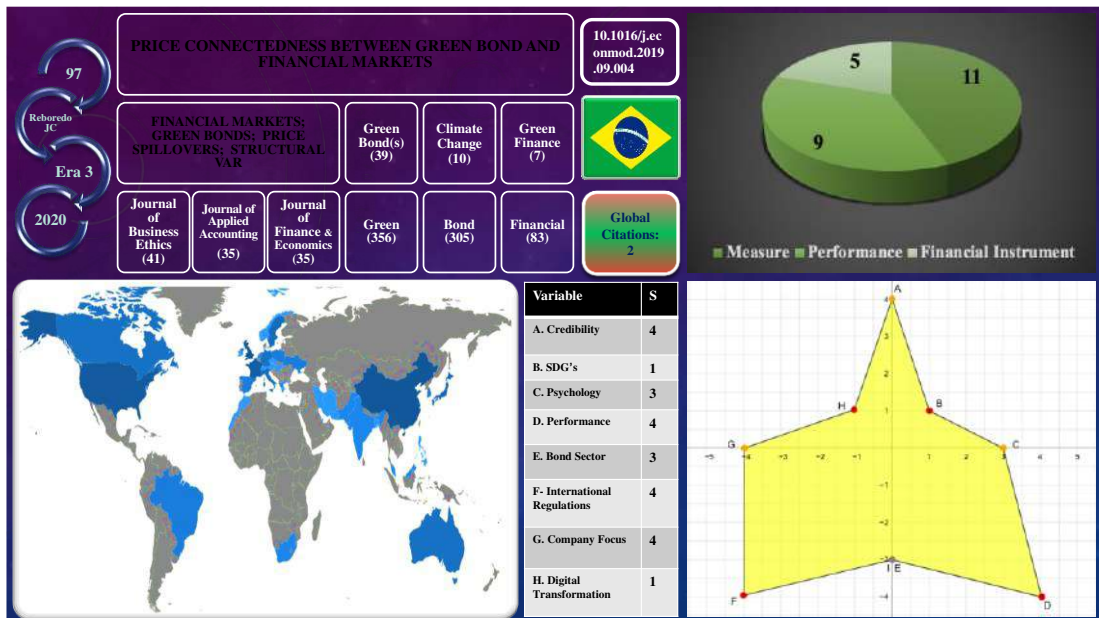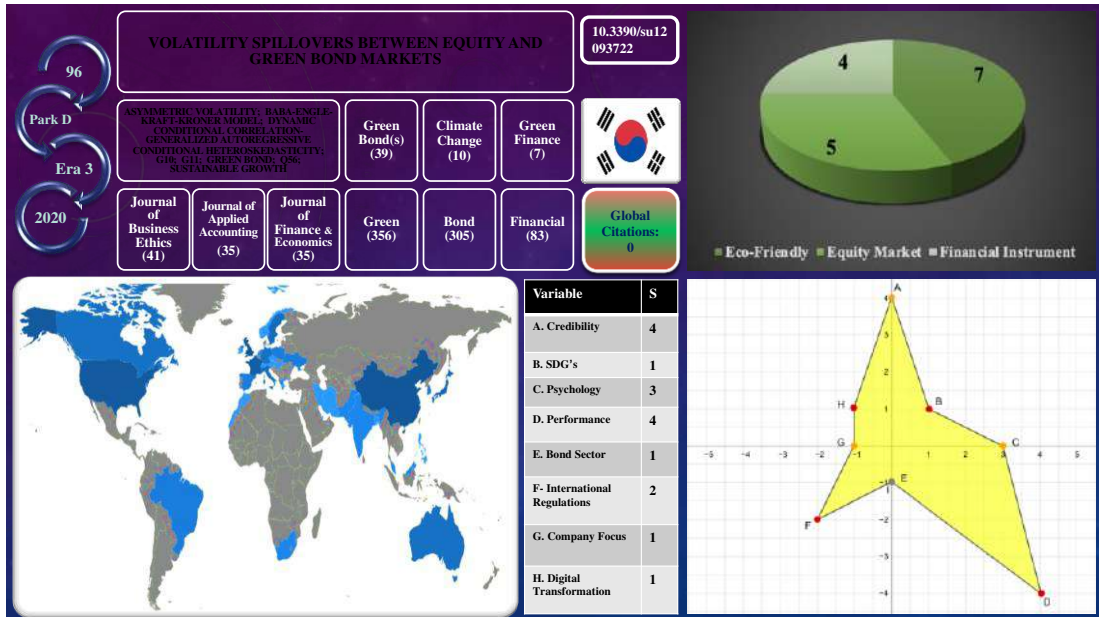
Variable	S
A. Credibility	2
B. SDG's	4
C. Psychology	3
D. Performance	4
E. Bond Sector	2
F- International Regulations	4
G. Company Focus	1
H. Digital Transformation	1

