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STATE-OF-THE-ART

What hampers innovation? External stakeholders, the organization, groups and individuals: a systematic review of empirical barrier research

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Abstract Innovation is essential for organizations. A variety of factors which hamper, delay or block innovation, so-called barriers, have been researched by a multitude of studies for more than 30 years. We map the field by a systematic review of 188 empirical studies on barriers complemented by a citation analysis, which highlights the fragmentation of barrier research. We propose the External environment Organization Group Individual barrier model (EOGI barrier model) aiming at a more encompassing identification of barriers which unites previous findings, acknowledges different level of analysis, and draws on theory (stakeholder theory, managerial levers of dynamic capabilities). The manifestations of innovation barriers identified in the reviewed studies are classified according to the EOGI barrier model: external environment (external stakeholders: investor, potential employee, supplier, competitor, customer, state, society), organization (managerial levers of dynamic capabilities: strategy, structure, size, resources, organizational learning, organizational culture), group (team structure, team climate, team processes, composition of members depending on their characteristics, leadership style), and individual (managers' attitudes and abilities, employees' attitudes and abilities). Additionally, we address strategies to reduce barriers. The research synthesis provides five directions for future research concerning multiple level of analysis, theory-driven sub-categories of each level, interaction of barriers, context

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specificity of barriers, and origin of the data (level of innovativeness, national culture, differences between developing, newly industrialized and developed countries).

Keywords Barrier · Innovation barrier · Multilevel analysis · Systematic review

JEL Classification 030

1 Introduction

Innovation is essential for organizations to gain and sustain competitive advantage, either by influencing their environment or by responding to changing organizational and environmental demands (e.g., Baregheh et al. 2009; Bessant et al. 2005; Damanpour 1991; Zain et al. 2002). The importance of innovation for businesses is reflected by an increasing body of research aimed at understanding successful innovations in firms (Anderson et al. 2004; Verhees and Meulenberg 2004). While not denying the worth of revealing key variables which may explain how innovations can be managed (i.e., success factors), the ability to learn from failures and detours is critical for progress as well (Pisano 2006). As approximately 70 percent of planned organizational change initiatives fail (Pellettiere 2006), it is actually regarded as a "key to innovative success" to minimize disruptions to innovation (Hall and Martin 2005, p. 274). Gradually, research on the flipside of success has emerged as more and more factors which hamper innovations have been mentioned (Mirow et al. 2007). Consequently, this paper addresses the "innovation problem" (Storey 2000, p. 348) by examining the question: What hampers innovation?

For our analysis, innovation is defined as something which is created new or something existing which is improved or changed (Baregheh et al. 2009). New in our context means perceived as new by individuals or the organization (e.g., Rogers 2003; Zain et al. 2002), whether or not the innovation has been used by others previously. The origin of innovation can be within the organization, which means the innovation is generated inside the organization, or from outside, which means the innovation comes to the organization by an adoption decision (Damanpour and Gopalakrishnan 1998). Regardless of its origin, the nature of innovation of being new or bringing change can provoke resistance to innovation from the organizational members (Hadjimanolis 2003).

Innovation barriers are seen as factors which impede, delay or completely block innovation (Mirow et al. 2007, 2008), though the terms barriers, hurdles, impediments, or obstacles are often used interchangeably despite their linguistic differences. The ability to identify barriers refers "to the firm's awareness of the difficulties involved as a result of engagement in innovation activities" (D'Este et al. 2012, p. 482). The identification of innovation barriers is indispensable for understanding the innovation process in organizations and enabling firms to overcome the barriers (Cooper 1998b; D'Este et al. 2012; OECD and Eurostat 2005). Thereby, innovation barrier research re-establishes the flow of innovation by revealing, understanding, and overcoming barriers to innovation (Hadjimanolis 1999).

We specify the question "What hampers innovation?" to "Which innovation barriers are identified by previous empirical studies?". This question is answered by a systematic literature review (Fink 2010; Tranfield et al. 2003) of 188 empirical studies, which have been conducted over a period of more than 30 years in a variety of different contexts, and complemented by a citation analysis.

Acknowledging innovation as a multilevel phenomenon (Anderson et al. 2004; Klein and Sorra 1996) and the coherent call for multilevel approaches (e.g., Anderson et al. 2004; Crossan and Apaydin 2010), we go beyond the mere summary of innovation barriers by structuring those barriers across four levels of analysis: external environment, organization, group, and individual. The proposed External environment Organization Group Individual barrier model (EOGI barrier model) provides a more detailed categorization of each level, which is driven by the findings of previous reviews on innovation literature (Anderson et al. 2004; Crossan and Apaydin 2010) complemented by stakeholder theory (Freeman 1984, 2004; Mainardes et al. 2011) and managerial levers of dynamic capabilities (Crossan and Apaydin 2010; Eisenhardt and Martin 2000; Helfat et al. 2007; Teece et al. 1997).

In sum, we contribute to innovation as well as barrier research by: (1) a citation analysis which underlines the fragmentation of this field of research; (2) a systematic review of 188 empirical barrier studies, which are conducted over a period of more than 30 years in a multiplicity of different contexts; (3) the development of the EOGI barrier model which provide directions for future research towards a more encompassing identification of innovation barriers by uniting previous findings, acknowledging different levels of analysis respective of the corresponding sub-categories of those levels, and drawing on stakeholder theory and managerial levers of dynamic capabilities; (4) strategies to reduce barriers; and (5) five directions for future research derived from the research synthesis.

2 Towards a model for classifying innovation barriers across multiple levels of analysis

As "innovation has been studied at the level of the industry, the firm, or the individual" (Damanpour 1996, p. 694), the analysis of barriers goes beyond organizational and individual levels "that are arguably within control of the firm" (Crossan and Apaydin 2010, p. 1156). Innovation barriers are frequently distinguished in internal and external barriers (e.g., Harris 2000; Puhlmann and Gouy 1999; Shi et al. 2008; Thun and Müller 2010; Wirtz 2009). Internal barriers mean inside the organization, for instance, related to resource allocation, culture, systems, or related to the individuals within the organization. Complementary, external barriers are linked with supply, demand, or environmental issues (Hadjimanolis 1999).

Some studies apply a more detailed classification and distinguish barriers related to technology (e.g., Antlová 2009; Heinemann et al. 2010), surrounding environment (e.g., Antlová 2009; Wymer and Regan 2005), organizational issues (e.g., Duh et al. 2006; Kunda and Brooks 2000), collective issues (Heinemann et al. 2010), and individuals (e.g., McLaughlin et al. 2008; Nagesha and Balachandra 2006; Sola and de Xavier 2007). Another approach to categorizing innovation barriers is to structure

them according to the value-added chain: research and development, production, and market launch (Kriegesmann et al. 2008). These examples of barrier categories are neither encompassing enough to capture all innovation barriers, nor do they allow a clear classification without overlaps and, thus, barrier categories remain a controversial topic (Rohdin and Thollander 2006; Thrän D and Kaltschmitt 2004; Wymer and Regan 2005).

We adopt the widely used differentiation in external and internal innovation barriers and combine it with the call for more multilevel approaches in innovation research (Anderson et al. 2004; Crossan and Apaydin 2010; Klein and Sorra 1996), particularly with regard to barrier research (Mirow et al. 2007) by structuring the innovation barrier categories across multiple levels of analysis: external environment, organization, group, and individual. Thereby we develop the External Environment Organization Group Individual barrier model (EOGI barrier model) towards a more encompassing identification of innovation barriers.

