On the Use of Bibliometrics for Domain Analysis
A study of the Academic Field of Political Science in Europe

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Abstract
The academic field of political science in Europe is studied in this thesis which examines the application of bibliometrics for domain analysis. It takes its point of departure in the domain analytic approach outlined by Birger Hjørland and Hanne Albrechtsen, which claims the study of domains as central for information specialists to be able to identify information needs in their fields of practice.

Three features of the domain were studied by the use of bibliometric methods. Data was extracted from the Web of Science. Impact Factor was used to select 50 journals from each of the years 1999, 2004 and 2009. Only items published by authors with European addresses were included. Co-word analysis was used to study topics within the discipline and several kinds of citation analyses were conducted to examine citation patterns of the domain. Lastly core journals, authors and works were identified by the use of citation analysis and co-citation maps were drawn for the analyses.

Several subfields within the domain, as well as some differences in citation patterns of the subfields, were possible to distinguish. The domain showed to be multifaceted, yet specific European research areas were identified. Some significant changes of the citation patterns were apparent between 1999 and 2009. In 2009 there were more references per article, journal articles were cited to a higher degree, relatively older publications were cited to a greater extent and the most cited journals received a larger share of the total amount of citations.

The existence of a specific European domain within political science is discussed as well as the diverse characteristics of the subfields and their implications for the bibliometric methods. Finally suggestions are presented of how bibliometrics can be used for domain analysis within library and information science as well as by information service institutions.

This paper is a two years master’s thesis in Library and Information Science.

Svenskt Abstract
Det akademiska statsvetenskapliga fältet i Europa studeras i denna uppsats, vilken utforskar bibliometrins tillämpbarhet inom domänanalysen. Den tar sin utgångspunkt i det domänanalytiska perspektivet formulerat av Birger Hjørland och Hanne Albrechtsen, vilket hävdar studier av domäner som centrala för att informationsspecialister ska kunna identifiera informationsbehov inom sina verksamheter.


Existensen av en specifik europeisk domän inom statsvetenskapen diskuterades samt hur de bibliometriska metoderna påverkas av skillnader mellan delfälten. Slutligen presenteras förslag på hur bibliometrin kan användas för domänanalys inom biblioteks- och informationsvetenskapen samt av institutioner tillhandahållande informationstjänster.
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Part I: Introduction, Theoretical Framework and Methodological Discussion

Introduction

Domain analysis outlines the study of knowledge domains as an important practice for information science to understand information structures within different fields of practice. The objective for an information system is described by Birger Hjørland to "[...] identify and communicate the knowledge needed [...]" by the practitioners within a domain to fulfill their task. Hjørland has recognized bibliometrics as one of several approaches that could be used within domain analysis and has proposed these approaches to be further developed to strengthen the field of information science.\(^1\) Nonetheless, the use of bibliometrics for domain analysis has not yet been thoroughly treated, leaving areas to be mapped and methods to be examined.\(^3\)

Bibliometrics has been acknowledged as an efficient tool for other theoretical approaches within information science where it has been used to study publications in different fields of study, typically in the academic sphere. Yet this work has most commonly been carried out for methodological development, for evaluation of journals or universities or for the mapping of scientific communication at large.\(^4\) More seldom has bibliometrics been used as suggested by the domain analytic approach, i.e. as a methodology for analyzing a domain to derive knowledge fruitful to the development of services within the field of information science. Contributions can therefore be made in this area.

Political science has served as one among other fields of example studies for development of bibliometric methods. It has been subject to the vivid debate of research evaluation and studied as one of several fields in comparative studies. Subfields have also been studied such as international relations and the field of terror-

\(^1\) Hjørland, B. (2002), "Domain analysis in information science - Eleven approaches - traditional as well as innovative", p. 422.
\(^3\) Contributions made will be discussed further ahead in part I.
\(^4\) The research field of bibliometrics is discussed in the chapter *The Research Field of Informetrics* p. 13.
ism research. Bibliometric studies of political science in a national aspect are fairly common though most often focusing on evaluation.⁵

There has been no domain analytic study focusing on the academic field of political science in Europe even though the political importance of Europe as a regional entity has increased as the European Union collaboration has expanded, likely to cause similar developments within the academic sphere. Such a study would be useful for information institutions serving scholars within political science in Europe with relevant information and can be used for the exploration of the usability of bibliometrics for domain analysis.

Research Objective
The purpose of the thesis is to study how bibliometrics can be used within the domain analytic approach to analyze a domain and its changes over time. Such analysis is assumed to derive knowledge about the studied domain, i.e. the academic field of political science in Europe, useful for information services such as collection development and information retrieval as proposed by the domain analytic approach. Hence the intention is not only to derive knowledge important for method development but also to obtain knowledge about the particular domain.

Theory and Application of Domain Analysis
Domain analysis is a theoretical approach in the field of information science where knowledge production and dissemination within a professional discipline is seen as the prime subject to analyses by the information specialists to achieve the aim to provide it with information services.⁶ This approach was formulated in an article by Birger Hjørland and Hanne Albrechtsen titled Toward a new horizon in information science – domain-analysis, published in 1996.⁷ In the article they stress that:

The domain-analytic paradigm in information science (IS) states that the best way to understand information in IS is to study the knowledge-domains as thought or discourse communities, which are parts of society's division of labor. Knowledge organization, structure, co-operation patterns, language and communication forms, information systems, and relevance criteria are reflections of the object of the work of these communities and of their role in society.⁸


⁶ In the thesis domain analysis is treated as it is used within information science, however the term is used and has different meanings within other disciplines, e.g. software engineering.


The domain analytic approach is thus adopting a social perspective in the study of information practices. Even though focusing on information specialists Hjørland stresses that the domain analytic approach can be used by general librarians since also they are coping with different domains.9

The epistemological foundation of the theory is explicitly formulated by Hjørland and Albrechtsen. Most essential in this context is that man is seen as "acting and living in a bio-physical, a socio-cultural and a subjective world" ,10 and that action is influenced by knowledge, but knowledge is also created in action. Hence action and knowledge can be said to be intertwined concepts where action is reflecting knowledge. The study of action in different discourse communities can therefore give us insights into the knowledge structure in that community. Studying practices is therefore legitimated by the epistemological assumptions.

The prime object of domain analysis is (as revealed by the name) the domain, which is contrasting to the individual. The way domain analysis is contrasting to cognitivism is interesting since it outlines some of the focal points of the domain analytic paradigm. The interest of the user from the perspective of the domain analytic paradigm is as an actor who is part of the analyzed domain, i.e. as a part of a social practice. Focus is thus always given a domain, never the single user which is an important difference from the cognitive perspective. Whilst cognitive psychology and artificial intelligence are central to the cognitive approach within information science, information structure and the sociology and theory of knowledge is central to the domain analytic approach.11 This induces differences in methodology and differences in prime concepts between the theoretical fields. According to Hjørland and Albrechtsen concepts of importance for domain analysis are "[...] scientific and professional communication, documents (including bibliographies [sic]), disciplines, subjects, information structures, paradigms etc."12

The objective for the information specialist is to study the structure of the domain, i.e. to outline the knowledge production of the domain and how it is communicated, changes in knowledge production and communication, mapping the different paradigms and to put the domain in its context.13

The domain analytic perspective is a pragmatic perspective which emanates in the practical work of the information specialist. It offers an ontological and epistemological framework as well as methods for the information specialist to function efficiently in the field of practice.

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9 Hjørland, B. (2002), "Domain analysis in information science - Eleven approaches - traditional as well as innovative", p. 422.
The pragmatism is obvious in a later article published in 2002 where Hjørlund poses the question about what information is needed for an information specialist working in a particular domain. The article treat eleven approaches united by their purpose to provide the knowledge needed by an information specialist to fulfill his or her mission to serve the domain at hand.\(^\text{\textsuperscript{14}}\)

All eleven approaches will not be treated here since the focus is solely of the bibliometric approach which unfortunately is only discussed briefly by Hjørlund. It can however be mentioned that Hjørlund recognizes bibliometrics as a tool that can be combined with several of the other approaches within domain analysis to develop information service practices within different domains, such as construction of special classifications and thesauri, development of indexing and retrieval practices, empirical studies of users, mapping the terminology and language of the domain, or mapping the structures and institutions within the domain.\(^\text{\textsuperscript{15}}\)

Development of the mentioned methods for domain analysis, as well as emergence of new methods, is explicitly proposed by Hjørlund. It is the intention of this thesis to make a contribution to this development by examining what role bibliometrics can have within domain analysis.

**Research Questions**

To reach the stated research objective three research questions have been formulated:

I. How has bibliometrics been used for the analysis of domains with relevance to the domain analytic approach?

II. How can the academic field of political science in Europe, thought of as a domain as described by the domain analytic approach, be analyzed using bibliometrics and which conclusions can be drawn from this study about the domain and its changes over time?

III. Which conclusions can be drawn about the use of bibliometrics for domain analysis and what strengths and weaknesses can be associated with the methods in this context?

The research questions roughly correspond to the disposition, i.e. Part I-III, of the thesis. The intention of the first question is to put the research in its context by ex-

\(^\text{14}\) Hjørlund, B. (2002), "Domain analysis in information science - Eleven approaches - traditional as well as innovative".

\(^\text{15}\) Hjørlund, B. (2002), "Domain analysis in information science - Eleven approaches - traditional as well as innovative". Hjørlund also discusses methodological implication with bibliometrics which is further discussed under the heading Critique of Bibliometrics (p. 26).
examining how bibliometrics has been used for the analysis of domains in general and within political science in particular.

To answer the second question the academic field of political science in Europe is used as an example of a domain which can be studied by the use of bibliometrics. The bibliometric study of this domain, outlined and presented in Part II, aims to describe the domain and its changes over time.

The results and methodology are further discussed in Part III where conclusions are drawn about the utility and efficiency of bibliometrics as a tool for domain analysis.

Layout of thesis

The remainder of part I will deal with the field of bibliometrics and its application within domain analysis and will form the theoretical and methodological foundation of the bibliometric study. Scope and delimitation is first discussed followed by a general introduction to bibliometrics, scientometrics and informetrics. Former research within informetrics related to domain analysis is addressed in the next chapter. Political science as a research field is briefly outlined thereon and bibliometric studies within the discipline are presented. The final chapters of Part I concern the application of bibliometrics for domain analysis and is completed with a critical discussion.

Part II presents the results of the bibliometric study of political science in Europe. Three main features of the domain (topic, citation patterns and core journals, authors and documents) are analyzed in the study which are presented in the beginning of part II, followed by the presentation and discussion of the material selection. Thereafter the methods and results are presented for each of the three features and the part is rounded off by a summary of the results.

The final part of the thesis departs from the research questions, discusses former research, the conclusions of the study and the usefulness of bibliometrics within domain analysis. Finally a summary of the thesis as a whole is located at the end of part III.

Scope and Delimitation

The thesis will solely analyze the domain by the use of bibliometrics since that is in accordance with the formulated research objective and stated research questions. There are of course other methods with which to analyze a domain and as suggested by Hjørland it is probably necessary to combine several methods to
make a thorough study of the domain. How bibliometrics can be combined with other methods for domain analysis will be addressed in the discussion.

The thesis aims to derive knowledge useful for information services which delimits the study to analyses of such features that are believed to be important in this perspective. A pragmatic perspective from a library and information science point of view is thus adopted and such features as the sociological development or discursive changes within the scholarly field are not the primary focus of the research, though the domain is seen as a sociological community. Rather such subjects as prime sources and publishers, important documents and changes in research topics are considered important for the development of information services. How the study is positioned within the research field of informetrics is discussed in the chapter The Research Field of Informetrics (p. 13).

The academic field of Political science in Europe was selected as the domain for the analysis. This is however not a homogenous entity but a heterogeneous one constituted by several subfields in regard to both subject and geography. The intention is to study this domain at the European level, not the separate parts and subfields nor to draw conclusions on a supra level, i.e. on an international level. The core characteristics of the domain is further considered as being more relevant for this study than the coverage of the periphery, yet differences between subfields must be considered. This issue is further discussed both in the chapter Critique of Bibliometrics (p. 26) and in the discussion. Since it is analyzing an academic domain this study naturally focuses on the academic field even though other kinds of domains also could be subject to domain analysis. The special characteristics of the formal communication of the academic community can however cause the study not to be generalizable to domains with a different set of characteristics.

Since adopting a pragmatic perspective the study will focus on the domain as it exists today and how it is changing and can be expected to change. It is not the purpose to try to sketch out the past for any other reason than to understand the present and the selection of time period is chosen in regard to this ambition (the chosen time period is discussed in the chapter Material Selection, p. 29).

Defining Bibliometrics, Scientometrics and Informetrics

In 1969 Alan Pritchard described the term bibliometrics to be “[...] the application of mathematical and statistical methods to books and other media of communication.” This definition corresponds to how the term is used by Riita Kärki and

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16 Hjørland, B. (2002), "Domain analysis in information science - Eleven approaches - traditional as well as innovative", p. 450 f.
Terttu Kortelainen in an introductory work to bibliometrics, and to how it will be used in this thesis.\textsuperscript{18}

The terms bibliometrics (or bibliometry) and informetrics\textsuperscript{19} are sometimes used synonymously. Kärki and Kortelainen suggest informetrics to constitute a broader term than bibliometrics and also superordinate the term scientometrics, which is also how the term is used by Judit Bar-Ilan in a review of the field of informetrics in the beginning of the 21\textsuperscript{st} century.\textsuperscript{20}

Glänzel notes that bibliometrics and scientometrics have been intertwined but acknowledges that historically scientometrics has been restricted to the science concerned with measuring science communication.\textsuperscript{21} This definition also corresponds to how the term is used by Kärki and Kortelainen who outline the difference between bibliometrics and scientometrics by pointing out that bibliometrics excludes other studies than those based on publications while scientometrics only concerns studies of the scientific field, but can be based on other objects than publications.\textsuperscript{22}

Since this thesis deal with the scientific communication through the analysis of publications all three terms can be used as descriptions of the “metrics” used in the thesis. However bibliometrics will be used when referring to the study of publications, scientometrics will refer to the study of the scientific field and when referring to the broader field including both bibliometrics and scientometrics the term informetrics will be used (see \textit{Figure 1}).

\begin{itemize}
\item \textsuperscript{18} Kärki, R. & Kortelainen, T. (1998), \textit{Introduktion till bibliometri}.
\item \textsuperscript{19} Sometimes spelled Infometrics.
\item \textsuperscript{20} Bar-Ilan, J. (2008), "Informetrics at the beginning of the 21st century--A review".
\item \textsuperscript{21} Glänzel, W. (2003), "Bibliometrics as a research field: A course on theory and application of bibliometric indicators", p. 6.
\item \textsuperscript{22} Kärki, R. & Kortelainen, T. (1998), \textit{Introduktion till bibliometri}, p. 4 ff.
\end{itemize}
The Research Field of Informetrics

Bibliometrics is used in a variety of ways. The methodologies vary as well as the subject and the purpose of analysis. Some of the major disciplines, their theories and methodologies will be outlined in this chapter to put the thesis in its context.