REGULATING GREEN BOND IN CHINA: DEFINITION DIVERGENCE AND IMPLICATIONS FOR POLICY MAKING

91 | Zhang H | Era 3 | 2020

10.1080/20430795.2019.1706310

CHINESE REGULATIONS; ELIGIBLE USE OF PROCEEDS; GREEN BOND IN CHINA; INFORMATION DISCLOSURE

| Green Bond(s) (39) | Climate Change (10) | Green Finance (7) |

| Journal of Business Ethics (41) | Journal of Applied Accounting (35) | Journal of Finance & Economics (35) | Green (356) | Bond (305) | Financial (83) |

Global Citations: 1

Variable	S
A. Credibility	4
B. SDG's	1
C. Psychology	2
D. Performance	3
E. Bond Sector	3
F- International Regulations	4
G. Company Focus	1
H. Digital Transformation	1

GREEN BONDS FOR FINANCING RENEWABLE ENERGY AND ENERGY EFFICIENCY IN SOUTH-EAST ASIA: A REVIEW OF POLICIES

92 | Azhgaliyeva d | Era 3 | 2020

10.1080/20430795.2019.1704160

ASEAN; GREEN BOND GRANT; GREEN BOND STANDARDS; GREEN BONDS; GREEN SUKUK; SUSTAINABLE AND RESPONSIBLE INVESTMENT; SUSTAINABLE FINANCE

| Green Bond(s) (39) | Climate Change (10) | Green Finance (7) |

| Journal of Business Ethics (41) | Journal of Applied Accounting (35) | Journal of Finance & Economics (35) | Green (356) | Bond (305) | Financial (83) |

Global Citations: 1

Variable	S
A. Credibility	4
B. SDG's	1
C. Psychology	4
D. Performance	3
E. Bond Sector	3
F- International Regulations	4
G. Company Focus	2
H. Digital Transformation	1

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Appendix 67: Summary of all Eras

Description	Results
MAIN INFORMATION ABOUT DATA	
Timespan	2008:2020
Sources (Journals, Books, etc)	65
Documents	98
Average years from publication	2,4
Average citations per documents	9,714
Average citations per year per doc	2,272
References	4831
DOCUMENT TYPES	
article	98
DOCUMENT CONTENTS	
Keywords Plus (ID)	263
Author's Keywords (DE)	356
AUTHORS	
Authors	196
Author Appearances	209
Authors of single-authored documents	29
Authors of multi-authored documents	167
AUTHORS COLLABORATION	
Single-authored documents	30
Documents per Author	0,5
Authors per Document	2
Co-Authors per Documents	2,13
Collaboration Index	2,46

Appendix 68: Three Articles Not Found

#	Title	Year
37	GREEN BONDS LIKE THE INCENTIVE INSTRUMENT FOR CLEANER PRODUCTION AT THE GOVERNMENT AND CORPORATE LEVELS: EXPERIENCE FROM EU TO UKRAINE	2018
50	GREEN ECONOMY: ROLE OF SOVEREIGN FUNDS [:]	2019
85	UNCOVERING HIDDEN SIGNALS FOR SUSTAINABLE INVESTING USING BIG DATA: ARTIFICIAL INTELLIGENCE, MACHINE LEARNING AND NATURAL LANGUAGE PROCESSING	2020

Appendix 69: Average of the entire sample set

Time Lapse	Credibitily	SDGs	Psychology	Performance	Bond Sector	Int'l Regulations	Company Focus	Digital
Average Era 1	3,00	1,10	3,10	2,00	1,50	1,90	1,00	1,40
Average Era 2	2,38	1,00	2,31	3,08	2,15	1,85	1,23	1,00
Average Era 3	3,31	1,50	2,58	3,19	2,57	3,49	1,94	1,07
Average total	2,90	1,20	2,66	2,76	2,07	2,41	1,39	1,16