2.1 External environment

We draw on stakeholder theory (Freeman 1984, 2004; Mainardes et al. 2011) to categorize barriers arising from the external environment. Innovation is characterized by the involvement of many actors, or stakeholders, and a multiplicity of interactions (Hadjimanolis 2003) from which potential barriers may arise. Stakeholders are broadly defined as "key actors" (Post et al. 2002, p. 22) who are affected by the firm or have the potential to affect it (Donaldson and Preston 1995; Fassin 2009; Freeman 1984, 2004; Mitchell et al. 1997). By identifying actors who have the capacity, opportunity, and willingness to threaten or benefit the organization (Freeman 1984; Savage et al. 1991), stakeholder theory contributes to an understanding of increasingly complex environments (Waxenberger and Spence 2003). The complex environment is specified in concrete groups or individuals with their stakes. This approach allows a more precise understanding of the influence on and of those stakes and their characteristic as innovation barrier. Furthermore, the stakeholder analysis uncovers conflicts as well as similarities between different stakes und thereby it highlights interrelationships between innovation barriers. Conclusions for the stakeholder management derived from this analysis with regard to innovation barriers facilitate developing strategies to overcome those barriers (Delgado-Ceballos et al. 2012).

According to the innovation value-added chain, *suppliers*, *customers*, and complimentary innovators (i.e., *competitor*s) are key stakeholders who are affected by an innovation or who can affect it (Afuah and Bahram 1995). Suppliers, defined as providers of "basic resources" for the organization (Fassin 2009, p. 114), are not limited to material resource suppliers. *Potential employees* as suppliers of human capital and *investors* as suppliers of financial funds emerge as further external stakeholders. Therefore, we add potential employees as additional stakeholders external to the organization. The often mentioned lack of finance (e.g. Hadjimanolis 1999; Larsen and Lewis 2007) constitutes an innovation barrier linked to investors not providing sufficient funds as well as lack of financial resources on the organizational level. The research on financial constraints highlights how external and internal financing are

related and hamper innovation (Czarnitzki and Hottenrott 2010; Savignac 2008; Silva and Carreira 2012).

Extending the innovation value-added chain with further stakeholders is consistent with the TCOS model for analyzing innovation confronted with uncertain side effects (Hall and Martin 2005), which adds the following stakeholders: *investor*, *state* as government and regulator, and *society*, for instance, local communities or environmental activists (Hall and Martin 2005). In terms of innovation barriers, two roles of the *state* are to be mentioned: By setting the regulatory framework, the state and its corresponding institutions may restrict innovation activities (e.g., Baldwin and Lin 2002; Cooper 1975; Guenther et al. 2013; Muench et al. 2014). However, regulation schemes can also trigger innovations, for instance by upgrading certain standards (van Hemel and Cramer 2002). Stakes of the local community as representatives of the stakeholder *society* can hamper innovation through so-called "community concerns" (Post and Altman 1994, p. 77), for instance, resistance against building new production facilities (Carlsen and Edwards 2008; Larsen and Lewis 2007).

2.2 Organization

From this outwards perspective the analysis turns to the inside of the innovating organization. As a response to the external environment, the organizations change (Barreto 2010). An organization can "purposefully create, extend, or modify its resource base" (Helfat et al. 2007, p. 4), which is captured by the concept of dynamic capabilities (Eisenhardt and Martin 2000; Helfat et al. 2007; Teece et al. 1997). We argue that a lack of dynamic capabilities manifests itself as an innovation barrier on the organizational level. Consequently, we accomplish a more detailed differentiation of the organizational level by referring to the managerial levers of the dynamic capabilities: mission, goals and strategy; structure and systems; resource allocation; organizational learning and knowledge management; and organizational culture (Crossan and Apaydin 2010). Another previous review of innovation research identified factors influencing innovation on the organizational level as strategy, structure, size, resources, and organizational culture (Anderson et al. 2004). Merging those findings we classify innovation barriers on the organizational level in strategy and structure related issues, size, resources, organizational learning, and organizational culture.

The targeted result of the innovation process is the aim of the innovation (Baregheh et al. 2009). If the aim of the innovation is not aligned with the *strategy* of the organization, then the innovation competes with different priorities (Arevalo and Aravind 2011). The organizational *structure* is shaped by the organizational strategy (Wolf and Egelhoff 2001) and, vice versa, the existing structure influences the strategy of an organization (Pertusa-Ortega et al. 2010). Strategic and structural issues can create barriers at the organizational level. Organizational structure institutionalizes practices which might act as innovation barriers, for instance, barriers between departments can hinder the required coordination and communication (e.g., Dougherty and Heller 1994; Kim et al. 2005; Panizzolo 1998). Organizational structure and strategy also influence the allocation of *resources*. Lack of resources can hamper achieving the aim of innovation (e.g., Czarnitzki and Hottenrott 2010; Evangelista et al. 2010).

In addition, there is a positive relationship between *size* and innovation (Damanpour 1992). Likewise to the lack of resources, a lack of training and development of organizational members (Dwyer and Doyle 2002) constitutes an innovation barrier related to *organizational learning*. Furthermore, *organizational culture* can create innovation barriers (Fard et al. 2011).

2.3 Group

The external environment and the organization, as macro-level perspectives originating from sociology (Klein and Kozlowski 2000), concentrate on regularities in social behavior and other contextual factors (Klein and Kozlowski 2000). "Organizations do not behave; people do" (Klein and Kozlowski 2000, p. 7). This statement reinforces the fact that organizations are shaped by their members. Before turning to the individuals, who are examined by the micro-level perspective, the group as meso-level is to be mentioned. Groups are embedded in the larger and even more complex organizational context (Anderson et al. 2004). Individuals work in groups which are characterized by their team structure, team climate, team processes, member characteristics, and the leadership style (Anderson et al. 2004), which determine if the innovation potential of the team is realized (Anderson et al. 2004). Barriers related to the *team structure* may arise from missing longevity of the team (Lederer and Sethi 1992) or the size of the group (Tuuli and Rowlinson 2010). Comparable to the organizational culture, the *team climate* is to be acknowledged on the group level (Anderson and West 1998). *Team processes* include the team building processes and the effective functioning of the team (e.g., Hoonakker et al. 2010). In addition to structure, climate, and processes, the *composition of members depending on their characteristics*, for instance, differences in perception and goals (Kunda and Brooks 2000, p. 720) or skills (Jun et al. 2004; Kim et al. 2005), can create innovation barriers. This is related to the *leadership style*, for instance, the loss of the innovation gatekeeper (Martini and Pellegrini 2005). These subcategories are complemented by "the wider organizational context" as they are embedded in the organization (Anderson et al. 2004, p. 162) and, of course, by the individual group members.