The field of bibliometrics is addressed by Wolfgang Glänzel who acknowledges three purposes for bibliometric analysis and their target groups. These are (1) "Bibliometrics for bibliometricians", i.e. the research done for theory and methodological development, (2) "Bibliometrics for scientific disciplines", i.e. the research conducted on different scientific disciplines to derive knowledge about the scientific community and (3) "Bibliometrics for science policy and management", i.e. the evaluation research conducted to be used for science policy and management.\(^2\)

Glänzel does not mention information services, libraries, librarians or the like as target groups in this list, which makes it difficult to place bibliometrics for domain analysis.\(^3\) Theory development and methodological development of bibliometrics as a research field: A course on theory and application of bibliometric indicators", Figure 1.1, p. 10.

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\(^{3}\) The connection between informetrics/scientometrics/technometrics and library science is acknowledged by Glänzel in a figure outlining the relation between bibliometrics and scientometrics and other fields. However no direct connection between scientometrics/technometrics and librarianship is made in this model. See Glänzel, W. (2003), "Bibliometrics as a research field: A course on theory and application of bibliometric indicators", Figure 1.1, p. 10.
metrics for domain analysis can however be placed in the first category. Further the results of bibliometric studies of domains can be important contributions in the study of scientific fields and also valuable for management and policy decisions, hence placed in both the second and the third category. The target group (and perhaps also the executor) of bibliometric studies for domain analysis is thus librarians and other groups working with information services. The scope of this thesis is to use bibliometrics for the analysis of the academic field of political science in Europe, which makes it possible to place the study in either of the three categories, however not fitting very well in either one. A fourth category can therefore be suggested, i.e. (4) Bibliometrics for information service institutions where this thesis could be placed along with other bibliometric studies within domain analysis. Hence we have four categories of bibliometric research. The remainder of this chapter will outline the present state of the research field.

The theory development within bibliometrics has focused on different laws to describe information patterns, such as laws describing information production patterns, use of publications and laws describing citation patterns. Another field of theory development is in the area of information retrieval where different models to measure the connection between two documents have been discussed. Also bibliometric methods for classification and thesauri development have been subject to research.

In the first decade of the 21st century the methodological discussion within informetrics has been focusing on mapping and visualization of domains, linguistic techniques (including co-word analysis), network analysis and methods for classification. There have also been discussions about differences between databases, their coverage and structure.

Most commonly debated within as well as outside the academic community is bibliometrics as a tool for research evaluation. The area includes evaluation through the $h$-index and the Impact Factor. This debate has been going on ever
since Eugene Garfield proposed that citation analysis could serve as a tool for journal evaluation in 1972.\textsuperscript{32} \textit{Scientometrics} is probably the most important forum for this debate. Examples of recent articles addressing this topic is Sebastian K Boell and Concepción S. Wilson's article introducing a new index through the use of Impact Factor, Giovanni Abramo et. al. comparing citation analysis and Impact Factor for evaluation of publications and José María Gómez-Sancho and María Jesús Mancebón-Torrubia addressing the problem of bias of the Impact Factor and suggesting a normalization to overcome this problem.\textsuperscript{33}

There is no doubt that information and communication technology have given new opportunities for bibliometric studies. A new field has also emerged from this development, namely \textit{webometrics}. As revealed by the name this field is concerned with measuring activities on the web, especially by the use of link analysis.\textsuperscript{34} Webometrics thus constitute another metrics along with the already mentioned.

Bibliometric methods for collection development is another approach used within informetrics. Examples of such studies are the research conducted by Joanna Tan Yeok Ching and K.R Chennupati who used citation analysis to study a domain for collection development, K. Brook Enger who used citation-analysis to develop a core book collection, and Sherri Edwards who analyzed citations in theses and dissertations with the purpose to create a ground work for journal purchase policy.\textsuperscript{35} These approaches are interesting since they have the pragmatism in common with the domain analytic approach, aiming to fulfill the information need of domains by the use of bibliometric methods.

Open access is another field of study within bibliometrics. Most often concerning citation analysis and how open access publication impinges upon citations and Impact Factor.\textsuperscript{36} Such studies are important for information service institutions since the growing amount of academic open access literature affect their conditions and possibilities to provide information.

Since bibliometrics is used as a tool for domain analysis in this thesis the prime areas of relevance within informetrics are those theories and methods concerned with describing patterns of the scientific community. Citation-analysis and the theories of citation patterns offer a powerful tool in this manner. Citation analysis is also linked to the practice of mapping and visualizing domains. The mapping and visualization of domains can also be done by co-word analysis and co-

\textsuperscript{32} Garfield, E. (1972), “Citation analysis as a tool in journal evaluation - journals can be ranked by frequency and impact of citations for science policy studies”.


\textsuperscript{36} De Bellis, N. (2009), \textit{Bibliometrics and citation analysis}, p. 294 ff.
author analysis. These bibliometric tools are therefore addressed more thoroughly later in this section. But first the discipline of political science will be presented as well as former bibliometric research within the discipline.

The Academic Field of Political Science

There is not room for a thorough discussion about the discipline of political science but a brief introduction to the discipline and its subfields will be presented. Knowledge about the discipline is essential for the analysis of the bibliometric study and the discipline has therefore been studied more thoroughly than is possible to give an account of. The purpose of this short introduction to the discipline is to present basic information essential to understand the results of the study.

Political science is often referred to as the study of politics, where politics is more problematic to define, however power can be said to be a key concept.37 Robert E. Goodin and Hans-Dieter Klingemann do for example describe politics as the “[...] constrained use of social power.”38

Political science is constituted by a number of subfields. These are not static and therefore shifting between political science departments, classification and categorization schemes or when the field is described in the literature. International relations, political theory (or political philosophy), comparative politics and public administration are usually mentioned as parts of the field even though international relations are sometimes considered a discipline of its own, i.e being parallel to political science.39 Specific national subfields are also often mentioned e.g. American politics in the US or regional subfields e.g. European politics in European countries.40 Methodology is sometimes mentioned as one of the subfields.41

Not surprisingly, since addressing topics as the distribution of power, political science contains competing theoretical and methodological approaches as well as diverse ontological and epistemological foundations.42 Behavioral analysis, rational choice, institutional approach, constructivism and interpretive theory, political psychology, feminism, Marxism and normative theory are mentioned as such theoretical approaches in an introduction to theories and methods in political

40 This kind of distinction is made in the English speaking Wikipedia, entry word "political science". Swedish speaking Wikipedia, entry word "Statsvetenskap", Spanish Speaking Wikipedia, entry word "ciencia politica" and German speaking Wikipedia entry word "politikwissenschaft" [2011-05-06].
science edited by David Marsh and Gerry Stoker. These are not always mutually exclusive and some of the approaches are overlapping.

Features such as subfields and competing perspectives in the domain are essential to understand and interpret the results of the bibliometric study and will therefore be considered when analyzing the results. My bachelor degree in political science and knowledge about the discipline will therefore be useful for the implementation of the analysis.

Previous Bibliometric Studies of Political Science

In accordance to the research field of informetrics at large, studies of political science have most often focused on certain aspects of scientific communication or the bibliometric methods, e.g. in the commonly debated field of research evaluation. Examples of studies evaluating journals or departments are numerous such as Simon Hix's international study evaluating political science departments and following articles discussing and criticizing this method e.g. Roland Erne's article titled “On the use and abuse of bibliometric performance indicators: a critique of Hix’s ‘global ranking of political science departments’” and Ulf Sandström's article addressing different methodologies for the evaluation of political science departments in Sweden. Also Micheal W. Giles and James C. Garand have discussed journal evaluation methods in the field of political science as well as Micheal J. Ballard and Neil J. Mitchell who have evaluated political science departments by citation analysis in an early study. More recently Kenneth Benoit and Michael Marsh compared impact measures and found high correlation among different methods but also discovered differences between citation measures based on articles and those based on books.

Bibliometric works addressing other topics than evaluation and methodological development are more rare within political science. Subfields have been subject to studies which could be categorized as domain analysis though this term most commonly are not explicitly used. Li Zhang analyzed citations within international relations with the intention to gain knowledge of the discipline for collection development. Another example is the research done by Edna F. Reid and Hsinchun Chen who analyzed the core authors and their relations as well as topics within the field of terrorism research.

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44 Hix, S. (2004), "A Global Ranking of Political Science Departments".
48 Zhang, L. (2007), "Citation analysis for collection development: A study of international relations journal literature".
49 Reid, E. F. & Chen, H. (2007), "Mapping the contemporary terrorism research domain".
Political science has also been studied as one of several scientific disciplines in research addressing more general research questions. Kristin Antelman used political science as one of several disciplines to analyze how open access influenced citation rates and concluded that open access articles has greater research impact within political science as well as in other disciplines. Political science also was one of the studied disciplines in an article by Amanda J. Swygart-Hobaugh exploring the different citation behaviors within quantitative and qualitative approaches, concluding that there are substantial differences.

To sum up, the bibliometric research conducted on political science follows the same pattern as the general field of bibliometrics. Some studies that can be categorized as bibliometrics for information service practices have been conducted, several in the field of collection development. Notwithstanding no studies of this kind have been carried out on the academic field of political science in Europe.

Bibliometrics as a Tool for Domain Analysis

It has been stated that the domain analytic approach is a social perspective, where the study of the sociology of the knowledge-domain is vital for the practice of information services. We have seen that Hjørland and Albrechtsen argue that knowledge-domains should be thought of as discourse communities and that “[k]nowledge organization, structure, co-operation patterns, language and communication forms, information systems, and relevance criteria are reflections of the object of the work of these communities and of their role in society.” So the question is how bibliometrics can be used for analyzing the mentioned aspects of a knowledge-domain?

First of all bibliometrics can not be the single approach for a complete domain analysis, and neither can any other approach. Hjørland suggests that the eleven approaches which he has outlined should be combined. As bibliometrics is the study of publications it is only through publications and the meta data affiliated to the publications that domains are analyzed within bibliometrics, yet this can be done in several ways. Figure 2 shows a bibliographic record from Web of Science.

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50 Antelman, K. (2004), "Do Open-Access Articles Have a Greater Research Impact?".
51 Swygart-Hobaugh, A. J. (2004), "A citation analysis of the quantitative/qualitative methods debate’s reflection in sociology research".
53 Hjørland, B. (2002), "Domain analysis in information science - Eleven approaches - traditional as well as innovative".
Glänzel identifies different elements in the bibliographic records that can be analyzed. He mentions (co)-authors, references/citations and the publications themselves to be such elements and stresses that “[p]ublications can be assigned to the journals in which they appeared, through the corporate addresses of their authors to institutions or countries, references and citations to subject categories, and so on.”

It can be acknowledged that Glänzel makes a distinction between references and citations. Reference is used in the notion of being given while citation is used in the notion of being received. Hence an article contains references but receives citations. This distinction will be used in the thesis.

Another way to describe the elements and relations between elements which are subject to bibliometric analysis is offered by Nicolai Mallig who uses an Entity-Relationship diagram. He identifies organizations, persons, articles and journals as entities. These entities are related to each other by relations. Journals relate to articles through publication, articles to authors by authorship, authors to organizations through affiliation and articles relate to other articles by the practice of reference. Attributes are also outlined in this model and can be provided to both entities and relations (see Figure 3).

Mallig's use of entities, relations and attributes will be used for description of the constituent concepts of the bibliometric study. Though the ER-diagram outlined by Mallig specifically uses articles for the bibliometric analysis it can be

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55 This distinction was first made by Price, D. de S. (1970), “Citation measures of hard science, soft science, technology, and nonscience”.
56 Mallig, N. (2010), A relational database for bibliometric analysis.
used for any other media by replacing the entity article by a general entity like *item*. The entity related to the document through publication will then depend on the studied entity (it would be *journal* if the studied entity is an *article*). Hence the units which can be studied by the use of bibliometrics are entities, relations and attributes as shown by *Figure 3*. 
Publication Activity of a Domain

*Figure 3: Revised version of Nicolai Mallig's Entity-Relation model of bibliometric units.*

Publications are an important part of scientific communication. The study of publication activity is therefore of importance for domain analysis. Publication activity by an entity (e.g. a person, an organization or a journal) within a domain can be analyzed by the study of publication frequencies. Changes over time can be studied through measuring publication activity at different periods of time. Publication activities can be described in definite numbers or by the use of relative counts, such as an organizations share of the publications expressed as a percentage in a defined domain at a given time. Attributes associated with the entities can also be studied such as language used in published articles.

Publication activity has been described by different mathematical laws. The first such law was suggested by Alfred. J. Lotka who described the distribution of scientific publications between authors as:

> [...] the number (of authors) making n contributions is about 1/n² of those making one; and the proportion of all contributors, that makes a single contribution, is about 60 per cent."

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This law is called \textit{Lotka’s law}, it is however far from perfect since it overlooks important factors. According to Glänzel the publication distribution is influenced by the subject matter, the author’s age and social status and the observation period, which is overlook by \textit{Lotka’s law}.

\textit{Bradford’s law} describes how articles within a particular subject field is distributed between journals. This law shows that a small number of journals within a subject field contains a relatively high number of articles in that field and that the remaining articles are published in a large number of journals.