Appendix 70: Full list of Results of Each Journal Article with the 8CMs Method

	Article no.:	Credibility	SDGs	Psychology	Performance	Bond Sector	International Regulations	Company Focus	Digital
	1	4	1	4	1	1	3	1	1
	2	4	1	4	1	1	1	1	2
	3	2	2	3	2	2	3	1	1
	4	2	1	4	2	2	3	1	1
	5	2	1	2	4	2	2	1	1
	6	3	1	2	2	3	2	1	1
	7	4	1	4	2	1	1	1	1
	8	1	1	1	1	1	2	1	4
	9	4	1	4	1	1	1	1	1
Era 1	10	4	1	3	4	1	1	1	1
	11	4	1	4	2	1	1	1	1
	12	1	1	1	4	2	1	1	1
	13	4	1	4	1	1	2	1	1
	14	3	1	2	1	3	1	4	1
	15	1	1	1	4	2	2	1	1
	16	1	1	3	4	3	2	1	1
	17	2	1	2	4	1	1	1	1
	18	4	1	2	4	1	1	1	1
	19	1	1	3	4	1	1	1	1
	20	2	1	3	4	3	2	1	1
	21	3	1	2	3	4	4	1	1
	22	3	1	2	4	3	4	1	1
Era 2	23	2	1	1	1	3	2	1	1
	24	3	4	1	1	1	2	1	1
	25	4	1	2	3	1	3	1	3
	26	4	1	2	3	1	2	1	1
	27	4	1	1	4	2	3	1	1
	28	3	1	3	1	1	4	1	1
	29	4	3	2	3	3	4	1	1
	30	4	2	2	3	4	2	2	1
	31	2	1	4	1	3	4	1	1
	32	2	1	3	2	1	4	4	1
	33	2	1	2	2	2	4	1	1
	34	3	1	2	4	2	4	4	1
	35	4	1	2	4	4	3	1	1
	36	3	1	3	4	4	3	1	1
	37								
	38	4	1	2	2	2	4	1	1
	39	4	1	2	4	1	4	3	1
	40	2	1	1	4	2	4	1	1
	41	2	2	1	2	2	2	1	2
	42	2	1	3	4	4	4	2	1
	43	4	1	2	4	2	3	2	1
	44	2	1	2	4	4	3	2	1
	45	4	1	1	4	1	3	1	1
	46	2	4	2	3	2	3	2	1
	47	4	1	4	4	4	4	1	1
	48	2	1	4	4	4	4	1	1
	49	3	1	2	3	2	3	1	1
	50								
	51	3	1	3	3	2	4	1	1
	52	3	1	1	2	4	4	1	1
	53	3	4	3	4	2	4	3	1
	54	3	1	2	3	2	2	1	1
	55	4	1	4	3	4	4	3	1
	56	3	1	3	3	3	4	2	1
	57	4	1	2	4	3	4	2	1
	58	2	4	3	4	3	4	1	1
	59	2	1	2	4	4	4	2	1
	60	4	2	3	3	3	4	3	1
	61	3	2	2	4	1	4	1	1
	62	2	1	4	4	2	1	1	1
	63	4	1	1	4	1	4	1	1
	64	4	1	4	4	2	4	3	1
	65	4	1	2	4	4	4	4	1
	66	2	2	4	4	3	2	2	1
	67	3	1	1	4	2	4	1	1
	68	3	1	2	1	2	4	1	1
	69	4	1	4	4	4	4	3	1
	70	3	2	4	4	4	4	2	1
	71	4	1	4	4	4	4	2	1
	72	4	3	4	4	4	4	1	1
	73	3	1	4	4	2	4	1	1
	74	4	2	4	2	1	2	1	1
	75	4	1	2	2	2	4	2	1
	76	4	3	3	1	4	4	2	1
	77	4	1	2	1	1	2	1	1
	78	2	2	2	4	2	3	4	1
	79	2	1	2	4	4	3	4	2
	80	4	1	2	3	4	4	4	1
	81	3	1	3	4	2	4	4	1
	82	4	4	4	1	1	1	1	1
	83	4	1	2	4	2	4	1	1
	84	4	1	2	1	4	4	4	1
	85								
	86	4	1	2	1	4	4	1	1
	87	4	1	4	4	4	4	4	2
	88	3	1	2	4	4	4	3	1
	89	4	1	4	4	4	4	3	1
	90	2	4	3	4	2	4	1	1
	91	4	1	2	3	3	4	1	1
	92	4	1	4	3	3	4	2	1
	93	4	1	2	2	1	4	2	1
	94	3	3	2	3	2	4	2	1
	95	4	1	4	4	1	2	4	1
	96	4	1	3	4	1	2	1	1
	97	4	1	3	4	3	4	4	1
Era 3	98	4	3	2	4	2	4	4	1