2.4 Individual

Drawing on the micro-level perspective with its psychological origins, research on the level of the individual focuses on different individual characteristics and recognizes the fact that an organization consists of individuals (Klein and Kozlowski 2000). According to this perspective, innovation depends on the *ability* and the *attitude* of individuals (Anderson et al. 2004). The influence of ability is further underlined by the entrepreneurship research as information about innovation and the "cognitive properties to necessary value it" (Shane and Venkataraman 2000, p. 222). The lack of those can create innovation barriers on the individual level, for instance, "poor knowledge" (Dibb et al. 2008, p. 546). In addition, innovation barriers on the level of the individual can originate from attitudes, for instance, as "resistance to change" (Duh et al. 2006, p. 946) or "efforts not useful" (Guenther et al. 2013, p. 413). Corresponding to the

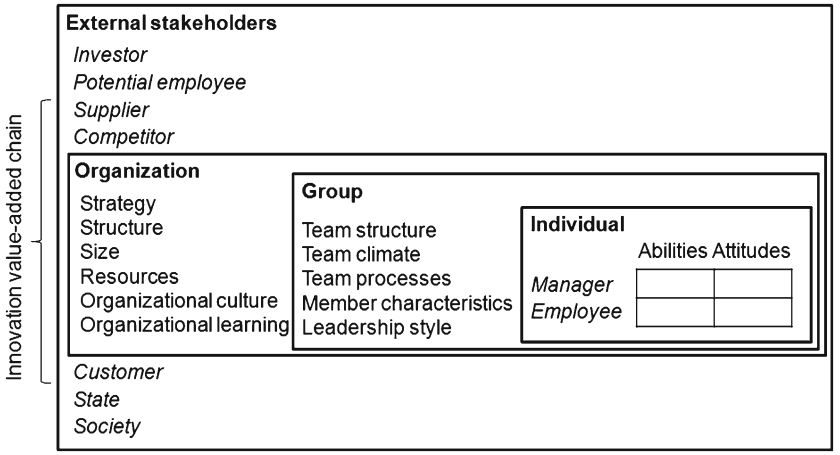

Fig. 1 EOGI barrier model (adapted from Afuah and Bahram 1995; Anderson et al. 2004; Crossan and Apaydin 2010; Hall and Martin 2005)

influence of attitude, entrepreneurship research highlights the influence of beliefs on the decision to pursue opportunities on innovation (Wood et al. 2014, p. 252). It should be acknowledged that specific job characteristics (autonomy, job demands) are displayed on the individual level (Anderson et al. 2004) which arise from the organization and are classified in the organizational sub-category structure. According to the stakeholder theory, employees and managers can be distinguished as internal stakeholders. Therefore, the barriers on the individual level will be classified in *manager*s' as well as *employee*s'*abilities and attitudes*.

2.5 The EOGI model for classifying innovation barriers across four levels of analysis

Summarizing the innovation barriers identified on the four levels of analysis, the proposed EOGI model can be displayed as in Fig. 1. The sub-categories of the EOGI barrier model will guide our systematic review of empirical studies on innovation barriers.

3 Method

During our analysis we could not identify any review capturing the breadth of innovation barriers and structuring the variety of innovation barriers identified in empirical studies across multiple levels of analysis, with the exception of a narrative review of 20 studies which focuses on internal barriers and highlights the complexity of innovation barriers (Mirow et al. 2007). Our review responds to its identified needs for future research (Mirow et al. 2007): (1) We address their claim for an integrated approach on innovation barriers by focusing on studies which research more than one innovation barrier, and excluding studies with segregating focus on one single innovation barrier. (2) We extend their analysis by including the external environment as an additional

level and identifying external innovation barriers structured through the stakeholder approach. (3) Our classification responds to their call for multilevel research.

With the intention to apply the proposed EOGI barrier model and to provide a 'snapshot' of the current state-of-the-science of the empirical research on innovation barriers, we adopt a systematic review method (Fink 2010; Tranfield et al. 2003). Systematic reviews are characterized by a replicable, scientific, and transparent process that aims to minimize bias through exhaustive literature searches and by documenting the reviewers' decisions, procedures, and conclusions (Cook and Murlow 1997). We follow a four-step procedure (Fink 2010; Tranfield et al. 2003) by (1) identifying data sources and search strings, (2) realizing a practical screening, (3) performing a content analysis, and (4) synthesizing the results. Step three is complemented by a citation analysis. Step four is presented in the result section.

3.1 Retrieval of studies: search strings and data sources

The search for empirical studies is mainly conducted as a structured keyword search. In consequence, English and German synonyms for the term barrier (hurdle*, barrier*, impediment*, obstacle*) are used. As a result of the high amount of hits, the English synonyms of barriers are combined with the keywords organi?at*, change*, decision*, innovat* and transformat*. As the publication of research results might be influenced by the language bias, we contribute to overcoming this criticism by extending our search with German keywords (Hemmnis*, Barriere*, Widerst*, Hindernis*). The use of truncations allows a more effective search by simultaneous searching for singular and plural as well as for varied spellings, such as British and American English.

As databases are the most fruitful source for research synthesis (Cooper 1998a), the following databases are searched for related articles: Elsevier Science Direct, Elsevier SciVerse Scopus, EBSCO PsycINFO, EBSCO PsycARTICLES, EBSCO Business Source Complete, EBSCO EconLit with Full Text, EBSCO Risk Management Reference Center, and WISO (BLISS Betriebswirtschaftliche Literatur, ECONIS and Arbeitswissenschaftliche Literatur).

Titles, keywords and abstracts are searched, with numbers returned and numbers of relevant entries recorded. Where more than 1,000 articles are retrieved, the search is refined by adding excluding keywords to the search string (e.g., trade, policy, gender, woman, career, children, school, teach*, health) and for Elsevier databases by restricting the research to social science and humanities.

The structured keyword search is complemented by forward and backward tracing of citation though the function cited-in and the reference section of potentially relevant entries. The function cited-in is used, which means that the reviewer manually screened articles which cited potentially interesting articles. In addition, the reference section of potentially interesting articles is manually screened for further potentially relevant entries.

Table 1 provides an overview of the number of entries per search string and database. The number in parentheses indicates the number of potentially relevant entries according to the manual screening of the number of entries. The sum of 537 potentially relevant studies is further reduced because of doublings of studies and through the practical and the methodological screening.

Table 1 Number of entries (in parentheses number of relevant entries)

Search string / source	Risk Management Reference Center	psycARTICLES, psycINFO	EconLit	Business Source Complete	Science Direct	SciVerse Scopus	WISO
organi?at* AND (barrier* OR hurdle* OR impediment* OR obstacle*)	148 (5)	1,379 (8)	1,763 (6)	1,827 (35)	6,910 (2)	1,757 (0)	127 (13)
change* AND (barrier* OR hurdle* OR impediment* OR obstacle*)	100 (10)	7567 (11)	1,763 (0)	5,785 (18)	145,129 (307)	1,894 (16)	89 (8)
decision* AND (barrier* OR hurdle* OR impediment* OR obstacle*)	62 (2)	780 (7)	1,767 (0)	733 (13)	47,765 (0)	2,025 (1)	23 (1)
innovat* AND (barrier* hurdle* OR impediment* OR obstacle*)	31 (4)	371 (13)	1,754 (0)	760 (13)	34,047 (0)	1,698 (8)	13 (2)
transformat* AND (barrier* OR hurdle* OR impediment* OR obstacle*)	9 (0)	152 (4)	1,751 (0)	5,712 (1)	34,048 (1)	1,266 (1)	1 (0)
Barriere*	8 (1)	11 (2)	2 (1)	49 (6)	2,576 (0)	93 (3)	44 (0)
Hemmnis*	0 (0)	0 (0)	0 (0)	0 (0)	20 (0)	4 (2)	30 (5)
Hindernis*	4 (1)	0 (0)	1 (0)	8 (1)	67 (0)	11 (0)	51 (10)
Widerstand*	0 (0)	4 (0)	0 (0)	18 (0)	201 (0)	23 (1)	75 (4)

3.2 Practical screening

The selection of papers is limited to journal papers in order to generate a homogeneous basis for the analysis. As a "publication in top-tier journals serves as evidence of scholarship and potential impact on the field […] and has a direct effect on pay, promotion, and tenure decisions" (Podsakoff et al. 2005, p. 473), those are included in the analysis. However, the sample is extended by all further journal articles found, since, although the impact of journals rises with the rating results (Podsakoff et al. 2005), we are "careful not to draw strong conclusions from any studies based on such transitional assessments and rankings" (Adler and Harzing 2009, p. 91) and, thus, in the further analysis we assume that all articles have the same value regarding the identification of barriers.