Models have also been created to describe the growth of scientific publications. There are three main curves describing the growth (\textit{Figure 4}), the linear curve (a constant growth), the exponential curve (an increasing growth) and the logistic curve (an s-formed curve, starting with an increasing growth which declines and ends with a constant growth). As acknowledged by Kärki and Kortelainen these curves are applicable to other phenomenons within bibliometrics as well as in other fields. Also \textit{Bradford's law} and \textit{Lotka's law} can be applied or related to when describing other phenomenons, such as distribution of citations which is how these laws will be relevant in the thesis.

\textit{Figure 4: Linear, exponential and logistic curves.}

\begin{equation*}
Y = mx + b
\end{equation*}

\begin{equation*}
Y = e^x
\end{equation*}

\begin{equation*}
Y(x) = \frac{1}{1 + e^{-x}}
\end{equation*}

\textbf{Citation Analysis}

Information about a scientific domain can be determined by analyzing citations to scientific publications.\textsuperscript{4} Hence the relation reference is used to determine relations between items. Relations and attributes that are associated with items can therefore be analyzed through the use of citation analysis. Kärki and Kortelainen list four sectors of applications as examples of which knowledge can be determined by the use of citation analysis:

\textsuperscript{4} Glänzel, W. (2003), "Bibliometrics as a research field: A course on theory and application of bibliometric indicators", p. 45 f.
• the practice of citation in different fields,
• character of the literature used in the publications,
• the relations between publications, authors, scientific communities and/or scientific topic fields,
• attention given to the publications in the scientific literature.65

Citation analysis includes different techniques for the study of citations. Co-citation analysis is one technique used which couples references in publications (most commonly an article) into pairs.66 Hence documents that are frequently cited together are assumed to be related and networks can be drawn from the coupled pairs.67 Also connections between relations, entities or attributes which are associated with the co-cited documents can be established by this technique, e.g. to study connections between organizations or journals.

In conformity with publication activity, citation activity can be described with mathematical laws, indexes and indicators. It has already been mentioned that laws describing the growth of literature also can be used for describing the growth of citations but there are several other options for mathematical description of citation activity.

Derek de Solla Price has developed an index to describe the aging of works which has been used for comparison between different scientific fields. The Price Index counts the share of publications cited in e.g. a subject field or journal, which are not older than 5 years.68 Price has concluded that the typical “hard” sciences have a higher index than the typical “soft” sciences.69

Impact Factor is perhaps the most debated indicator derived from citation analysis.70 Since it is not within the scope of this thesis to evaluate journals, authors or organizations within the studied field this indicator will not be discussed here, yet it will be used for the selection of journals. This is discussed in the chapter Material Selection, p. 29.

Distributions between entities or associated attributes of the citations within a domain can also be subject to research. Different medias share of citations is one such indicator which has been studied and is of course important for information service practices since it is an indicator of which material is being used.71 Also the chronological distribution of citations (i.e. how the citations are spread over time) is important for such practices which has been acknowledged and studied for the

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66 Glänzel, W. (2003), "Bibliometrics as a research field: A course on theory and application of bibliometric indicators", p. 84.
71 Distribution between cited materials have for example been studied by Zhang, L. (2007), "Citation analysis for collection development: A study of international relations journal literature"; Yeoh, K. H. & Kaur, K. (2008), "Subject support in collection development: using the bibliometric tool".
purpose of collection development.\textsuperscript{72} The proportion of citations received by a journal within a certain period of time from the publication date has also been suggested as a factor to be used for collection development.\textsuperscript{73} How citations are distributed between journals, e.g. how many journals it takes to cover 80 percent of the total amount of citations, is another indicator that has been suggested for collection development.\textsuperscript{74} The distribution between cited countries, organizations and departments are also indicators studied within citation analysis as well as citations between different scientific disciplines.\textsuperscript{75}

Hence there are several attributions associated with the relation reference that can be analyzed to benefit information service practices, e.g. for collection development and information retrieval. The chronological distribution of references and the distribution between medias and journals can be acknowledged as such attributions.

Other Co-Occurrence Analysis
Basically any bibliographic field containing more than one unit of information can be subject to co-occurrence analysis. Co-citation is one type of co-occurrence analysis where the co-occurrence of citations in (usually) scientific publications is analyzed. Authors (their universities and departments), keywords, or words in titles or abstracts are other examples of entities and attributes that can be analyzed through co-occurrence analysis.\textsuperscript{76}

Since knowledge domains are regarded as discourse communities by the domain analytic approach, language can be seen as a key for domain analysis to understand these communities. According to Nicola De Bellis co-word analysis can be used “[... ] to detect constant associations of scientific concepts for delineating subject areas, growing subfields, or disciplinary patterns.”\textsuperscript{77} Glänzel acknowledges co-word analysis (as well as co-citation analysis and bibliographic coupling) as a tool “[... ] to describe the structure of science and it [sic] evolution at the macro and meso level”,\textsuperscript{78} i.e. on the level of institutions or journals (meso level) and regions, countries or supra-national aggregations (macro level).\textsuperscript{79}

Also collaboration patterns between authors, departments or organizations in the scientific field can be analyzed by the use of co-author analysis.\textsuperscript{80} Co-author analysis is however outside the scope of this thesis since a pragmatic view has been adopted, rather focusing on aspects of citations and topics which are directly useful for information service practices.

**Visualization**

The above mentioned units (e.g. authors, words, journals etc.) and their relationships (e.g. co-citations or other co-occurrences) can be visualized by the use of visualization techniques. Using such techniques facilitates the analysis of data in a variety of ways according to Katy Börner et. al. It makes it possible to get an overall picture and understand large and small sets of data. It can also be time saving and show relationships that can be hard to acknowledge in raw data.\textsuperscript{81}

Börner et. al. describe visualization as referring to "[...] the design of the visual appearance of data objects and their relationships."\textsuperscript{82} They acknowledge the connection between domain analysis and visualization and suggest visualization techniques as a methodology within domain analysis.\textsuperscript{83} Also Benjamín Vargas-Quesada and Félix de Moya-Anegón are exploring how visualization techniques can be used as tools for analysis of domains. By the use of visualization techniques they show connections between actors in social networks.\textsuperscript{84} Such a scientometric exploration uses publications and their references as representations of the communication taking place in a domain and uses visualizations to analyze the domain. Examples of similar studies are numerous. An early study by Howard D. White and Katherine W. McCain published in 1998 can be mentioned since it also refers to Hjørland and Albrechtsen and uses visualizations of co-authored scholars for the analysis of information science as a scientific domain.\textsuperscript{85} Also Shauna Eggers et. al. uses bibliometric methods and visualization techniques for domain analysis (though not mentioning Hjørland and Albrechtsen) using both content and authors as the units of analysis.\textsuperscript{86}

A model outlined by Börner et. al. distinguishes six steps of the general visualization process of meta data. These are:

\begin{itemize}
  \item \textsuperscript{83} Börner, K., Chen, C. & Boyack, K. W. (2005), "Visualizing knowledge domains".
  \item \textsuperscript{84} Vargas-Quesada, B. & Moya-Anegón, F. de (2007), *Visualizing the Structure of Science*.
  \item \textsuperscript{85} White, H. & McCain, K. (1998), "Visualizing a discipline".
  \item \textsuperscript{86} Eggers, S. et al. (2005), "Mapping Medical Informatics Research".
\end{itemize}
The data can be extracted from databases such as Web of Science or Scopus but can also be manually inputted. The units of analysis can be any of the hitherto discussed units (entities, relations and attributes). Selection of measures generally refers to frequency counts of occurrences as the means to limit the number of units for analysis. The relevant similarity measure for the thesis is co-occurrence frequencies though other measures are possible (such as correlation measures, e.g. Pearson's $r$). Ordination can be done by the use of different algorithms, such as dimensionality reduction algorithms, cluster analysis algorithms and scalar algorithms (e.g. force-directed placement), calculations hard to perform without the use of computers. Finally the results need to be displayed which Böner et. al. recognize as one problem associated with visualization techniques since the results need to be manipulated to be comprehensive, i.e. fitted into a limited space and reduced to 2 or 3 dimensional spaces.

Besides being a valuable tool for the analysis of a domain, visualization is also a powerful tool for the presentation of data. Since it makes it easier to get a grip of the overall picture it also makes it easier for readers to understand the results.

Critique of Bibliometrics

As with every other method there are several problems associated with bibliometric studies. One such problem is the coverage of the databases used for the analysis. Since Web of Science has been used for the extraction of data there will be a focus on Web of Science (the choice is discussed in the chapter Material Selection, p. 29). The three indexes searched by Web of Science, the Science Citation Index, the Social Sciences Citation Index and the Arts and Humanities Citation Index, have been criticized for being biased towards English language publications in general and towards American publications specifically. There is also a bias towards languages using roman characters which means that e.g. Russian publications published in Russian might be discriminated against (citations to such publications using roman characters are however not discriminated).

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80 This was done early by MacRoberts, M. H. & MacRoberts, B. R. (1989), "Problems of citation analysis: A critical review", p. 346; and more recently by Fingerman, S. (2006), "Web of Science and Scopus: Current Features and Capabilities".
A related problem is the quality of the bibliographic fields which are affected by how the references have been created by the authors. Examples of such errors are given by Glänzel who mentions “[...] misspellings, incomplete or wrong addresses and incorrect citations.” Errors in the bibliographic fields have different impact on the analysis depending on which units are to be studied. When analyzing cited authors only one piece of information (name of the author) is needed, while cited documents have to be identified by several (author, year, page and journal) making analyses of documents more dependable on the data being correct.

Citation practices and the incentives to cite is another topic of discussion. Hjørland mentions negative citations where authors cite to “[...] express their disagreement”.

Non-citedness and under-citedness is also discussed by Hjørland as well as by Michael H. MacRoberts and Barbara R. MacRoberts who also discuss informal influences which are not referred to.

Another problem regarding citations is the practice of self-citing. This issue has been discussed and different conclusions have been made of the influence of self-citations on such measures as Impact Factor.

MacRoberts and MacRoberts also point out that no distinction is made between different kinds of citations when using bibliometric methods.

A problem with bibliometric studies that is of particular interest for this study is how different subfields influence the results causing a bias towards larger subfields or subfields communicating through the selected type of documents, e.g. journals, to a higher degree.

In the field of political science comparative government scholars communicate relatively more through journal articles than do political theorists who rely more on monographs. Such differences must be carefully considered when analyzing the results, not the least since analyses based on monograph references and those based on article references have shown different impact measures within the field of political science.

Hjørland stresses that “[...] in order to interpret bibliometric analyses properly, one needs some knowledge of other kinds too”, mentioning historical studies as well as epistemological and criti-

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93 Hjørland, B. (2002), "Domain analysis in information science - Eleven approaches - traditional as well as innovative", p. 434.
97 Hjørland, B. (2002), "Domain analysis in information science - Eleven approaches - traditional as well as innovative", p. 434.
98 McLean, I. (2010), "Reputational and bibliometric methods of evaluating people and journals in political science: a UK perspective".
ical studies. Hence knowledge about the domain is important for the interpretation of the results.

The addressed criticism makes it clear that considerations of the methods used, the material selected and how the results are to be presented and analyzed are of great importance for the validity of the study. Thus the quantitative studies do not serve ready-made answers, but have to be objected to thorough analyses and such features as outliers and outstanding characteristics must be investigated and the plausibility of the results must be evaluated.

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1 0 0 Hjørland, B. (2002), "Domain analysis in information science - Eleven approaches - traditional as well as innovative", p. 436.
Part II: Bibliometric Study of the Academic Field of Political Science in Europe

The bibliometric analyses focus on three different features of the academic field of political science in Europe, which are considered as important for information service practices. To begin with topics within the domain were studied with the purpose to gain knowledge about the scope of the domain and how it has been changing over the last decade. The next feature studied was the citation patterns of the domain, focusing on present patterns and changes over time. Lastly core authors, journals and works were studied, with the purpose to map important actors and documents, focusing on present time, i.e. 2009.

The selection of material and the characteristics of the selected material is initially presented. Thereafter are the three features of the domain addressed, i.e. topics, citation patterns and lastly core authors, journals and documents. Methods used for the analysis of each of the three features are presented and discussed in the beginning of the relevant chapters, followed by the presentation and analysis of the results.

Material Selection

The 50 journals with the highest Impact Factor, categorized within the subject category “political science”, for each of the years 1999, 2004 and 2009 were selected from the Journal Citation Reports which is part of the Web of Science. Items in these 50 journals were retrieved for each of the selected years. The search results were refined to those published by authors affiliated to Universities with addresses in European countries. The search queries are presented in Appendix 1: Conducted Searches in Web of Science. The material selection is perhaps the most important choice of the study since it is the operational definition of the domain, and as such, far from unproblematic and will therefore be thoroughly discussed in this chapter.

The choice to analyze items published by the selected journals infer that these are set to represent the discipline of political science despite the fact that other publication forms are important in the scholarly communication of the discipline.

Footnote: “Items” will be used when referring to all types of publications retrieved from the selected journals. “Article” will be used when specifically referring to journal articles.
This can cause a bias towards those subfields using journals in a higher degree for their communication, at the expense of others using monographs and other publication forms to a larger extent. According to Iain McLean political theorists publish more frequently in monographs while comparative theorists more frequently publish in journals. Such differences must therefore be carefully considered when analyzing the results and will be further discussed in Part III.

Journal articles are indexed with their references in databases, such as Web of Science, which monographs are not. Analyzing articles makes it possible to study a large amount of material and draw conclusions about large research fields and how they have been changing. This could not have been done if monograph references were to be analyzed, which would have forced the study to be manually conducted. Even though monograph references are not indexed in Web of Science, citations to monographs are included in the database and therefore possible to analyze. This also applies to other publications not indexed in Web of Science.

Web of Science is one of the largest citation databases. The Social Sciences Citation Index (SSCI) presently contains over 1950 journals and included 112 journals categorized within political science in 2009, 79 in 2004 and 76 in 1999. Web of Science has been the leading citation database since it started in 1960 but has recently been challenged, primarily by Scopus. It is however still widely used within informetrics and the use of Web of Science makes the results comparable with other studies.