Appendix 71: Set of different word variables utilized in Three-Word GB Pie Chart

Term	Key word 1	Key word 2	Key word 3	Total
Environment	11	8	3	22
Performance	4	5	10	19
Greenwashing	3	3	4	10
Sustainable	2	3	3	8
Measure	2	4	2	8
Premium	3	2	2	7
Standard	1	4	2	7
Marketing	0	3	3	6
Proceeds	0	4	2	6
Instrument	2	3	0	5
Rating	1	3	1	5
China	3	2	0	5
Regulatory	1	2	2	5
Investment	2	2	0	4
Index	4	0	0	4
Asean	2	0	2	4
Green Finance	1	1	2	4
Corporate Bond	0	3	1	4
Debt	2	0	1	3
Ecological	2	1	0	3
no data	3	0	0	3
Ethical	1	1	1	3
Policy	1	1	1	3
Green Bond Issuance	3	0	0	3
Green Bond Market	2	0	1	3
Financial Instrument	0	0	3	3
Volatility	2	0	0	2
Pricing	1	1	0	2
Sukuk	2	0	0	2
Sovereign	1	1	0	2
Yield	1	1	0	2
Regional	1	0	1	2
Guideline	1	0	1	2
Issuer	1	1	0	2
Europe	1	1	0	2
Emissions	1	1	0	2
Legitimacy	0	2	0	2
Framework	0	2	0	2
Corporate	0	0	2	2
Credibility	0	0	2	2
Environmental Friendly	1	0	0	1
Environmental	1	0	0	1
Data	1	0	0	1

Term	Key word 1	Key word 2	Key word 3	Total
Communication	1	0	0	1
Long term	1	0	0	1
Agreement	1	0	0	1
Climate Bonds Standards	1	0	0	1
Hydropower Projects	1	0	0	1
Hong Kong	1	0	0	1
Governance	1	0	0	1
Economics	1	0	0	1
Brown Bond	1	0	0	1
Basis Point	1	0	0	1
Green Bond	1	0	0	1
Economic Policy	1	0	0	1
Green Label	1	0	0	1
Issuance	1	0	0	1
Rating Grades	1	0	0	1
Credit Rating	1	0	0	1
Asian	1	0	0	1
Vietnam	1	0	0	1
Sustainability	1	0	0	1
Financial Risk	1	0	0	1
EU	1	0	0	1
Greeness	1	0	0	1
India	1	0	0	1
Indonesia	1	0	0	1
Financial Sector	1	0	0	1
Green Bond Index	1	0	0	1
Eco-Friendly	1	0	0	1
Culture	0	1	0	1
Bonds	0	1	0	1
Greening	0	1	0	1
Spread	0	1	0	1
Invest	0	1	0	1
Internet	0	1	0	1
Greenhouse	0	1	0	1
Government	0	1	0	1
Financial Vehicules	0	1	0	1
Chinese Banks	0	1	0	1
Diversification Benefits	0	1	0	1
Bid-Ask Spread	0	1	0	1
Collaboration	0	1	0	1
Measure	0	1	0	1
Green Prudential Instrument	0	1	0	1
Patterns	0	1	0	1
Green Bond Supply	0	1	0	1
Developing Economies	0	1	0	1
Financial Performance	0	1	0	1