To capture all empirical evidence we include qualitative and quantitative studies (Pittaway et al. 2004). We are interested in empirical findings, not conceptual or theoretical studies. This includes a great variety of research designs (Pittaway et al. 2004), ranging from the assessment of existing statistical data to interpretive methodologies of special cases. We decided to include papers based on empirical data on innovation barriers in one or more organizations. Aiming to capture the breadth of innovation barriers, we directed the search towards studies which researched more than one innovation barrier.

In summary, only studies which fulfill the following criteria are included: (1) the study is written in English or German, (2) the study was published as a journal article, (3) the study is based on empirical data, (4) the study investigates innovation barriers in one or more organizations (private or state-run organizations), and (5) the study addresses more than one innovation barrier.

3.3 Methodological screening: content analysis of the studies

In the next stage, the identified articles are subject to a double screening (Becheikh et al. 2006). With the aim of assuring excellent evidence, the relevance of the articles is judged by two reviewers. Only studies which fulfill the selection criteria are included.

In the third stage, the screening goes beyond title and abstract; the whole article is reviewed. Further studies are excluded because innovation barriers are not identified based on empirical evidence. By these means, 188 studies[1] that investigate innovation barriers are included for the following research synthesis.

We synthesize the studies by summarizing their findings (Tranfield et al. 2003). Therefore, we chose a content analysis approach (Krippendorff 2009) complemented by a citation analysis. To ensure a systematic data analysis (Gephart 2004) and to facilitate coding (Kelley et al. 2011) we use MAXQDA, a computer-aided qualitative data analysis program to analyze the studies.

Before coding the studies, a coding scheme is developed. The first section contains general bibliographic and methodological analyses of the studies such as by year,

[1] For a list of studies please contact the authors.

language, and journal, their research design (methodological approach, data collection method, data analysis method), and their source of data (size of organization, country, industry, level of innovativeness of organization). The industry is classified according to the NACE-Code (Eurostat 2008) and further grouped by the traditional arrangement of a primary, secondary, tertiary and quaternary sector (Kenessey 1987; Wolfe 1955). The next sections are devoted to innovation barriers classified according to the EOGI barrier model (see Fig. 1).

3.4 Citation analysis of the studies

While reviewing the articles, the impression is enhanced that the majority of studies seem to reinvent the wheel for their barrier analysis without acknowledging previous work in innovation barrier research. In order to explore how the studies relate to each other and how many citations exist in between the sample, a citation analysis is conducted by using HistCite, a software package for bibliometric analysis.

4 Results and discussion

4.1 Mapping the field: some general characteristics of the included studies

4.1.1 Publication year, language and journal

All identified studies were published between 1981 and 2012. Figure 2 indicates that the number of empirical studies on innovation barriers published in journals has risen in the last decade. As the search was conducted in June 2012, there might be further studies published in 2011 and 2012 which were not yet available through the database search.

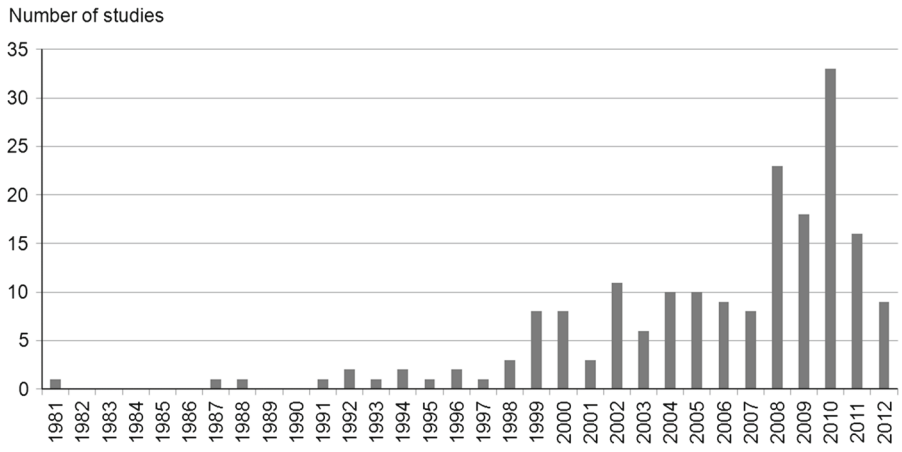

Fig. 2 Number of studies according to year of publication

Table 2 Number of ranked journals

Journal ranking	Number of studies
A	7
B	25
C	47
D	25
E	7
Not ranked in VHB Jourqual 2.1	77

Besides a vast majority of English-written papers analyzed in this study, also eight papers published in German are examined. The intention to lessen the language bias is contrasted by the fact that neglecting the eight studies written in German does not substantially alter the results. This is consistent with findings that language restrictions do not bias the results of meta-analysis (Moher et al. 2000).

Similarly, the reviewed studies have been collected from 147 different journals from different fields, for instance, management, information systems, technical, political, psychological, or health economics issues. With a total of six, the Journal of Cleaner Production comprised the largest number of studies, which is succeeded by five studies published in Information & Management and five in Technovation, followed by four in the Journal of Organizational Change Management. Furthermore, three studies were published in the following journals: Business Strategy and the Environment, Energy Policy, Long Range Planning, and Research Policy. The remaining 140 journals published one or two of the studies in our sample.

According to the VHB journal ranking Jourqual 2.1, which allows the classification of German speaking as well as the studies published in English, about two-thirds (112) of the studies are published in ranked journals, thereof the majority in B, C or D journals (see Table 2).

4.1.2 Research design, data collection and data analysis methods

Innovation barriers are researched with quantitative and qualitative oriented research designs (see Table 3). Our sample counts 128 surveys, 78 case studies, and eight action research studies. 21 studies combine two research methodologies. Data is collected through questionnaires, interviews, observation, document analysis, and combinations of those methods (see Table 3). Corresponding to the research design, the sample sizes range from 32 single case studies (e.g., Donaldson and Conway 2010) to large surveys which assess questionnaire data of up to 16,445 firms (D'Este et al. 2012). Twelve studies rely on existing data, for instance, national innovation statistics (e.g., Galia and Legros 2004). Seven studies do not report their data collection methods.