There were several alternatives for the inclusion of publications in the study. Keyword search was considered as well as the chosen method to make a selection of journals and include the containing items. The latter method offered a higher degree of control of the selection, which was the main reason for choosing that alternative.

The next question to be considered was which journals to include, the premises in which to include them and the number of journals to include. The Journal Citation Report makes it possible to select journals arranged by subject category. This is of course problematic since subjective choices are made when selecting the categories, yet it is likely that these choices are more carefully considered than categorizing the individual items. There are less journals than items and the subject category of a journal is more likely to be controlled by others, e.g. publishers, and the category can be changed if incorrect, since the journals are persistently updated in the database. Even though there is a risk that items in interdisc-
ciplinary journals might be excluded by the use of this selection method, the benefits of controlled selection were preferred.

Additionally problematic is that Web of Science includes journals categorized within two of the subfields of political science, i.e. international relations and public administration. Since only assigning one category per journal, journals which are categorized within either of these categories are not categorized within political science. Hence such journals were excluded when selecting the material. This choice was made since both of the mentioned subfields contain journals which dubiously could be categorized within political science and since these subfields would have had a major impact on the result, causing a bias towards these subfields. Such bias would have been problematic since these categories contain journals in the periphery of the studied domain. Though not included in the material, references to journals categorized within international relations or public administration are part of the analysis, just as references to any other work outside the research material.

The inclusion of all the journals for each year was perhaps possible (though time-consuming) but scarcely desirable since peripheral journals would have had equal impact on the result as core ones. The number of journals for inclusion therefore was a balance between the inclusion of a large part of the field and the concentration of the core of the field. A test study, conducted on the contents of 30 journals from 2007-2010, selected by their Impact Factor and categorized in political science, showed that a relatively few number of journals receive a large share of the citations. 50 journals received approximately 50 percent of the citations while it took over 3000 journals to cover all the citations. Though not being the same top 50 journals, since Impact Factor was used for the selection, 50 journals were considered to be an adequate balance between inclusion and concentration.

Since the ambition of the thesis is to analyze the core of the field Impact Factor was chosen for the selection of journals. On the web page of Journal Citation Report (JCR) Impact Factor is described as “[...] the average number of times articles from the journal published in the past two years have been cited in the JCR year”. Though being criticized for a number of reasons, e.g. the time period which the measure is based upon, biases in citation practices (which has been discussed in the chapter Critique of Bibliometrics p. 26), not considering the citing paper (i.e. giving all the citations the same value) and not taking into account the differences in regard to citation practices in different academic fields, the Impact Factor has had a major impact and is widely used within scientometrics. This is perhaps because the Impact Factor has several advantages, and other competing

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107 This conclusion is approximately in accordance with the result of the main study.
108 Of the 50 journals selected from 2009 29 were in the top 50 in the test study and 9 in the top hundred.
109 Thomson Reuters (n.d.), “Journal Citation Reports” > help > contents > journal impact factor.
measures have also been associated with problems.\textsuperscript{111} Glänzel points out that “[t]he strengths of the Impact Factor lies above all in its independence of the “size” of the journal, its comprehensibility, stability and seeming reproducibility.”\textsuperscript{112} Furthermore, the Impact Factor has been compared to a ranking given by American scholars with the result of a high correlation (Pearson r = 0.656). The journal ranking applied by American scholars has also been concluded to have high correlation with those given by UK scholars.\textsuperscript{113}

These strengths make the Impact Factor suitable since the thesis is dealing with three different periods of time and comparison between these periods. Using Impact Factor to select the top 50 journals means that different journals were selected for 1999, 2004 and 2009 which causes both advantages and disadvantages. It prevents a direct comparison of the citation patterns in the included journals. On the other hand, the inclusion of journals that were influential in for example 1999 but not in 2009 reflects changes within the domain and makes analysis of such changes possible. Since the changes are of great interest to fulfill the purpose of the thesis, this advantage was crucial when choosing the method for journal selection.

The Material
The search resulted in 1077 retrieved items for 2009, 964 items for 2004 and 1265 for 1999. The number of items retrieved from each journal varies greatly since some journals do solely include European authors while others do not include any European authors. These differences do of course implicate that some journals do influence the results more than others, which is a natural consequence since journals containing more items written by European authors constitute a larger part of the field than journals containing just a few of these items. Journals included which do not contain any or just a few items written by European authors are mainly American journals with American perspectives. Table 3 displays the selected journals and the number of retrieved items.

Articles and Book reviews are the main document types in the material and compose more than 85 percent of the publications in all of the three time periods. Proceedings papers, editorial material and reviews are also fairly common. The distribution of document types is important since they have different character, book reviews do for example contain a low frequency of references. Hence the distribution must be considered when analyzing the results.

\textsuperscript{111} see Glänzel, W. (2003), "Bibliometrics as a research field: A course on theory and application of bibliometric indicators", p. 63 ff.
\textsuperscript{112} Glänzel, W. (2003), "Bibliometrics as a research field: A course on theory and application of bibliometric indicators", p. 63.
\textsuperscript{113} McLean, I. (2010), "Reputational and bibliometric methods of evaluating people and journals in political science: a UK perspective".
A growing impact of the English language, at least from 1999 to 2004, appears when analyzing the retrieved items (see Table 2). The difference between 2004 and 2009 where German seems to have had a growing impact is accounted for by only one journal, *Politische Vierteljahresschrift*, which was omitted in 2004 since it was not among the top 50 journals (ending up as the 61st journal ranked by Impact Factor). The differences between 1999 and 2004 are mainly accounted for by 3 journals, the already mentioned German journal *Politische Vierteljahresschrift*, *Osteuropa*, which is another German journal mainly including items in German but also in Russian, and the Czech journal *Politicka Ekonomie*, also including a small number of items in Slovak. Of these journals *Politische Vierteljahresschrift* is the only one with an Impact Factor among the top 50 in 2009.

**Table 2: Languages of the retrieved items in 1999, 2004 and 2009. Frequency and relative frequency.**

<table>
<thead>
<tr>
<th>Language</th>
<th>1999</th>
<th>2004</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>836</td>
<td>962</td>
<td>976</td>
</tr>
<tr>
<td>German</td>
<td>321</td>
<td>101</td>
<td>0</td>
</tr>
<tr>
<td>Czech</td>
<td>84</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Russian</td>
<td>20</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Slovak</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>French</td>
<td>1</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>1265</td>
<td>964</td>
<td>1077</td>
</tr>
</tbody>
</table>

114 The *Canadian journal of political science-revue canadienne de science politique* have one item in French included.
### Table 3: List of included journals and number of items in 1999, 2004 and 2009.

<table>
<thead>
<tr>
<th>2009</th>
<th>Total</th>
<th>2004</th>
<th>Total</th>
<th>1999</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>JCMS-journal of common market studies</td>
<td>123</td>
<td>Journal of common market studies</td>
<td>137</td>
<td>Osteuropa</td>
<td>189</td>
</tr>
<tr>
<td>Politische vierteljahresschrift</td>
<td>103</td>
<td>Environmental politics</td>
<td>92</td>
<td>Politische vierteljahresschrift</td>
<td>154</td>
</tr>
<tr>
<td>West european politics</td>
<td>83</td>
<td>West European politics</td>
<td>83</td>
<td>Europe-asia studies</td>
<td>136</td>
</tr>
<tr>
<td>Environmental politics</td>
<td>76</td>
<td>Europe-asia studies</td>
<td>66</td>
<td>Parliamentary affairs</td>
<td>98</td>
</tr>
<tr>
<td>European journal of political research</td>
<td>58</td>
<td>Political quarterly</td>
<td>57</td>
<td>Politika ekonomie</td>
<td>88</td>
</tr>
<tr>
<td>African affairs</td>
<td>42</td>
<td>Local government studies</td>
<td>49</td>
<td>Political geography</td>
<td>83</td>
</tr>
<tr>
<td>Party politics</td>
<td>40</td>
<td>Public choice</td>
<td>43</td>
<td>Local government studies</td>
<td>47</td>
</tr>
<tr>
<td>Political geography</td>
<td>38</td>
<td>Scottish journal of political economy</td>
<td>36</td>
<td>European journal of political research</td>
<td>46</td>
</tr>
<tr>
<td>Political studies</td>
<td>36</td>
<td>Party politics</td>
<td>35</td>
<td>Scottish journal of political economy</td>
<td>33</td>
</tr>
<tr>
<td>Acta politica</td>
<td>35</td>
<td>European journal of political research</td>
<td>32</td>
<td>American political science review</td>
<td>30</td>
</tr>
<tr>
<td>Annals of the american academy of political and social science</td>
<td>32</td>
<td>Journal of peace research</td>
<td>32</td>
<td>Party politics</td>
<td>30</td>
</tr>
<tr>
<td>Terrorism and political violence</td>
<td>32</td>
<td>Political geography</td>
<td>30</td>
<td>Policy and politics</td>
<td>29</td>
</tr>
<tr>
<td>Electoral studies</td>
<td>27</td>
<td>Policy and politics</td>
<td>23</td>
<td>Government and opposition</td>
<td>27</td>
</tr>
<tr>
<td>Geopolitics</td>
<td>27</td>
<td>Electoral studies</td>
<td>21</td>
<td>Electoral studies</td>
<td>24</td>
</tr>
<tr>
<td>Governance-an international journal of policy administration and institutions</td>
<td>23</td>
<td>Review of international political economy</td>
<td>21</td>
<td>Public choice</td>
<td>22</td>
</tr>
<tr>
<td>Review of international political economy</td>
<td>21</td>
<td>Scandinavian political studies</td>
<td>19</td>
<td>Nation</td>
<td>19</td>
</tr>
<tr>
<td>Journal of peace research</td>
<td>20</td>
<td>Survival</td>
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Topic Analysis

Topics were analyzed using both co-occurrences of words, i.e. co-word analysis and by visualizations of these analyses. The extraction of data from Web of Science has already been discussed, the next question is the choice of units for the analysis.

Different units were possible to analyze to gain knowledge about current and present topics within the domain. Two alternatives were considered, either to analyze attributes related to the entity article in the ER-diagram (Figure 3, p. 21), i.e. key words, abstract and/or title, or to analyze attributes related to the relation reference, where title was the choice mainly considered. Titles of cited publications would have been necessary to input manually and article was considered to be a more direct way to analyze topics why article was chosen for the analysis. Article is further preferable since book reviews are included as subject to analysis (why this entity rather should be named item in this case), which would not have been the case if analyzing reference since book reviews contain a limited amount of references. Reference was however used for the analysis of referred authors, journals and works which also reveals information about the topics. The analysis of both these two units have something to say about the topics within the domain. This chapter is therefore complemented by the chapter addressing core authors, journals and works.

Title was further chosen as the unit of analysis for multiple reasons. To begin with both the description field (DE) and the identification field (ID) turned out to be missing in a substantial part of the items making them unsuitable units to analyze. Abstract and title were then considered and test runs were made on both units. Analyzing the abstract turned out to be more problematic than title since abstracts contain a higher degree of function words, hence a lower degree of content words. A review of the title fields showed that titles within the field in general contain content words possible to analyze, i.e. not using metaphorical language and the like and if doing so also containing subtitles to express the topic. A low degree of function words and a high degree of meaningful content words motivated title as the unit for analysis of topics.

Processing Data Using Bibexcel and Gephi

The extraction of data and the selection of units for analysis has already been discussed. For the remaining steps of the visualization process Bibexcel and Gephi

\footnote{The DE-field is the keyword field usually used by the author while the ID-field is the automatically assigned subject by Web of Science known as KeywordPlus.}
were used. Bibexcel is a software designed to analyze bibliometric data by extracting and manipulating the fields and units of data. Gephi is a software for generation of maps from data, i.e. visualization of data. Gephi also makes it possible to manipulate and design maps for comprehensibility and presentation of data.

For the co-occurrence analysis frequencies of words in titles were calculated using Bibexcel. Bibexcel automatically removes function words using a list of stop words. Some words turned out to be frequent due to two series, “Political data yearbook” in 2009 and “Special issue: Political data report” present in 1999, which were removed from the material. All top 50 words or equally frequent as the word placed 50th were included in the analysis. The next step was to pair the words occurring in the same title and to calculate the frequencies of pairs, this was also done in Bibexcel. The last step in Bibexcel before importing the material to Gephi was to create a net-file, which was created from the file containing frequencies of pairs. The net-file contains information about the co-occurrence network, i.e. information about nodes and their relations.

Gephi uses the net-file for construction of co-occurrence maps. The force atlas algorithm was used for creating the maps and the betweenness centrality measure for modification of node sizes. Betweenness centrality is a measure based on the shortest path between nodes in a network. Nodes that occur many times as the shortest path between other nodes will get a high betweenness centrality. Finally the appearance of the maps was adjusted, e.g. font sizes and node colors. Shadowed areas were manually drawn after analyzing the results. The categories are not always obvious neither self written but were drawn to facilitate the interpretation and will be further discussed.

Results of the Topic Analysis
The list of co-occurring pairs revealed central concepts of the domain and differences between the analyzed time periods (see Table 4). Simple frequency lists of words were not as effective and the results of the visualization of co-word analyses were somewhat diffuse, since distinctly separated clusters were not formed, neither were words similar in content or meaning grouped together in a distinguishable manner. This is seen by looking at the extensions of the shadowed areas in Figure 5. Therefore only the co-citation map of 2009 is presented and the analyzes were conducted mainly by comparing co-occurring words between the years, see Table 4.

The most obvious result of the co-word analyses is a regional focus represented by words like “Europe”, “European” and “EU” which is seen in all three years.

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116 Bibexcel, version 2010-09-01, [2010-05-06]; Gephi, version 0.7 Beta, [2010-05-06].
117 This process is explained in Persson, O. & Danell, R. (2009), “How to use Bibexcel for various types of bibliometric analysis”.