Term	Key word 1	Key word 2	Key word 3	Total
Bloomberg	0	1	0	1
Greenium	0	1	0	1
High Yield	0	1	0	1
Greenbrand	0	1	0	1
International	0	1	0	1
International Green Bond	0	1	0	1
Central Bank	0	1	0	1
Renewable Energy	0	1	0	1
Impact	0	1	0	1
Solactive	0	1	0	1
Equity Market	0	1	0	1
Environment	0	0	1	1
Digital	0	0	1	1
Development	0	0	1	1
Green Real Estate	0	0	1	1
Psychology	0	0	1	1
Classification	0	0	1	1
Climate Bond	0	0	1	1
Web	0	0	1	1
Water Management	0	0	1	1
Lux. Green Exchange	0	0	1	1
BNP Paris Bank	0	0	1	1
Municipal Bond	0	0	1	1
Label	0	0	1	1
Climate Bond Initiative	0	0	1	1
Instrumental	0	0	1	1
AAA Rated	0	0	1	1
Global Financial Centre China	0	0	1	1
Islamic-Finance	0	0	1	1
Regulate	0	0	1	1
Pro-Environmental	0	0	1	1
Factor	0	0	1	1
Sharia	0	0	1	1
Finance-Climate	0	0	1	1
Green Investment	0	0	1	1
Greening	0	0	1	1
Bond Characteristics	0	0	1	1
Ecuador	0	0	1	1
Regulation	0	0	1	1
Value Enhancing	0	0	1	1
Environmental-Responsible	0	0	1	1
China's Green Bond Market	0	0	1	1
CO2 Emissions	0	0	1	1
Swedish	0	0	1	1
Legal Framework	0	0	1	1
Website	0	0	1	1
Developing Country	0	0	1	1
MexiCO2	0	0	1	1
Compare	0	0	1	1
Environmental-Risk	0	0	1	1
Liquidity	0	0	1	1
Energy	0	0	1	1
Sovereign Green Bond	0	0	1	1
Use of Proceeds	0	0	1	1

Appendix 72: Hypothetical GB Octagon of Total Results
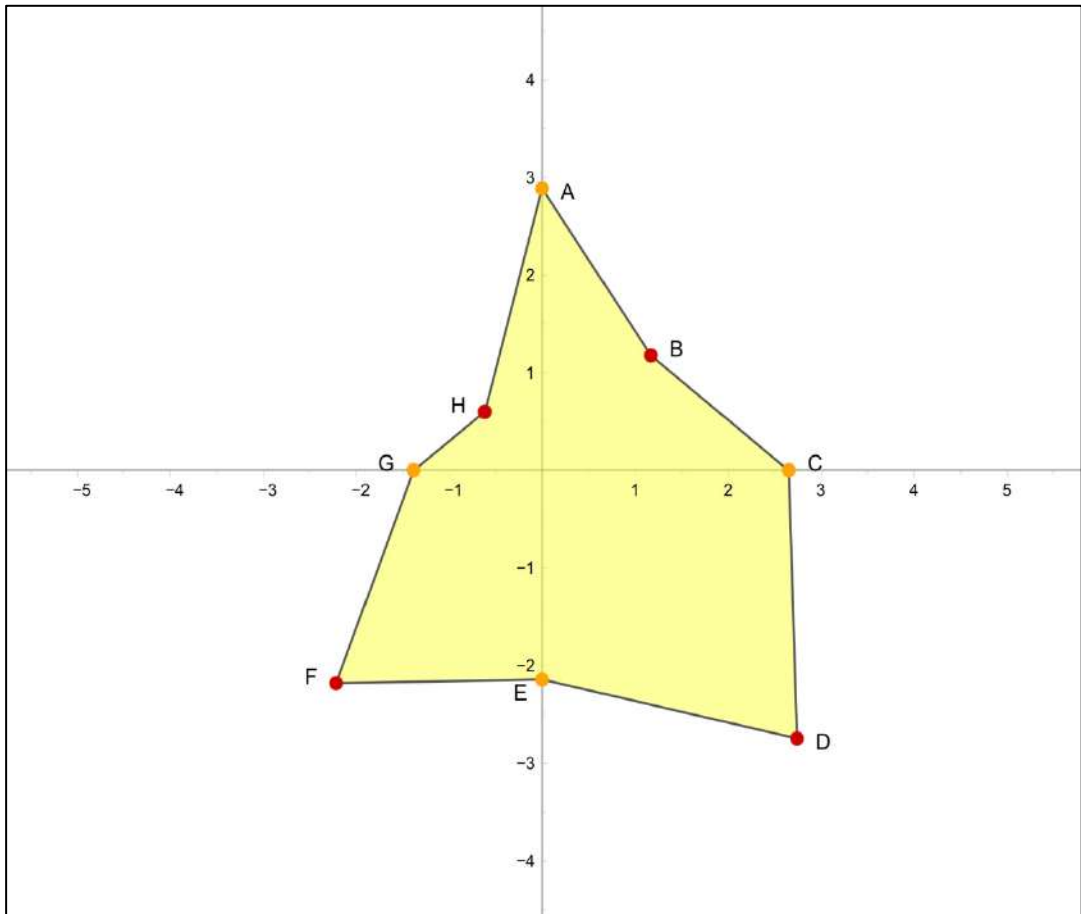
Appendix 73: Hypothetical Three-Word GB Pie Chart of Total Results