The innovation barriers are evaluated by a variety of data analysis methods (see Table 3): 89 studies use no statistics and rely on qualitative assessment methods. 54 studies use descriptive statistics and calculate percentages, frequencies, means, and standard deviation of the investigated innovation barriers, or apply descriptive statistical methods, for instance, variance analysis, factor analysis, and cluster analysis. 46 of the studies go beyond descriptive statistics and apply inferential statistical methods, for instance, t-tests, chi square tests, correlation coefficient, and regression. For the

Table 3 Research design, data collection and analysis

	Number of studies
Research design	
Survey	112
Case study	52
Case study combined with survey	16
Case study combined with action research	5
Action research	3
Data collection method	
Questionnaire	65
Interview	61
Observation	9
Document analysis	2
Combination of these data collection methods	51
Data analysis method	
Qualitative, no statistical method	89
Only descriptive statistics	54
Inferential statistics	45

latter, it might be a direction for future research to verify meta-analytical procedures for research synthesis.

4.1.3 Origin of the data: country, industry, size and perceived level of innovativeness of the organization

Table 4 shows the number of studies which use data of a certain country or continent. As some studies research data from several continents, they are counted several times; for example, one study assessed data from India, Sri Lanka, UK, and USA (Koh et al. 2008). In contrast to the bilingual search, the countries referred to in the studies are widespread. About half of the studies (92) research data from Europe. A similar amount of studies use data originating from North America (32 studies) and/or Asia (30 studies). Furthermore, 13 studies are based on data from Australia and/or New Zealand. Only four studies research Latin America and only two studies investigate data from Africa.

The sample consists of 162 studies with data from one country. Eight studies assess data originating from two countries (e.g., Johnson 2010; Lozano 2012). Six studies have more of a worldwide focus; for instance, one researches the US military stationed in Europe (Lam and Mackenzie 2005). Five studies researched international companies (e.g., Pardo et al. 2011; Ren 2009). One of those interviewed managers of Airbus, operating in 88 countries worldwide (Heinemann et al. 2010). The data of eleven studies could not be related to one or several countries.

The sample studies enlarge the focus beyond the North American and Anglo Saxon perspective (Anderson et al. 2004) by researching especially USA, UK, Germany, Australia, Canada, Italy, and Spain. The question of language bias due to the bilingual keyword search can be further rebutted due to the fact that the sample included 76

Table 4 Researched countries (studies using data from several continents or countries are counted several times)

Continent	States (number of studies)
Europe (92)	European Union (3), UK (32), Germany (14), Italy (7), Spain (6), Czech Republic, Denmark (4), Finland (3), Turkey (3), Greece (1), Slovenia (2), Albania (1), Austria (1), Croatia (1), Cyprus (1), Estonia (1), France (1), Ireland (1), Norway (1), Poland (1), Portugal (1)
North America (32)	USA (25), Canada (9), Mexico (2)
Latin America (2)	Brazil (2)
Asia (30)	India (8), China (5), Iran (3), Jordan (3), Pakistan (2), Singapore (2), Bahrain (1), Indonesia (1), Israel (1), Saudi Arabia (1), Sri Lanka (1), Taiwan (1), Thailand (1)
Africa (2)	Egypt (1), South Africa (1)
Australia (13)	Australia (12), New Zealand (3)

studies with data from non-English speaking and non-German speaking countries. Data is collected from a total of 43 different countries. The usual focus on Anglo-Saxon based research is contrasted by data from 23 European states and 13 Asian states. Despite the eight studies from India and five from China, there are only a few studies of research in emerging economies. Furthermore, our sample reveals little research in South America and Africa. Innovation barriers can be perceived differently depending on the national culture (van den Berg et al. 2000). Even if the barriers are similar despite different national cultures, the strategies to reduce them need to be adapted to the national culture (Jun et al. 2004). Therefore, intercultural comparisons and the influence of national culture on innovation barriers and on strategies to reduce them provide directions for future research.

Regarding the industry, 181 studies report the analyzed industry. Thereof, 57 studies are classified as intersectional. The others focus mainly on the secondary sector (49 studies on manufacturing, 9 on construction) and tertiary sector (55 studies on services). For a more detailed specification according to NACE see Fig. 3.

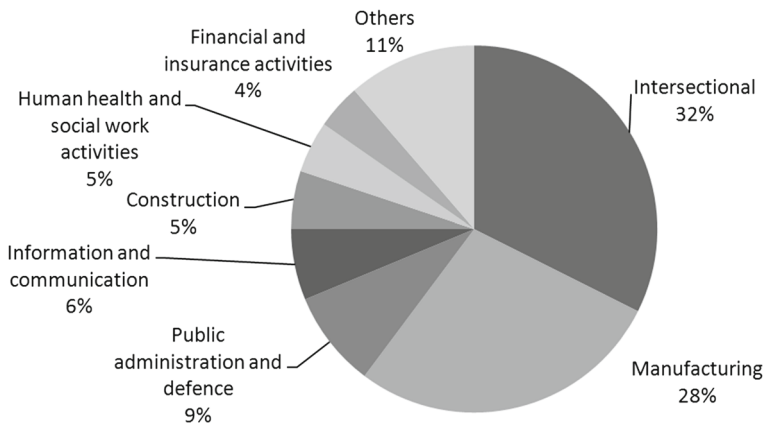

Fig. 3 Industries analyzed by the studies

All sizes of organizations are analyzed: 36 of the studies focus on SMEs (e.g., Al-Allak 2010; Hadjimanolis 1999; Larsen and Lewis 2007), 40 studies research large organizations (e.g., Ettlie and Rubenstein 1981; McLaughlin et al. 2008), and 54 of the studies analyze organizations of various sizes (e.g., Jun et al. 2004). 58 studies do not report the size of the researched organizations.

About a third of the studies (64) report about the level of innovativeness of the investigated organization.[2] Those studies can be further differentiated in three groups: innovative (13 studies, e.g., Storey 2000; Tourigny and Le 2004), non- or least innovative (six studies, e.g., Loukis et al. 2011; Türkeli and Erçek 2009), and mixed sample (45 studies, e.g., MacGregor and Kartiwi 2010; Nelson and Rottman 1996).

A variety of classification criteria to identify innovative organizations is applied: One study based its selection on interviews and literature review (Ren 2009). Other studies relied on evidence of innovation, for instance, innovation awards (e.g., Borins 2000; Larsen and Lewis 2007), "at least one accepted patent during the observed period" (Mellahi and Wilkinson 2008, p. 683), R&D activities in a certain period (Morandi 2009), and recently introduced a new product or process (Harms and Meierkord 2008; Tourigny and Le 2004; Vermeulen 2004). Another selection criteria for surveyed organizations is their leadership in the industry (e.g., Pan 2010) or because they declared innovation a serious goal of their organization (Storey 2000). One study investigated an innovation leader which failed during the researched innovation process (Scarbrough and Lannon 1988). This variety of ways to identify innovative organizations and especially the latter mentioned study prompts the questions: How to measure the level of innovativeness and how to define innovators and delimit them from non-innovators in future barrier studies? Are there differences in the perception of barriers depending on the innovativeness of an organization?

Twelve studies with a mixed sample deal with the second question by comparing the results regarding the innovativeness of the organization. Interesting is the "rather counter intuitive finding" that the level of innovativeness is not correlated with the perceived importance of barriers (Hadjimanolis 1999, p. 566). The missing link could be rebutted with shortcomings of the study, as the study itself remarks that "truly innovative firms […] are rather rare" in the researched context (Hadjimanolis 1999, p. 563). In addition, those findings are contrasted by two studies which narratively report differences in the perception of barriers depending on the innovativeness of the responding organization (Nečadová and Scholleová 2011; Nielsen et al. 2000). One study summarized the results of those different perceived barriers and derived recommendation for future projects (Kim et al. 2005).