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Since political science is the studied discipline it is not surprising that “politics”, “policy” and “political” are frequently combined with other words in the analyzed item titles. Politics in Europe is the most salient feature seen in the co-word analysis which confirms that there are specific European research areas within political science. Some of the European research areas are indicated by the word pairs “European integration”, “EU policy”, “European market”, “European governance”, “European identity”, “European parties” and “European security”.

Significant differences between the years can be distinguished. “Eastern Europe” is the most common co-occurring pair of words in 1999. Eastern Europe is as well represented by the word pairs “Soviet Union”, “Eastern European”, “central eastern”, “east European”, “Eastern history”, “Russia politics”, “Russia state” and “Soviet war”, which makes it reasonable to presume that eastern Europe was an important research topic in 1999. In 2009 no representation of Eastern

Figure 5: Visualization of co-occurrence analysis of words in titles. 50 most frequently used words in 2009.
Europe can be seen at all which is likely to be because journals concerning this geographic area have dropped in the list of Impact Factor. This circumstance suggests that the Eastern European focus within the domain has declined.

In 2004 and 2009 there are research areas visible which do not occur as frequently in 1999. Concepts related to the study of democratic parties and the democratic system is one such research area represented by “political parties”, “public policy”, “party politics”, “party system”, “parliamentary elections” and “European parties”. These areas are common topics within the subfield of comparative politics. A connection can possibly be made between the comparative approach and these areas since the word pairs “comparative perspective”, “comparative study” and “comparative analysis” do as well occur in 2004 and 2009 but not in 1999.

Another clearly distinguishable feature is the rise of the climate issue which does not occur in 1999 but becomes visible in 2004 and 2009, represented by “environmental policy” in both years and furthermore by “environmental governance” and “environmental Europe” in 2004 and “climate change” as well as “climate policy” in 2009. Yet one visible global issue, which is absent in 1999 and 2004 but evident in 2009, is the global financial crisis. It is represented by “global crisis” in Table 4 but further down the list (with less than 5 co-occurrences) “crisis” co-occur with “economic”, “economy” and “world” as well.

To sum up the co-word analysis, no clearly distinguishable groups of words were formed on the visualization map. Co-occurring pairs revealed topics within the discipline more effectively than the visualizations and central concepts within the field could be seen in these lists. A focus on Europe and the European Union for the whole period was clearly visible. The most apparent difference was the strong representation of Eastern Europe in 1999 which is totally absent in 2009. It seems like studies of the democratic systems, e.g. of parties and elections, have become more common. The rise of the climate issue as well as the financial crises as research topics could also be seen in the study.
Table 4: Words co-occurring in item titles 5 times or more in 1999, 2004 and 2009.

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Citation Pattern Analysis

Naturally reference was used for the analysis of citation patterns which was done in several ways. Simple frequency counts and calculations of mean values of references in articles were conducted for each of the analyzed years. This calculation was conducted on articles solely, since book reviews, which was the other of the two distinctively large categories of document types, do not normally contain references. Furthermore the inclusion of more than one document type would have made the result confusing, creating lurking variables.

The second analyzed feature of the citation patterns was the cited material and the proportion of citations between material types. Bibexcel can identify material type by analyzing the elements of the reference field (CR), however only journals and non-journals can be identified.119 Even if this delimits the alternatives for automatically comparing cited material, Bibexcel offers the important feature to see the share of citations made to journals.

Bibexcel can also identify the publication year in the cited reference and thereby makes it possible to analyze features of this attribute, e.g. the Price index. This can be made on all document types, but since only journals and non-journals are recognized this is the only possible distinction.

Cited journal is another attribute possible for Bibexcel to distinguish in the reference field. This attribute was analyzed in two different senses answering questions about both the citation practices and the core journals. Features about the citation patterns to journals were analyzed by comparing total number of cited journals between the years and the proportion of citations received by the most frequently cited journals. The analysis of core journals is an issue for the next chapter, addressing the questions about which units are the most frequently cited.

Citation Patterns – Material and Age

The frequency count of references showed that the number of references per article has grown significantly from 1999 to 2009. Approximately following a linear curve the amount of references has grown with about 50 percent from averaging about 29 references in 1999 to averaging 45 references in 2009 (Figure 6). This result is in accordance with other studies within the social sciences as well as in other disciplines.120

119 The name of the CR field is converted to CD in Bibexcel.
This relatively dramatic growth of references could be explained by the fact that it has become easier to retrieve information along with the growth of coverage of databases. Reference handling software (such as Endnote or Zotero) could also be an explanation of the growth. Other explanations could be the constant increase of publications as well as changes regarding citation practices in the scientific community.

Along with a quantitative growth of references there is also a significant proportional growth of journal articles' share of citations (Figure 7), from receiving about 30 percent of the citations in 1999 to a share of about 43 percent in 2009. The curve is steeper between 2004 and 2009 indicating that this change has increased in pace. Hence journals have become more important for the communication within the analyzed domain, possibly because of improved access due to the technological development which not yet has had the same effect on the accessib-
ility of monographs. Another explanation could be that subfields communicating to a higher degree through journals have achieved a more prominent position.

*Figure 8* shows how citations are distributed by the age of the cited publications in journals and non-journals. Both graphs show an increase of references to older material, though more apparent for citations to non-journals. The peak of the non-journal graph has in fact shifted from 1 year old publications in 1999, to three years old publications in 2009. This development might be a result of enhanced access to older publications, and/or meta data about older publications, supported by the digitalization of publications which have made it easier to find and retrieve information.

The age of publications receiving a given share of the total amount of citations, has also been increasing (see *Figure 9*). In 1999 publications from the recent five years covered just above 50 percent of the citations. In 2009 publications from 7 years covered about the same amount of citations. The *Price index*, i.e. the share of citations not older than five years, thus has decreased.\(^{121}\) In 1999 the *Price Index* was about 54 percent and in 2009 the index was approximately 40 percent, which must be considered a significant decrease.

It can be interpreted that the improved access to information has in fact caused changes in the information behavior of the domain. A physical collection is delimited in space which is less of a problem in a digital collection. Age of publications is one aspect considered in the weeding process in the physical collection, giving newer material more space in the collection than older material. Some collections are usually arranged chronologically, e.g. journals, also making it easier to obtain recent publications than precedent publications. Hence the possibilities to find and retrieve information differ between the digital environment and the physical envir-

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\(^{121}\) Glänzel, W. (2003), "Bibliometrics as a research field: A course on theory and application of bibliometric indicators", p. 60.
onment, causing different information seeking patterns. These differences are likely to cause enhanced access to older publications.

*Figure 9: Age of cited publications as cumulative percentages in 1999, 2004 and 2009. Citations to publications older than 25 years excluded.*

Despite these changes publications older than 25 years do not receive more than 8-9 percent of the citations for either of the studied years. This is perhaps because there has not been any major change in accessibility to publications this old. It could however be because this literature is regarded to old to be cited.

**Distribution of Citations Between Journals**
In all three years a relativity few number of journals received a large share of the citations. A histogram of journal citations in 2009 (*Figure 10*) shows a left skewed distribution with a short tail to the right. Hence a majority of the journals have only been cited once or just a few times. Only a small share of the journals received a relatively high number of citations. Histograms for 1999 and 2004 would
look approximately the same and are therefore not presented. In 2009 1457 journals were cited only once, notwithstanding the high number of journals they only received about 10 percent of the total amount of citations.

*Figure 11: Cumulative graph of citations to journals, 1999, 2004 and 2009.*

A cumulative graph of journal citations reveals a similar pattern as the graph of citation age. The graph is steeper to the left and flattens out, having a long tail (Figure 11). Noticeable in the figure is the shifting lengths of the graphs indicating differences between the years of the total number of journals receiving citations. 1629 journals were cited in 1999 by the retrieved items and in 2009 the number had grown to 2472 journals. This reflects the growing number of journals in the academic field as well as the growing number of references. The distribution of citations between journals can be related to *Bradford’s law* since it follows the same pattern, relatively few journals receive a large proportion of citations while the rest of the citations are spread over a large number of journals.
When limiting the graph to journals covering 80 percent of the total amount of citations another difference becomes clear (see Figure 12), fewer journals receive a larger share of the citations in 2009 than in previous years. Thus a perhaps contradictory development can be seen in the results, an increasing number of journals receive citations while a small number of journals become more important. It took 119 journals to cover more than 50 percent of the citations in 1999, a number which had declined to 75 in 2009. To cover 80 percent of the citations 595 journals had to be included in 1999 and 468 in 2009. Even though decreasing this can still be regarded as a rather high number of journals if thinking of the context of an information service institution with the task to fulfill information needs of a domain.

A movement towards more cited publications is relatively easy to explain since the academic field constantly grows and new publication forms have emerged, making it easier to publish new journals. It is however more difficult to understand why the most cited journals have become even more influential since the former development ought to counteract the latter. Perhaps this tendency can be explained if looking at broader international tendencies, where globalization causes centralization and the information technology and new developing information structures which have been a condition for globalization, at the same time engendering decentralization. This development is a sign of an increasing Matthew effect, i.e. already known authors are recognized, read and cited to a higher degree than unknown author, an effect that probably could be applied to journals as well as authors. Robert K. Merton argues that this effect is likely to increase “in

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frequency and intensity with the exponential increase [...] in the volume of scientific publications, which makes it increasingly difficult for scientists to keep up with work in their field.”\textsuperscript{124}

Also the evaluation systems of productivity, such as the Norwegian register of journals and publishers (known as the \textit{Norwegian list}), where publications are assigned points depending on the publisher could cause known authors to publish in highly ranked journals. This could in turn generate even more citations to the top ranked journals and even higher ranking of these journals. Hence the Matthew effect seems to be a satisfying explanation of these trends.

\textbf{Analysis of Core Journals, Authors and Works}

Also core works, authors and journals were analyzed using the reference field. Both journals and authors are recognized by Bibexcel by their location in the field. This means that references must be constructed with the units in the appropriate order to be recognized, which is not always the case and has been discussed as one of the problems associated with citation analysis. Works are represented by the whole field, e.g. author, publication year and title for monographs, and for articles by author, publication year, volume, page number and journal title.

Not surprisingly, handling tens of thousands of references, erroneous data were detected in the material. How inaccuracy of the material is affecting the results is hard to determine, yet the large amount of references is likely to have an equalizing effect. Since identified by all units in the reference field, works are more likely to be affected by incorrect references such as misspellings or synonymous spellings, assignments of wrong authors or incorrect publication years, page numbers or volumes.

For each of the attributes, works, authors and journals, citation frequencies were used for the selection of units for the analyses, as done in the co-word analysis. Three cases of synonymy were detected among the units chosen for co-citation analysis, one in the analysis of works and two in the analysis of journals.

There are different methods to assign authorship to publications if co-authored by two or several authors. Either the publication can be considered to have the value 1 and then be split into equivalent parts so that each author is assigned equivalent fractions of the publication, called \textit{fractional counting scheme}. Another method is to assign the whole publication to the first mentioned author called the \textit{first author count}. A third option is the \textit{full or integer counting} which assigns all authors the full value of 1 for the publication.\textsuperscript{125} However, the reference field in the material extracted from Web of Science only contain the first author, delimiting

\textsuperscript{124} Merton, R. K. (1968), ”The Matthew Effect in Science”, p. 4.
\textsuperscript{125} Glänzel, W. (2003), ”Bibliometrics as a research field: A course on theory and application of bibliometric indicators”, p. 36.
the analysis to be conducted on the first author.\textsuperscript{126} It has been concluded that differences between analyzing all authors and analyzing first author gives similar results if the collaboration level within the field is “sufficiently low”.\textsuperscript{127} About one fourth of the publications in the material was co-authored in 1999 a number which had grown to one third in 2009. Though an increase in co-authored articles can be seen, the amount is still relatively low, which makes a first author count implementable.

Misplacement of units in the reference field caused publication years to be represented as authors in the co-citation analysis of authors. These units have therefore been removed from the co-citation map. A look through references with publication year placed in the author location reveals that such references typically refer to daily papers and the like and hence generally should not be regarded as erroneous.

The co-citation analysis was conducted the same way as the co-word analysis (see \textit{Processing Data Using Bibexcel and Gephi} p. 35). Bibexcel was used for the making of co-occurring pairs in the reference field as well as the frequency count of pairs and the creation of net-files. Gephi was used for the creation and manipulation of maps for analysis and presentation. The same measures were used as in the creation of co-word maps, i.e. force atlas algorithm for creation of maps and betweenness centrality for manipulation of node sizes. Shaded areas in the co-citation maps were drawn manually after analyzing the maps. Information about authors was primarily gathered from official web pages, presentations on university web pages or publications, and secondarily from Wikipedia and other sources.

\textbf{Journals}

Core journals were analyzed both by co-citation analysis and by comparison of the 10 most cited journals in each year. It has already been concluded that citations are widely spread among journals. The top journals therefore receive a relatively low share of citations, making them less important than would have been the case if citations were more concentrated. Only two journals received more than two percent of the citations in 1999 and 2004. Three journals reached above that level in 2009. Still the top 10 journals receive about 21 percent of the total citations in 2009 making a closer look worthwhile, not the least since the results of the analysis of citation patterns have shown that the top journals are increasingly cited. This is seen in Table 5 showing the most cited journals in each year.

\textit{American political science review} tops the list in all of the years and shows a significant growth of the proportion of citations received between 2004 and 2009. The journal publishes articles in all subfields within political science which might

\begin{flushleft}
\textsuperscript{126} Zhao, D. (2006), "Going beyond counting first authors in author co-citation analysis".  
\textsuperscript{127} Zhao, D. \& Strotmann, A. (2008), "All-author vs. first-author co-citation analysis of the Information Science field using Scopus"; see also Zhao, D. \& Strotmann, A. (2011), "Counting first, last, or all authors in citation analysis: A comprehensive comparison in the highly collaborative Stem Cell research field".
\end{flushleft}
engender more citations than journals dealing with a particular subfield. This also applies for the second most cited journal in 2009, *American journal of political science*, and *Journal of Politics* ending up 7th. The rest of the journals on the top 10 list in 2009 is more or less specialized towards one or several subfields.

Table 5: 10 most cited journals in 1999, 2004 and 2009.

<table>
<thead>
<tr>
<th></th>
<th>1999 Cites</th>
<th>2004 Cites</th>
<th>2009 Cites</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>American political science review</em></td>
<td>3.51%</td>
<td>3.42%</td>
<td>4.51%</td>
</tr>
<tr>
<td><em>American economic review</em></td>
<td>2.26%</td>
<td>2.07%</td>
<td>3.40%</td>
</tr>
<tr>
<td><em>Public choice</em></td>
<td>1.63%</td>
<td>1.81%</td>
<td>2.55%</td>
</tr>
<tr>
<td><em>International organization</em></td>
<td>1.30%</td>
<td>1.70%</td>
<td>1.90%</td>
</tr>
<tr>
<td><em>American journal of political science</em></td>
<td>1.24%</td>
<td>1.64%</td>
<td>1.70%</td>
</tr>
<tr>
<td><em>Econometrica</em></td>
<td>1.11%</td>
<td>1.59%</td>
<td>1.60%</td>
</tr>
<tr>
<td><em>European journal of political research</em></td>
<td>1.04%</td>
<td>1.56%</td>
<td>1.57%</td>
</tr>
<tr>
<td><em>British journal of political science</em></td>
<td>1.02%</td>
<td>1.50%</td>
<td>1.36%</td>
</tr>
<tr>
<td><em>British medical journal</em></td>
<td>0.89%</td>
<td>1.50%</td>
<td>1.34%</td>
</tr>
<tr>
<td><em>World politics</em></td>
<td>0.88%</td>
<td>1.14%</td>
<td>1.29%</td>
</tr>
</tbody>
</table>

That American journals occupy the top of the list could be a sign of the field of political science in Europe being a part of an international field, where American journals have a great impact. It can also be acknowledged that no other country outside Europe is represented with a journal, neither in *Table 5* nor in the co-citation map of journals (*Figure 14*).

International relations is dominating the list of top 10 journals in 2009 with the journals *International Organization*, *Journal of Conflict Resolution*, *Journal of Peace Research* and *European Union Politics*, all addressing this subfield. Comparative politics is also a subfield which is seen on this list, *Comparative political studies*, *European Journal of Political Research*, *European Union Politics* and *Journal of European Public Policy*, all within the subfield of comparative politics, though several of these journals deal with other topics as well. Public administration is mostly covered by a couple of the already mentioned journals, journals that deal with the European region specifically, i.e. *European Union Politics* and *Journal of European Public Policy*. Political theory is the least visible of the subfields with no specific journal on the list, yet represented in the general journals and in some of the other journals, e.g. *Journal of European Public Policy* and *European Journal of Political Research*. 
Figure 13 shows the same journals as Table 5 but displays changes in citation rates more clearly. Since some journals have dropped outside the top ten list and others have taken their place there are 18 journals in total occurring in the top ten lists for the three years. Noteworthy are the three journals not primarily addressing political science (Econometrica, American Economic Review and British Medical Journal) on the top 10 list in 1999, with a decreasing share of citations from 1999 to 2009. Another trend is the increase of citations to specifically European journals, i.e. European Journal of Political Research, European Union Politics and Journal of European Public Policy. There might as well be a trend towards more
citations to journals within international relations addressing conflict and peace issues, manifested by the increase of citations to *International Organization*, *Journal of Conflict Resolution* and *Journal of Peace Research*.

Also the co-citation map of the 30 most cited journals in 2009 (Figure 14) reveals some of the subfields within political science. International relations is distinctly represented on the top of the map by the already mentioned journals and furthermore by *World Politics*, *Political Geography* and *International Studies Quarterly*. *Environmental Politics*, dealing with environmental politics on the local, national and international levels, is also placed close to these journals and can be included in that cluster. Another journal closely linked to the international relation journals is the general economic journal *American Economic Review*.

*Figure 14: Visualization of co-citation analysis of journals. 30 most cited journals in 2009.*

On the right side of the map two general sociological journals are positioned. To the left of these, a cluster of general political science journals take up a central part of the map. *Political Analysis* addressing theoretical and methodological approaches to political science can be found between these two groups.

A small cluster with journals publishing articles within voting behavior, electoral systems and party politics is seen on the bottom left of the map, represented by *Party Politics*, *Public Opinion Quarterly* and *Electoral Studies*. *British Journal of Political Science* is placed between these three journals and the journals spe-
cifically addressing European issues, however described as a general political science journal by the publisher.\textsuperscript{126} 

A group of journals addressing European issues is located to the left. There seems to be seven journals but a closer look reveals that the problem of synonymy has caused two journals to be represented twice. The Journal of Common Market Studies is abbreviated both as “J Common Mark Stud” and “JCMS – J Common Mark S” in the Web of Science abbreviation list. The abbreviation “European J Political” can not be found in the list of abbreviations. References using this abbreviation can however be found in European Journal of Political Research proving the case of synonymy. European Journal of Political Research is the biggest node of the map, making it the most central of the journals, using the betweenness centrality measure.

Public Choice, Comparative Political Studies and Politische Vierteljahresschrift could not be categorized with other journals on the map. Public Choice specifically address the public choice theory, i.e. a specific theoretical approach. The same counts for Comparative Political Studies concerning comparative politics, which, even though big enough to constitute a subfield of its own, also can be described as a theoretical approach with a set of methodologies.

In summary the subfields of international relations and European studies are easily located on the co-citation map, while public administration and political theory can not be clearly distinguished, which suggests a stronger position for the former subfields. A group of journals dealing with the democratic system and its citizens as well as a group of general political science journals can also be distinguished. Hence the results indicate a focus within the domain on global and regional development as well as features of the democratic systems.

Authors
At a first glance the co-citation map of the most frequently cited authors in 2009 (Figure 15) shows two salient features, a compact cluster in the upper right corner and about five larger nodes. The larger nodes connect other nodes in different parts of the map and make up centers of these parts. The cluster in the upper left corner constitutes authors who have made contributions within the field of international relations, more specifically within conflict and peace research, i.e Gleditsch, Gurr, Huntington, Collier, Hegre and Fearon. Fearon is the most cited of these authors and the second most cited of all authors and makes up a center of this cluster, yet co-cited with authors on other parts of the map.

Political economy seems to be a common denominator in the upper part of the map. In the top right a few institutions are gathered, i.e. the World Bank, OECD and the European Commission. Due to synonymy the European Commission is represented twice. Pierson, Olson and Hall are placed close to these institutions.

\textsuperscript{126} Cambridge Journals Online, "British Journal of Political Science".
These three authors have made contributions within political economy. The European Commission also co-occur frequently with the group of authors below. This group, Majone, Scharpf, Marks, Hooghe and Moravcsik, have a focus on European integration and/or on European policy making in common. To the left of this group we find Alesina who has been addressing both economic issues and European integration issues and also has connections to these two groups of authors.

Figure 15: Visualization of co-citation analysis of authors. Authors with 22 citations or more in 2009.

Alesina has also studied differences in the economic system and the welfare state in the US and Europe. He has the comparative approach in common with a number of authors placed below on the co-citation map of authors, e.g. Przeworski, Putnam, Ingelhart and Lijphart. King and Beck have both made contributions
within quantitative methodology which could be the connection placing them next to this group of scholars with comparative approaches.

On the left of the map Weber, Giddens and Habermas are found, all with spread linkages and without strong connections to any particular group of authors. Likely this is because they are all general social science scholars with a broad repertoire of publications within multiple fields and subfields within the social sciences.

To the right of Giddens and Habermas we find a group of authors addressing sociological aspects of politics such as gender issues, social capital, ethnological aspects and cultural change, represented by Putnam, Inglehart, Lipset, Norris, Verba, Dalton and Kriesi. Also Downs, who has focused on the freedom of speech and academic freedom, has strong connections to this group, as well as Lijphart who has been addressing ethnic aspects of politics.

Lijphart is the most cited author which is seen in Table 6, also displaying the most cited works. He has published works on election and voting systems with a comparative approach, which links him to several authors in the bottom right corner. Most authors in this group have a specific focus on the European context. Elections, democratic systems, party politics and organizations are topics for the research conducted by these scholars.

Table 6: 20 most cited authors and works in 2009.

<table>
<thead>
<tr>
<th>Authors</th>
<th>citations</th>
<th>Works</th>
<th>citations</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIJP]HART A</td>
<td>59</td>
<td>DOWNS A, 1957, EC THEORY DEMOCRACY</td>
<td>33</td>
</tr>
<tr>
<td>FEARON JD</td>
<td>54</td>
<td>LIJP]HART A, 1999, PATTERNS DEMOCRACY G</td>
<td>27</td>
</tr>
<tr>
<td>NORRIS P</td>
<td>51</td>
<td>COLLIER P, 2004, V56, P563, OXFORD ECON PAP</td>
<td>26</td>
</tr>
<tr>
<td>WORLD BANK</td>
<td>48</td>
<td>BUDGE I, 2001, MAPPING POLICY PREFERE</td>
<td>23</td>
</tr>
<tr>
<td>PUTNAM RD</td>
<td>44</td>
<td>GLEDITSCH NP, 2002, V39, P615, J PEACE RES</td>
<td>22</td>
</tr>
<tr>
<td>COLLIER P</td>
<td>43</td>
<td>FEARON JD, 2003, V97, P75, AM POLIT SCI REV</td>
<td>22</td>
</tr>
<tr>
<td>DOWNS A</td>
<td>41</td>
<td>TSEBELIS G, 2002, VETO PLAYERS POLITIC</td>
<td>19</td>
</tr>
<tr>
<td>ALESINA A</td>
<td>40</td>
<td>BEN]IT K, 2006, PARTY POLICY MODERN</td>
<td>18</td>
</tr>
<tr>
<td>KING G</td>
<td>40</td>
<td>PUTNAM RD, 2000, BOWLING ALONE COLLAP</td>
<td>17</td>
</tr>
<tr>
<td>BUDGE I</td>
<td>39</td>
<td>HEGRE H, 2006, V50, P508, J CONFLICT RESOLUT</td>
<td>16</td>
</tr>
<tr>
<td>STROM K</td>
<td>37</td>
<td>BRAMBOR T, 2006, V14, P63, POLIT ANAL</td>
<td>15</td>
</tr>
<tr>
<td>HOOGHE L</td>
<td>37</td>
<td>OLSON M, 1965, LOGIC COLLECTIVE ACT</td>
<td>15</td>
</tr>
<tr>
<td>TSEBELIS G</td>
<td>35</td>
<td>VERBA S, 1995, VOICE EQUALITY CIVIC</td>
<td>14</td>
</tr>
<tr>
<td>INGLEHART R</td>
<td>34</td>
<td>CAMPBELL A, 1960, AM VOTER</td>
<td>14</td>
</tr>
<tr>
<td>EUR COMM</td>
<td>34</td>
<td>ESPINGANDERSEN G, 1990, 3 WORLDS WELFARE CAP</td>
<td>14</td>
</tr>
<tr>
<td>SCHARPF FW</td>
<td>34</td>
<td>FEARON JD, 2003, V97, P1, AM POLIT SCI REV</td>
<td>13</td>
</tr>
<tr>
<td>OECD</td>
<td>32</td>
<td>BAUMGARTNER FR, 1993, AGENDAS INSTABILITY</td>
<td>13</td>
</tr>
<tr>
<td>LAVER M</td>
<td>32</td>
<td>PUTNAM RD, 1988, V42, P427, INT ORGAN</td>
<td>13</td>
</tr>
<tr>
<td>HALL PA</td>
<td>30</td>
<td>BECK N, 1998, V42, P1260, AM J POLIT SCI</td>
<td>13</td>
</tr>
</tbody>
</table>
In summary a number of features within the domain can be distinguished from the co-citation map of authors. Most obvious is the group of international relation scholars within conflict and peace research who are distinctly connected on the map. In the upper part of the map an economic focus is seen, represented by scholars within political economy and organizations. In the lower left side sociological aspects of politics seem to be the common denominator, partly represented by general theorists within the social sciences and partly by the group of scholars specifically addressing sociological aspects of politics. Finally there is a large group of authors in the lower right corner dealing with aspects of the formal political system. A specific European focus is apparent in the works of the major part of these authors. The comparative perspective is represented both by authors in the bottom left of the map and by authors in the center of the map.

Works
The co-citation map of works shows some similarities with the co-citation map of authors. Most striking is the cluster on the right side of the map were the international relation authors we saw clustered in the co-citation map of authors are represented (except Huntington). This cluster is compact in the co-citation map as well, i.e. nodes in this group have strong relations between each other and weaker bonds to other nodes in the map. Noticeable is that monographs are gathered on the left and journal articles on the right, with only a few exceptions. This is likely to be a sign of different subfields using different communication forms. Also visible at first sight is that a few works are located in the middle of the map, co-cited both with the group on the left and the group on the right side of the map.
Civil war is the topic of the majority of articles in the international relations group. The relation between ethnicity and civil war is addressed in several of the articles, e.g. “Ethnicity, insurgency and civil wars” by Fearon, “Ethnic polarization” by Montalvo and “Beyond Fractionalization: Mapping Ethnicity Onto Nationalist Insurgencies” by Cederman. Comparative studies and case studies seem to be dominating in the field of international relations. As mentioned this group seems to almost exclusively use journal articles as the formal communication medium. There is one case of synonymy in this group. The mentioned article authored by Fearon is represented twice due to incorrect page number.

Methodology is the common denominator of two of the works located in the center of the map, Bramport, “Understanding interaction models: improving empirical analyses” and King, Designing social inquiry. Also works by Olson and Putnam are linked with works from both sides, Olson addressing group theory and Putnam addressing politics in the national and the international arena as well as the entanglement between these arenas. Both these works are connected to the lower left side where works concerning politics on the regional level of the European Union are found, i.e. Tsebelis, Veto players: how political institutions work, Majone, Regulating Europe, Moravcsik The choice for Europe: social purpose and state power from Messina to Maastricht and Strøm Delegation and accountability in parliamentary democracies.
Above this group three works within comparative politics are located, authored by Lijphart, Baumgartner and Steenberger respectively. Most noticeable of these are Lijphart's *Patterns of democracy* which constitutes the biggest node on the map, co-cited with works of the major part of the map. This work contains comparative analysis of 36 democracies and draws conclusions about the functionality of different kinds of democratic systems. The methodology appears to group *Patterns of democracy* with works addressing methodological aspects, while the topic seems to connect this work with several of the works in the upper left corner.