One study finds that incentives for adopters are regarded as barriers by non-adopters (Wymer and Regan 2005). Another study finds very few differences, only 2 of 38 statements differ significantly (Archer et al. 2008). Two other studies confirm that adopters perceive lower barriers than non-adopters (Duh et al. 2006; Fletcher and Wright 1995). This is confirmed by a study which surveyed respondents on their perceived least and most successful project; the first faced significantly more difficulties (Suwardy et al. 2003).

[2] We thank an anonymous reviewer for adding this point.

In contrast to those results, two large scale studies provide empirical evidence that innovative organizations are more sensitive to barriers and more likely to report them (Baldwin and Lin 2002; Galia and Legros 2004). These ambiguous findings are explained by a recent study (D'Este et al. 2012) which identified a non-linear relationship between the level of innovativeness and perceived barriers, which is curvilinear for barriers related to costs and market.

In sum, the findings indicate that the perception of innovation barriers differs depending on the level of innovativeness of the organization; however, the nature of this relationship needs to be clarified.

4.2 Synthesis of identified innovation barriers across four levels of analysis

4.2.1 External barriers

About half of the studies (98) mention external innovation barriers (see Table 5). A new sub-category emerged under external stakeholders: 15 studies mention innovation barriers related to partners, for instance "cooperation with other firms" (Tourigny and Le 2004, p. 220), which could not be classified in one of the previously identified external stakeholders. Further research should clarify if this sub-category is needful or if it can be more differentiated and merged with customers, suppliers etc.

External innovation barriers begin with funding difficulties (Hadjimanolis 1999; Herath 2010; Love et al. 2001), which relate to the stakeholder *investor*, recruiting difficulties (Gocmen and Ventura 2010; Hueske et al. 2014), which relate to stakeholder *potential employee*, and supply difficulties, which relate to the stakeholder *supplier*, such as lack of expertise (e.g., Wirtz et al. 2010), resistance (e.g., Zutshi and Sohal 2004), and lack of cooperation(e.g., Jun et al. 2004).

*Competitor*s can raise further barriers along the innovation value-added chain through market power (e.g., Reynolds and Hristov 2009) or by copying the innovation (Hadjimanolis 1999). Interesting is the fact that competitor behavior as innovation barrier depends on the point of view. Competitors could act as an innovation driver by setting a new standard, which urges the competitors to follow. However, the potential to easily copy an innovation can act as innovation barrier (Hadjimanolis 1999; Oke 2004). Although, an easy to copy innovation induces fast followers and progress in the industry, the inventing organization might neglect the innovation because the cost for research and development might not be recovered.

The stakeholder *customer* plays a similarly ambitious role. Research identified customers, especially large customers in asymmetric business to business relationships and end-consumers, as drivers for innovation (Walker et al. 2008). Retrospective on 25 years in product innovation research, Cooper identified dedication to customer as a critical success factor (Cooper 1999). Empirical evidence still confirms that lack of demand causes innovation failure (e.g., Galia and Legros 2004; Mudgal et al. 2010; Tourigny and Le 2004). In addition, customers are accused of causing innovation barriers because of resistance or lacking knowledge or awareness (Bala et al. 2008; Faisal 2010). Consequently, the innovation needs to fit with customer requests or

Table 5 Barriers related to external stakeholders

Sub-category	Number of studies	Exemplary quotes
Investor	21	"Lack of venture capital" (Hadjimanolis 1999, p. 567), "problems obtaining external funding" (Herath 2010, p. 271), "amount of available credit" (Love et al. 2001, p. 37)
Potential employee	5	"Staffing availability/ recruiting" (Gocmen and Ventura 2010, p. 177), "lack of experts" (Nečadová and Scholleová 2011, p. 835)
Supplier	21	"Resistance from suppliers" (Zutshi and Sohal 2004, p. 348), "missing experience of the suppliers" (Wirtz et al. 2010, p. 29), lack of preparedness on side of suppliers" (Mudgal et al. 2010, p. 90), "no joint planning with supplier" (Jun et al. 2004, p. 67), support from vendors" (Waldron 2005, p. 247)
Competitor	24	"Competitors may interfere/influence other trading partner" (Koh et al. 2008, p. 260), "market dominated by established companies" (Reynolds and Hristov 2009, p. 323)
Customer	36	"Lack of knowledge" (Bala et al. 2008, p. 1617), "customers are not familiar with" (Bazini et al. 2011, p. 6), "lack of consumer concern" (Faisal 2010, p. 181), "Customer reluctance" (González-Torre et al. 2010, p. 896)
Partners	15	"Technological incompetence within trading partners" (Koh et al. 2008, p. 260), "cooperation with other firms" (Tourigny and Le 2004, p. 220)
State	64	"Laws and regulation" (Abdul-Hadi et al. 2005, p. 311), "institutional-related problems stem from taxation practices involving R&D investment, tax credits and capital cost allowances, and from government regulations and standards" (Baldwin and Lin 2002, p. 17), "legal concerns" (Bazini et al. 2011, p. 6), "lack of support and guidance from regulatory authorities" (Mudgal et al. 2010, p. 90), "not yet required by legislation" (van Hemel and Cramer 2002, p. 444)
Society	14	"Lack of public media interest" (Faisal 2010, p. 184), "Societal readiness" (Lam and Mackenzie 2005, p. 74), "community concerns" (Post and Altman 1994, p. 77)

convince the customer to generate demand otherwise innovation barriers in the form of lack of demand or even resistance might arise.

Two-thirds of the studies (64) which identify external innovation barriers refer to the stakeholder *state*. Innovation barriers are caused, on the one hand, by the regulatory constraints (e.g., Larsen and Lewis 2007; Wirtz et al. 2010; Ozgen and Olcer 2007) as well as unclear or unstable legislation (e.g., Doniec et al. 2002); on the other hand, lack of government support (e.g., Madrid-Guijarro et al. 2009) and no strict legislation, e.g., environmental standards (van Hemel and Cramer 2002) can be identified.

Innovation barriers related to *society* are likewise characterized by two extreme poles: Innovation needs to convince the society either of its harmlessness (Hueske et al. 2014; Post and Altman 1994) or make society aware of the usefulness of the innovation to promote it (e.g., Faisal 2010).

This wide range of innovation barriers highlights the need for a detailed innovation barrier analysis. The ambiguous findings stress the context specificity of innovation barriers. No study researches all identified external stakeholders. Only one study investigates innovation barriers related to investor, supplier, competitor, customer, state and society (Walker et al. 2008). The external innovation barriers identified by 38 studies relate only to one external stakeholder, especially the state, which is mentioned by 19 of those studies. These results raise the question of whether external innovation barriers are less important or whether the study design does not allow for the identification of them. We expect that a study design accounting for external barriers structured according to external stakeholders provides a more detailed specification than solely distinguishing in external and internal barriers. Future studies researching external innovation barriers should consider two points: First, each external stakeholder needs to be examined for his/her potential to hamper innovation. Second, acknowledging the ambiguous findings and the context specificity of innovation barriers, each identified stakeholder needs to be investigated regarding how he/she hampers the innovation.