In the upper left corner we find works concerning different political aspects within the democratic societies, e.g. topics like the dynamic of party systems, voting behavior, political communication and the effect of societal and cultural change on the political landscape. This group is far more diverse than the international relations group, partly because the group is dealing with a wider degree of topics and partly because the methodological approaches are of a greater variety, also the span of the publication years is significantly wider.

In summary the co-citation analysis of works displays two distinctly separated groups of works, one containing works within international relations, communicating through journal articles, and one more diverse group communicating through monographs addressing diverse political aspects within as well as between democratic states on a national and international level.

**Summary of the Bibliometric Study**

The bibliometric study revealed some characteristics of the domain and some changes taking place during the analyzed time period, however some methods turned out to be more efficient than others in this task. The analysis of several different units gave a broader picture since they complemented each other.

To compare and study the lists of co-occurring words turned out to be more effective in revealing topics of the domain than the visualization of the co-word analysis. Some aspects of the topics within the domain were manifested as well as some central concepts. A regional focus was obvious on all maps and the rise of the climate change and financial crises as research areas could be seen. Further aspects of the topics were revealed when analyzing core journals, authors and works, which gave clearer answers about the scope of the domain.

Fairly distinct answers were given by the analysis of citation patterns. A growing number of references in the selected articles and a higher share of citations to journal articles compared to other medias was apparent. A perhaps surprising result is that older material was cited by the domain in 2009 than in 1999. This apply to citations made both to journals and to non-journals. The tendency is however more evident in citations made to non-journals. Also the analysis of the distribu-
tion between journals showed some salient features. A larger number of journals received citations in 2009 than in previous years, yet the already highly cited journals increased their share of the total amount of citations, thus increasing their impact within the field.

The analysis of core actors and works not only showed the most cited journals, authors and documents but also revealed some of the subfields within the domain. International relations was represented on all three co-citation maps, as well as the regional field focusing on Europe and the European Union. Two American journals were in the top of the list of the most cited journals in 2009 indicating a strong American impact. The co-citation map of journals also showed the subfield focusing on different features of the democratic system. This field was also apparent on the co-citation map of authors which did as well display a group of authors addressing sociological aspects as well as a group of important political organizations. Two distinctly separated fields were revealed by the co-citation map of works where international relations was tightly clustered and almost solely represented by journal articles. The other field was more multifaceted, constituted by works concerning democratic aspects, sociological aspects as well as specifically European aspects of politics. This field was almost exclusively represented by monographs.
Part III: Discussion

Former Research Using Bibliometrics for Domain Analysis

Bibliometrics is not commonly recognized as a tool for domain analysis. However, some of the research areas within bibliometrics could be used for domain analysis and some studies categorized as such. When Glänzel outlines the three target groups of bibliometrics information service professionals are not mentioned as one of these target groups. The domain analytic approach is on the other hand a pragmatic approach where information service practice is the main focus of the analysis of domains. Using bibliometrics for domain analysis makes information service institutions and professionals the target group for research. This group is suggested to be emphasized as one of the important target groups for bibliometric studies.

However, information services have been the focus for some research areas using different bibliometric methods and approaches. Within the field of visualization the connection to domain analysis has been explicitly recognized, though bibliometricians and scientific disciplines most often have been the target groups for analyses of this kind.

The research using bibliometrics for collection development has information services as the prime target, mainly trying to rationalize the acquisition practices. Since analyzing publication activity and citation patterns of a domain, a domain analytic perspective is adopted, rather than a cognitive one. Therefore such studies can be described as domain analysis. However only limited aspects of the domain is addressed by this field of research since mainly focuses on specific methods for efficient acquisition practices.

Also bibliometrics for information retrieval sometimes focuses on information services. These approaches are in fact important since they are the main reason for the creation of citation databases such as Web of Science and Scopus. Also studies for thesauri development and classification methods are in the scope of bibliomet-

\(^{112}\) Glänzel, W. (2003), "Bibliometrics as a research field: A course on theory and application of bibliometric indicators", p. 9 f.

\(^{113}\) This is done by Börner, K., Chen, C. & Boyack, K. W. (2005), "Visualizing knowledge domains"; and White, H. & McCain, K. (1998), "Visualizing a discipline".
rics for information retrieval, which are features explicitly mentioned by Hjørland as part of the domain analytic approach, and bibliometrics is suggested to be one method used in this area.\textsuperscript{131}

Publication and citation patterns, evaluation and impact studies of journals, institutions or authors as well as the impact of open access publication are other research areas within bibliometrics which could be used for domain analysis. Such studies can also be part of collection development, visualization and information retrieval. These research areas should not be considered mutually exclusive but rather as complementing and overlapping.

Hence several areas within bibliometrics have analyzed different aspects of domains. This has been done with different purposes and with different target groups in mind, most commonly with other target groups than information service professionals such as librarians or information specialists. The domain analytic approach can contribute to bibliometrics since it focuses on domains with the purpose to develop information service practices, thus offering an approach which could unify research addressing different aspects of domains focusing on information services within a theoretical framework.

Is There a Specific European Domain Within Political Science?

The study has shown that there are specifically European research areas within political science and that journals, authors and works within these areas were among the most cited by the selected publications, thus part of the core of the discipline. A major part of the co-citation map of authors was occupied by European authors who have published works within European research areas. The co-word analysis of title words showed “Europe”, “European” and “EU” to be frequently used in item titles. And the analysis of core journals revealed that European journals are increasingly cited by political science scholars at European universities. These features are probably a natural consequence of the expansion of both policy areas and geographic areas of the European Union, which has brought forth major changes in the political landscape.

The specifically European research areas address aspects of the democratic system, such as political parties, voting behavior and elections. Comparative approaches seem to be the dominating methodological approach. European Union integration and policy making are also in the scope of this regional subfield. If one can talk about a particular domain of political science in Europe these research areas can be considered the constituent parts of this field.

\textsuperscript{131} Hjørland, B. (2002), "Domain analysis in information science - Eleven approaches - traditional as well as innovative".
However, other research areas were manifested in the study, e.g. within international relations, political sociology, economics and methodology. These areas do not seem to be part of a specifically European domain, they rather seem to be parts of international domains (or at least European/American domains).

Besides the field specifically focusing on Europe, international relations was the most clearly distinguishable field in all of the co-citation maps forming a tight cluster on each of the maps. International relations is sometimes considered as a discipline of its own, parallel to political science, which thus could be seen in these co-citation analyses. This field seems to be international rather than European if looking at topics of the most cited documents, authors and journals.

Also sociological aspects of politics were manifested in several maps indicating the close connection between sociology and political science. Sociology and economics were the only disciplines outside political science represented in the study. Connections to other academic fields were however not specifically addressed and could be suggested to be studied further. Also methodological works and authors focusing on methodology were represented but can as well be suggested as a topic for future studies.

Hence a diversity of research areas with a variation in focus and scope are addressed and cited by the publications selected for this study. To define this group as a domain has therefore shown to be problematic. Scholars within political science from European universities do not constitute a homogenous, distinctly demarcated entity. More probable is that these scholars act within several subfields with different characteristics, sometimes within an international community and sometimes within regional or national boundaries. Furthermore, some of the subfields within the discipline are overlapping each other, as well as other disciplines. To demarcate domains per se should not be considered a possibility in this complex net of relations, yet to define domains for analyses with specific purposes can be fruitful. This study has turned out to be effective in identifying different subfields and some of their characteristics and connections, which was possible by using several complementing bibliometric methods. To treat the selected publications as a domain has in this manner proven to give valuable information about the field of political science in Europe.

Subfields and Their Implications for Bibliometric Methods

One problem associated with bibliometrics in general and perhaps within domain analysis in particular, is the various modes of communication used by different subfields, which could cause bias towards some subfields at the expense of others. This problem has been recognized by McLean who mentioned the differences between comparative government and political theory, where comparative govern-
ment scholars communicate through papers in a higher degree than political theorists. Research areas within comparative government were distinguishable in the study, not the least within the particular European research areas, which political theory was not. This relation could be a sign of a bias towards subfields using journal articles to a larger extent for their communication.

The field of international relations was clearly represented in the study, notwithstanding that journals categorized within this discipline by the Journal Citation Report were not included. The co-citation map of works showed distinct differences in material types used by the field of international relations and other subfields. Studies conducted on material based on journal items hence are likely to have a bias towards the field of international relations.

Differences between the subfields must be recognized to avoid fallacious conclusions to be drawn due to bias. By the use of several bibliometric studies, e.g. by the study of both journal articles and monographs, and by complementing bibliometric methods with e.g. literature studies, the problem of bias can be reduced, resulting in a more multifaceted picture of the discipline. Future research is suggested to further examine differences in communication patterns within political science and the consequences for bibliometric studies within the field.

Whenever using bibliometrics for domain analysis subfields must be recognized and differences regarding communication patterns must be taken into account. In general, it can be suggested to treat subfields separately to complement studies addressing larger fields, such as this study. The problem of bias due to differences between subfields is not only a methodological issue for bibliometric analyses but for the practice of information service institutions as well, since affecting the information needed by domains and their subfields. Information service institutions are suggested to identify the subfields which are the most important within the field of practice and analyze these subfields, their characteristics, scope and development to be able to efficiently provide information required for their practice.

The differences in scope and communication forms between international relations and other subfields within the discipline of political science have implications for information service institutions in their task to meet the information needs of this subfield. The co-citation analysis of documents strongly indicated that journal articles are the dominating media for communication in this subfield, suggesting that institutions providing it with information should focus on such medias. However, this is likely not to be the case within political theory. When providing both these subfields with information one needs to take into account the communication patterns within both subfields to elaborate policies, e.g. collection development policies.

132 McLean, I. (2010), "Reputational and bibliometric methods of evaluating people and journals in political science: a UK perspective".
Changing Citation Patterns of the Domain

The study of communication patterns has been stated by Hjørland and Albrechtsen as important for information specialists to fulfill the task to provide domains with information. Citation patterns could be considered to be of direct interest for information service practices such as collection development and information retrieval since they reflect both use of publications and communication within the domain.

The analysis of citation patterns showed some significant changes taking place between 1999 and 2009. The frequency of references per article has grown substantially which perhaps is a consequence of improved information access and reference management caused by the information technological development. Thus a sign of improved information accessibility causing changes of the practices within the domain. Also the co-authorship frequency has been growing during the time period which is another sign of increasing communication within the domain. These changes are likely to influence information service institutions, especially publication practices.

A proportional growth of references to journal articles is seen in the study which could have direct consequences for information services since this reflects which material is being used by the domain. Non-journals still receive more than half of the citations but this category contains such diverse publications as newspaper articles, publications by organizations, monographs and chapters in monographs. Hence a comparison between citation rates to monographs and to journal articles was not made in this study and could be suggested for future studies. Neither a comparison between electronically accessed and physical publications was made which also can be subject to future studies. This can possibly be conducted by comparison between library loans and downloads from scholars within the domain. Also citation rates to publications by organizations and newspapers could be of great interest for information service institutions within political science. However, it is probably most important to identify differences between sub-fields to make it possible for information service institutions to provide domains with relevant media types.

The bibliometric study has shown that older material receive a higher degree of citations in 2009 than in 1999 which applies to both journals and non-journals which seems to be a general tendency. The enhanced accessibility of older material and improved search functions and retrieval possibilities of older material due to digitalization could be explanations of this result. Likely such development has caused changes in information consuming habits among scholars which immediately influence the work of information service institutions. The fairly rapidly decreasing Price index poses a couple of questions, is the domain either changing

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from being “harder” to becoming ”softer”, or does this change apply to all scholarly fields causing the Price index to drop across the whole academic field? The latter of these alternatives seems more likely since this phenomenon possibly could be explained by the already mentioned features causing changing information consuming habits. If so, it would affect the accuracy and usability of the Price index.

The analysis of citation patterns to journals showed significant changes taking place during the time period. A higher amount of journals are cited in 2009 than in 1999 and the most cited journals receive a bigger proportion of the total amount of citations. This is a sign of an increasing Matthew effect and can be due to scholars experiencing information overload. Another, perhaps complementing, explanation is the growing pressure to publish in highly ranked journals causing established, highly cited authors to more frequently publish in top ranked journals. Regardless of the cause this tendency bears implications for information service institutions. Firstly, the high influence by the top ranked journals must be recognized and the information need for such journals be satisfied. Secondly, an eventual information overload can be suggested for investigation, and information services further developed for handling such problems, i.e. facilitating the retrieval of information based on subject, quality and relevance, rather than Impact Factor and reputation, which could improve research quality and prevent unwanted Matthew effects.

The Usefulness of Bibliometrics for Domain Analysis

Domain analysis has been outlined as a sociological perspective where the information specialist focuses on the domain, i.e. on a community rather than individuals, to fulfill the mission to develop efficiently working information service institutions. “[...] [S]cientific and professional communication, documents [...], disciplines, subjects, information structures and paradigms” have been stated as central concepts within this theory.134 This bibliometric study was conducted to gain knowledge about these concepts by examining different bibliographic fields using several bibliometric methods. Since the analysis was delimited to bibliometric methods no claim was made to study all relevant features of the domain to make a thorough domain analysis. It rather has been obvious that a thorough domain analysis can not be conducted with one single methodological approach, but has to be complemented by several to make it possible to fully understand the information structure of the domain.

However, bibliometrics turned out to be an effective tool to gain knowledge about some of the mentioned characteristics of the studied domain. Since it uses a

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quantitative approach it is possible to analyze a large set of data, which makes bibliometrics efficient when studying general structures and tendencies and therefore particularly useful when initializing analyses of domains. Topics turned out to be problematic to analyze using visualizations of co-occurrence analysis of title words, yet the frequency of co-occurring words showed some general characteristics, tendencies and central concepts possible to study further by e.g. interviews or literature studies. Also the co-citation analyses of journals, authors and documents revealed some features of the topics within the domain which could form a foundation for further studies. By complementing bibliometric studies of this kind with qualitative studies to examine the scope of a domain useful information for information services could be gained.