Consequently, strategies to overcome external innovation barriers vary according to the specific situation. Stakeholder integration can help to overcome barriers (Delgado-Ceballos et al. 2012). Integrated supply chain management enhances the mutual understanding and the cooperation with suppliers, investors and customers, for instance, large organizations can train their suppliers with regard to quality related innovation (Antony et al. 2008). Another example is to involve end-users in product and service development (e.g., Anumba et al. 2006; Butler 2006; Kunda and Brooks 2000) to correspond to the customers' needs instead of blaming customers for their lack of demand. Another strategy is to choose customers which fit to the innovation (Peltola 2012).

Concerning the relationship with the state, the organizations need to rely on active exchange to communicate their need for a clear and applicable legal framework (e.g., Schleich 2009) as well as tailored measures to promote innovation, for instance subsidies or favorable taxation (e.g., Borins 2000; Ettlie and Rubenstein 1981; Stewart et al. 2004). Likewise, active stakeholder management is required to establish and keep a good relationship with society. Assessment of the social and environmental consequences in parallel to the innovation process responds to concerns within the society, for instance, eco-assessments need to be integrated in the R&D activities of eco-innovation based on nanotechnology (Kristensen et al. 2009).

4.2.2 Organizational barriers

Barriers related to organizational level are researched by 185 studies (see Table 6).

The reviewed studies address all sub-categories based on the managerial levers of dynamic capabilities. With 99 studies, half of the studies research at least three categories. *Strategy*-related innovation barriers are short-term orientation (e.g., Al-Allak 2010; Antlová 2009), unclear or even no strategy (e.g., Fard et al. 2011; Hrebiniak 2006), and other priorities and goals (e.g., Ren 2009). Inadequate organizational *structure* includes inconsistencies with existing processes and rules, bureaucracy or performance measurement (Fard et al. 2011; Loukis et al. 2011), which hampers innovation. The most often identified innovation barrier (157 studies) relates to the lack of

Table 6 Barriers related to the organizational level

Sub-category	Number of studies	Exemplary quotes
Strategy	105	"Lack of clear business strategies" (Al-Allak 2010, p. 93), "missing long-term corporate strategy" (Antlová 2009, p. 151), "unclear goals" (Fard et al. 2011, p. 390), "Inaccuracies in strategic business planning" (Ali and Hadi 2012, p. 267), "No clear DBM strategy" (Fletcher and Wright 1995, p. 120), "Poor or vague strategy" (Hrebiniak 2006, p. 17), "lack of prioritization" (Ren 2009, p. 296)
Structure	121	"Bureaucratic resistance" (Borins 2000, p. 61), "Inappropriate organizational structure" (Fard et al. 2011, p. 397), "inability to specify performance measurement" (Fard et al. 2011, p. 397), "Inconsistency with existing internal processes, rules and regulations" (Loukis et al. 2011, p. 139)
Size	11	"Firm size" (Johnson 2010, p. 169), "scale of operation is too small" (Herath 2010, p. 271), "the older, larger, and more successful organizations become, the more likely they are to have a large repertoire of structures and systems which discourage innovation" (Salaman and Storey 2002, p. 161)
Resources	157	"Lack of resources and resource allocation" (e.g. Fard et al. 2011), "lack of resources, including time, access to research articles and funding" (Manuel et al. 2009, p. 621) "lacked the necessary financial resources" (Geri and Ahituv 2008, p. 355), "inadequate funding" (McGaughey and Roach 1997, p. 258), "Lack of time and resources" (Evangelista et al. 2010, p. 40), "Insufficient people" (Duh et al. 2006, p. 946), "shortage of personnel" (Mohnen et al. 2008, p. 204)
Organizational culture	38	"Organizational culture incompatible" (Ali and Hadi 2012, p. 267)
Organizational learning	44	lack of training (e.g. Arevalo and Aravind 2011; Chadha and Kapoor 2010; Delgado-Ceballos et al. 2012; Magd 2010), learning difficulties (Cicmil 1999; Heide et al. 2002)

resources concerning finances, time or staff and resource allocation (e.g., Fard et al. 2011; Evangelista et al. 2010; Storey 2000). Resources, structure, and strategy seem to be the most important issues on the organizational level. However, the findings indicate that organizational learning, organizational culture, and size should be included for a comprehensive analysis of barriers on the organizational level.

The empirical findings concerning the *size* of the organization are ambiguous as both, small size (Herath 2010) as well as large size (Salaman and Storey 2002, p. 161), constitutes an innovation barrier. Besides the focus on size as innovation barrier, 76 studies focus their research either on SMEs or on large organizations. 54 studies use samples including different sizes. This indicates awareness of the fact that innovation is influenced by the size of the organization. Lack of support or even conflicting *organizational culture* hampers innovation (e.g., Ali and Hadi 2012; Hernández-Mogollon 2010) as well as *organizational learning*, which is often identified in the form of lacking training (e.g., Arevalo and Aravind 2011; Chadha and Kapoor 2010; Delgado-Ceballos et al. 2012). As in the case of the external environment, future research on the organizational level can benefit from accounting for all categories.

The identified innovation barriers highlight the need that the innovation is aligned with existing strategy, structure, size and culture of the organization as well as its organizational learning capabilities to identify potential conflicts and avoid or reduce the relating barriers. Consequently, if the innovation aims to change the strategy, size or culture, this related potential for resistance should not be neglected but actively addressed by, for example, redefining the strategy of an organization (Giacomazzi et al. 2004), overcoming mismatches between organizational culture and the innovation through a change agent which ignores the culture (Gordon and Gordon 1992) or an external person countering the organizational culture (Yauch and Steudel 2002), or deciding to manage around the culture by demonstrating how the innovation supports the culture (Gordon and Gordon 1992), or changing the organizational culture, which is difficult (Gordon and Gordon 1992; Hoonakker et al. 2010). The reward system needs to be reviewed to overcome innovation barriers and provide incentives for innovation (e.g., Jun et al. 2004; Kunda and Brooks 2000). Lack of resources relates to the attitude of managers, who can promote innovation through the provision of resources and training (Aggarwal 2003). Training and communication which relate to organizational learning are identified as significant factors to reduce barriers (e.g., Okumus and Hemmington 1998).

4.2.3 Group level barriers

32 studies investigate innovation barriers related to the group level (see Table 7). Only five studies can be classified in two or three sub-categories (e.g., Sedmak 2010; Vermeulen 2005). The group level seems to lack extensive research, which indicates a need for future innovation barrier research on the group level in general and a more detailed research on this level by acknowledging all sub-categories on the group level.

Team structure can hamper innovation barriers if the groups are too large (Antony et al. 2008) or if the people involved have different goals and values (Niazi 2009). Other issues are the temporality of groups (Lederer and Sethi 1992, p. 79) and "personnel shortage" (Antony et al. 2008, p. 486). These findings underline that the group needs to fit with the organizational structure and targets to avoid conflicting priorities.

Innovation barriers concerning *team climate* are caused by the protection of own interests (Sedmak 2010) and work unit thinking (Tan and Heracleous 2001). *Team processes* are hampered by lack of team building (Hoonakker et al. 2010), which can be increased due to groups which are too large, have different members with contrary objectives, and lack of communication. Furthermore, findings confirm innovation barriers based on *composition of members depending on their characteristics*, like different perceptions and goals (Kunda and Brooks 2000) or lack of knowledge and skills of group members (Jun et al. 2004; Kim et al. 2005). Lack of leadership (Martini and Pellegrini 2005; Yauch and Steudel 2002) and "management commitment" (e.g., Fard et al. 2011, p. 397), which is classified as a barrier related to managers' attitudes, are innovation barriers related to *leadership style*. Although at least five studies can be classified in one of the sub-categories on the group level, no study researched all five sub-categories of the group level identified by the state of the art review on innovation research (Anderson et al. 2004).