The formal communication through publications using citations is an important part of the communication within the academic society and is the natural focus for bibliometric studies within this sphere. The study has shown that several important features of the domain were possible to gain knowledge about analyzing the reference field. The analysis of citation patterns revealed some changes taking place during the studied time period which are of direct importance for information services. Combined with e.g. interviews and the analysis of lending statistics and usage reports bibliometrics could be a powerful tool to map information practices within domains. The study has been able to identify several characteristics of the domain which could form a point of departure for complementing studies, i.e.:

- Research areas and subfields.
- Communication forms within subfields.
- Central concepts.
- Core journals, authors and works.
- Distribution of cited material types.
- Age of cited publications.
- Changes of citation patterns, i.e. frequency of references, cited material types and age of cited publications.
- Distribution of citations between journals (in relation to indexes).

If the objective for an information system is to “[...] identify and communicate the knowledge needed [...]” by the practitioners within a domain to fulfill their task as stated in the introduction to this thesis, then to have knowledge about these features is important for information specialists since these are affecting the information need of the domain. It is reasonable to argue that a collection should reflect

13 Hjørland, B. (2002), "Domain analysis in information science - Eleven approaches - traditional as well as innovative", p. 422.
the information need of the community which it provides with information. It is also feasible that information specialists and librarians with knowledge about the domain have better possibilities to create such collections, as well as to develop efficient information retrieval tools and efficiently search and find information. Bibliometrics for domain analysis can be proposed to be used within information service institutions to:

- Create literature guides or pathfinders.
- Map domains, e.g. to produce research reviews.
- Support collection development decisions.
- Develop and enhance knowledge organization tools such as thesauri or classification systems.
- Support management decisions, e.g. recruitment and staff training.

In a time of rapidly changing information structures bibliometric analyses of domains could be the foundation of informed management decisions within information service institutions. Domain analysis has proven to be a useful theoretical approach within bibliometrics since it identifies information service professionals as an important target group for bibliometric studies. Hence both domain analysis and bibliometrics could benefit from further development of this combination of theory and methodology.
Summary

The field of political science in Europe has been analyzed in this thesis to obtain knowledge about the field that is useful for information services. The thesis adapts the domain analytic approach which is a theoretical approach in the field of information science where knowledge production and dissemination within a professional discipline are seen as the prime features to be analyzed by the information specialists to achieve the aim to provide it with information services. The purpose of the thesis was not only to gain knowledge about the particular domain but also to study how bibliometrics can be used within the domain analytic approach to analyze a domain and its changes over time. Three research questions were posed, (1) How has bibliometrics been used for the analysis of domains with relevance to the domain analytic approach? (2) How can the academic field of political science in Europe, thought of as a domain as described by the domain analytic approach, be analyzed using bibliometrics and which conclusions can be drawn from this study about the domain and its changes over time? (3) Which conclusions can be drawn about the use of bibliometrics for domain analysis and what strengths and weaknesses can be associated with the methods in this context?

Topics, citation patterns and core journals, authors and works within the domain were studied. Impact Factor was used to select the top 50 journals in 1999, 2004 and 2009 respectively. Web of Science was searched for items within these 50 journals and the search results were refined to items published by authors with European addresses. Bibexcel and Gephi was used to process and analyze the data. Co-word analysis was used to study topics within the discipline, several kinds of citation analyses were conducted to examine citation patterns of the domain and lastly, core journals, authors and works were identified by the use of citation analysis and co-citation maps were drawn for the analyses.

Several subfields within the domain, as well as some differences in citation patterns of the subfields, were possible to distinguish. The domain showed to be multifaceted, yet specific European research areas were identified. Some significant changes of the citation patterns were apparent between 1999 and 2009. In 2009 there were more references per article, journal articles were cited to a higher de-

136 In the thesis domain analysis is treated as it is used within information science, however the term is used and has different meanings within other disciplines, e.g. software engineering.
gree, relatively older publications were cited to a greater extent and the most cited journals received a larger share of the total amount of citations.

The existence of a specific European domain within political science has been discussed as well as the diverse characteristics of the subfields and their implications for the bibliometric methods. How the changes of citation patterns, which could be seen in the study, influence the practice of information service institutions within the field of political science in Europe was also a topic addressed in the discussion. Finally suggestions have been presented of how bibliometrics can be used for domain analysis within library and information science as well as by information services institutions.
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Appendix 1: Conducted Searches in Web of Science

Search 2009

2009: Search 1 (#1)

SO=((POLITICAL ANALYSIS) OR (AMERICAN POLITICAL SCIENCE REVIEW) OR (ANNUAL REVIEW OF POLITICAL SCIENCE) OR (AMERICAN JOURNAL OF POLITICAL SCIENCE) OR (JOURNAL OF PEACE RESEARCH) OR (POLITICAL GEOGRAPHY) OR (SCANDINAVIAN POLITICAL STUDIES) OR (EUROPEAN UNION POLITICS) OR (JOURNAL OF POLITICS) OR (AFRICAN AFFAIRS) OR(GOVERNANCE-AN INTERNATIONAL JOURNAL OF POLICY ADMINISTRATION AND INSTITUTIONS) OR(INTERNATIONAL STUDIES QUARTERLY) OR(PUBLIC OPINION QUARTERLY) OR(EUROPEAN JOURNAL OF POLITICAL RESEARCH) OR(JOURNAL OF CONFLICT RESOLUTION) OR(POLITICS & SOCIETY) OR(BRITISH JOURNAL OF POLITICAL SCIENCE) OR(WEST EUROPEAN POLITICS) OR(COMPARATIVE POLITICAL STUDIES) OR(NW LEFT REVIEW) OR(POLITICAL PSYCHOLOGY) OR(JOURNAL OF DEMOCRACY) OR(JCMS-Journal of Common Market Studies) OR(Global Environmental Politics) OR(REVIEW OF INTERNATIONAL POLITICAL ECONOMY) OR(POLITICAL COMMUNICATION) OR (Quarterly Journal of Political Science) OR (HARVARD INTERNATIONAL JOURNAL OF PRESS-POLITICS) OR ENVIRONMENTAL POLITICS) OR(ELECTORAL STUDIES) OR (State Politics & Policy Quarterly) OR(TERRORISM AND POLITICAL VIOLENCE) OR(ANNALS OF THE AMERICAN ACADEMY OF POLITICAL AND SOCIAL SCIENCE) OR(JOURNAL OF POLITICAL PHILOSOPHY) OR(Acta Politica) OR(POLITICAL RESEARCH QUARTERLY) OR(STUDIES IN COMPARATIVE INTERNATIONAL DEVELOPMENT) OR( LATIN AMERICAN POLITICS AND SOCIETY) OR(POLITICAL BEHAVIOR) OR(POLITICAL STUDIES)) AND PY=(2009)

2009: Search 2 (#2)
SO=((PUBLIUS-THE JOURNAL OF FEDERALISM) OR(INTERNATIONAL JOURNAL OF PRESS-POLITICS) OR(JOURNAL OF THEORETICAL POLITICS) OR(POLITISCH VEREITELJAHRESSCHRIFT) OR(Geopolitics) OR(NEW POLITICAL ECONOMY) OR(HUMAN RIGHTS QUARTERLY) OR(PARTY POLITICS) OR(ARMED FORCES & SOCIETY) OR(LEGISLATIVE STUDIES QUARTERLY)) AND PY=2009

2009: Refinement

#2 OR #1
Refined by: Countries/Territories=(NORTH IRELAND OR ENGLAND OR TURKEY OR GERMANY OR LITHUANIA OR NETHERLANDS OR WALES OR SCOTLAND OR HUNGARY OR SLOVAKIA OR NORWAY OR SLOVENIA OR PORTUGAL OR ITALY OR BULGARIA OR SWITZERLAND OR BELGIUM OR GREECE OR CROATIA OR SWEDEN OR POLAND OR CYPRUS OR DENMARK OR ICELAND OR IRELAND OR RUSSIA OR LATVIA OR SPAIN OR FRANCE OR ESTONIA OR FINLAND OR MALTA OR LUXEMBOURG OR AUSTRIA OR ROMANIA OR CZECH REPUBLIC)

Search 2004

2004: Search 1 (#15)

SO=((AMERICAN POLITICAL SCIENCE REVIEW) OR (AMERICAN JOURNAL OF POLITICAL SCIENCE) OR (JOURNAL OF DEMOCRACY) OR (JOURNAL OF CONFLICT RESOLUTION) OR (POLITICAL GEOGRAPHY) OR (POLITICS & SOCIETY) OR (JOURNAL OF PEACE RESEARCH) OR (COMPARATIVE POLITICAL STUDIES) OR (REVIEW OF INTERNATIONAL POLITICAL ECONOMY) OR (JOURNAL OF COMMON MARKET STUDIES) OR (NEW LEFT REVIEW) OR (SURVIVAL) OR (STUDIES IN COMPARATIVE INTERNATIONAL DEVELOPMENT) OR (COMPARATIVE POLITICS) OR (PUBLIC OPINION QUARTERLY) OR (JOURNAL OF POLITICS) OR (BRITISH JOURNAL OF POLITICAL SCIENCE) OR (POLITICAL SCIENCE QUARTERLY) OR (JOURNAL OF THEORETICAL POLITICS) OR (POLITICAL SCIENCE QUARTERLY) OR (JOURNAL OF THEORETICAL POLITICS) OR (POLITICAL PSYCHOLOGY) OR (WEST EUROPEAN POLITICS) OR (POLICY AND POLITICS) OR (INTERNATIONAL POLITICAL SCIENCE REVIEW) OR (ANNUAL REVIEW OF POLITICAL SCIENCE) OR (JOURNAL OF POLITICAL PHILOSOPHY) OR (EUROPEAN JOURNAL OF POLITICAL RESEARCH) OR (PARTY POLITICS) OR (SCANDINAVIAN POLITICAL STUDIES) OR (LATIN AMERICAN POLITICS AND SOCIETY) OR (POLIT-
ICAL COMMUNICATION) OR (POLICY REVIEW) OR (SCOTTISH JOURNAL OF POLITICAL ECONOMY) OR (ELECTORAL STUDIES) OR (LOCAL GOVERNMENT STUDIES) OR (HARVARD INTERNATIONAL JOURNAL OF PRESS-POLITICS) OR (ISSUES & STUDIES) OR (AMERICAN POLITICS RESEARCH) OR (EAST EUROPEAN POLITICS AND SOCIETIES) OR (COMMUNIST AND POST-COMMUNIST STUDIES) OR (ENVIRONMENTAL POLITICS)) AND PY=(2004)

2004: Search 2 (#16)

SO=((POLITICAL QUARTERLY) OR (POLITICAL BEHAVIOR) OR (LEGISLATIVE STUDIES QUARTERLY) OR (PUBLIC CHOICE) OR (POLITICAL THEORY) OR (ANNALS OF THE AMERICAN ACADEMY OF POLITICAL AND SOCIAL SCIENCE) OR (PS-POLITICAL SCIENCE & POLITICS) OR (HUMAN RIGHTS QUARTERLY) OR (POLITICAL RESEARCH QUARTERLY) OR (EUROPE-ASIA STUDIES)) AND PY=(2004)

2004: Refinement

#16 OR #15
Revised by: Countries/Territories=( RUSSIA OR ENGLAND OR DENMARK OR SWITZERLAND OR ICELAND OR GERMANY OR LITHUANIA OR NETHERLANDS OR TURKEY OR SLOVAKIA OR SCOTLAND OR AUSTRIA OR BELGIUM OR GREECE OR ITALY OR SWEDEN OR HUNGARY OR FRANCE OR POLAND OR NORWAY OR LATVIA OR LUXEMBOURG OR WALES OR PORTUGAL OR MACEDONIA OR IRELAND OR MALTA OR FINLAND OR CZECH REPUBLIC OR SPAIN OR ROMANIA OR NORTH IRELAND OR SLOVENIA OR ESTONIA OR BULGARIA )

Search 1999

1999: Search 1 (#7)

SO=((AMERICAN POLITICAL SCIENCE REVIEW) OR(POLITICAL GEOGRAPHY)OR(JOURNAL OF CONFLICT RESOLUTION)OR(AMERICAN JOURNAL OF POLITICAL SCIENCE)OR(NEW LEFT REVIEW)OR(REVIEW OF INTERNATIONAL POLITICAL ECONOMY)OR(COMPARATIVE POLITICS)OR(PUBLIC OPINION QUARTERLY)OR(COMPARATIVE POLITICAL STUDIES)OR(HUMAN RIGHTS QUARTERLY)OR(JOURNAL OF POLITICS)OR(JOURNAL OF THEORETICAL POLITICS)OR(POLITICAL THEORY)OR(BRITISH JOURNAL OF POLITICAL SCIENCE)OR(POLITICS
1999: Search 2 (#8)

SO=((LEGISLATIVE STUDIES QUARTERLY)OR(EUROPE-ASIA STUDIES)OR(PUBLIC CHOICE)OR(JOURNAL OF INTERAMERICAN STUDIES AND WORLD AFFAIRS)) AND PY=1999

1999: Refinement

#8 OR #7

Refined by: Countries/Territories=(IRELAND OR SLOVENIA OR ENGLAND OR GERMANY OR LITHUANIA OR SPAIN OR FINLAND OR SERBIA OR CZECH REPUBLIC OR SCOTLAND OR BULGARIA OR ESTONIA OR NETHERLANDS OR HUNGARY OR FRANCE OR BELGIUM OR ICELAND OR ITALY OR POLAND OR WALES OR SWITZERLAND OR GREECE OR LUXEMBOURG OR AUSTRIA OR MALTA OR NORTH IRELAND OR SLOVAKIA OR SWEDEN OR NORWAY OR PORTUGAL OR DENMARK OR RUSSIA OR ROMANIA OR TURKEY)