Table 7 Barriers related to the group level

Sub-category	Number of studies	Exemplary quotes
Team structure	6	"Team too large" (Antony et al. 2008, p. 486), groups are not permanently anchored in the organizational structure: "No permanent IS planning group" (Lederer and Sethi 1992, p. 79)
Team climate	9	"Work units trying to outdo one another, making passing off hard cases" (Tan and Heracleous 2001, p. 371), "team members protecting their interests" (Sedmak 2010, p. 8)
Team processes	5	"Lack of effective teams and/or team building skills" (Hoonakker et al. 2010, p. 961)
Members' characteristics	6	"Different perception [,] different goals" (Kunda and Brooks 2000, p. 720), "Lack of people experienced in earlier implementations" (Jun et al. 2004, p. 164; Kim et al. 2005, p. 67)
Leadership style	11	"No project leader or champion" (Yauch and Steudel 2002, p. 612)

In order to reduce those barriers, we renew the call for team training (Dwyer and Doyle 2002) and true cross-functional teams, which means assigned team members, cross-functions having an equal influence, and a dedicated and accountable leader (Cooper 1999). Likewise, one strategy to overcome different perceptions is providing the organizational members with opportunities to informally exchange, which can resolve differences (Kunda and Brooks 2000). In addition to education on team work and more exchange, jobs and tasks need to be designed in a manner to promote and reward team work especially in individualistic national cultures (Ali and Hadi 2012).

4.2.4 Individual level barriers

One hundred and sixty-four studies investigate innovation barriers classified on the individual level. According to the stakeholder theory, we classify innovation barriers to managers (116 studies) and employees (128 studies) as internal stakeholders, and further differentiate them in ability and attitude related studies (see Table 8).

The most frequently mentioned innovation barriers on the individual level relate to managers' attitudes and employees' abilities and attitudes. Only 47 studies name *managers' abilities*, like expertise, management and leadership skills (e.g., Adams and McNicholas 2007; McGaughey and Roach 1997; Ozorhon et al. 2005). Vitally, more studies (89 studies) identify *manager's attitudes*, especially lack of commitment (e.g., Arevalo and Aravind 2011; Fard et al. 2011; Jacobs et al. 2006; Tamimi and Sebastianelli 1998), as an innovation barrier. A comparable number of studies investigate employees' attitudes and ability. In addition to knowledge, experience and skills, innovation barriers concerning *employees' abilities* include shortage of suitable staff (e.g., Peltola 2012; Salomone 2008; Scupola 2012). *Employees' attitudes* relate to resistance to change caused by the potential loss of status or habits (e.g., Delgado-Ceballos et al. 2012; Loukis et al. 2011) as well as the unawareness or the lacking

Table 8 Barriers related to individuals within the organization

Sub-category	Number of studies	Exemplary quotes
Managers' abilities	47	"Lack of experience and knowledge on the part of the managers" (Adams and McNicholas 2007, p. 396), "managers lack capabilities to implement change management" (Čater and Pučko 2010, p. 215), "managers lacking business/training skills" (Simkin 2002, p. 13), "inadequate leadership" (McGaughey and Roach 1997, p. 258)
Managers' attitudes	89	"Lack of management commitment" (e.g. Fard et al. 2011, p. 397), managers' resistance to change (Madrid-Guijarro et al. 2009, p. 476), "hampered by manager's unwillingness" (Salaman and Storey 2002, p. 160), "poor management attitude" (Baldwin and Lin 2002, p. 17)
Employees' abilities	73	"Workers do not have the necessary skills/education" (Arevalo and Aravind 2011, p. 409), "lack of skilled worker" (Hoonakker et al. 2010, p. 961), "not having the right skills-set to cope with the new technical environment constitutes a crucial issue" (Raus et al. 2009, p. 252), "employees with low abilities" (Seifi and Sazvar 2012, p. 855)
Employees' attitudes	85	"Our employees preferred the old ways of doing business" (Archer et al. 2008, p. 76), "hesitation and unwillingness of some employees" (Loukis et al. 2011, p. 139), "fear of changing the way they do things" (Ngai et al. 2008, p. 230), "key people considered the effort to be useless, believing that the status quo was good enough" (Bhuiyan and Alam 2005, p. 181)

understanding of the innovation's usefulness (e.g., Bhuiyan and Alam 2005; Fiedler 2010; Gocmen and Ventura 2010).

Eighty studies investigate innovation barriers related to managers and employees. 36 studies relate their innovation barriers only to managers and 48 studies focus only on employees. Disregarding the distinction in internal stakeholders, 104 studies could be classified in ability and 125 studies could be classified in attitude. In sum, only five studies are classified in all four sub-categories. This prompts the question if the other studies might have missed the identification of potential innovation barriers on the individual level. Consequently, the differentiation of innovation barriers according to the matrix in manager versus employee and ability versus attitude should guide further research on the individual level towards an encompassing identification of innovation barriers on the individual level.

Another direction for further research on this level of analysis might be the appliance of the five factor model (McCrae and Costa 2004) as the influence of individual entrepreneur characteristics on innovation is confirmed by a variety of studies (Zhao and Seibert 2006). The majority of the investigated studies provide no or very little information to characterize the individuals. With the exception of one study (Krieges-

mann et al. 2008), which surveyed promoters of innovation, no study provides much information about the individuals. The majority (118 studies) reports only the position or function within the organization. The remaining 69 studies provide information of the investigated organizations. One of these studies measured top management risk posture (Aggarwal 2003). Some studies based on interviews provide some exemplarily quotes to illustrate the barriers, but it is not possible to conclude about the individuals much more in detail than what is done with the categories abilities and attitudes.

Several strategies address barriers on the individual level: At the beginning stands "effective staffing" (McGaughey and Snyder 1994, p. 252), which means to hire employees and managers with appropriate abilities and attitudes, which relates to potential employees as a sub-category of the external environment. Innovation barriers caused by abilities can be reduced by educating and training to build the needed skills (e.g., Gocmen and Ventura 2010; McGaughey and Snyder 1994; Zutshi and Sohal 2004). Communicating the innovation and its benefits is identified as "the most important factor" (Okumus and Hemmington 1998, p. 285). Consequently, attitude can be changed by communicating the benefits and need for innovation to convince the organizational members (Antony et al. 2008; Stewart et al. 2004). One study even recommends the strategy of "scaremongering" to create uncertainty and a climate wherein the innovation appears valuable (Harris 2000, p. 862). Effective communication means that the organizational members affected by the innovation need to be involved, and fears and prejudices need to be addressed via education and training (McGaughey and Snyder 1994; Okumus and Hemmington 1998; Zutshi and Sohal 2004). Resistance management needs to be addressed as a content-related activity in a change process (Fiedler 2010). Another approach to reduce barriers on the individual level is the focus on individuals open-minded towards the innovation, which can act as champions for innovation (Dibb et al. 2008; McGaughey and Snyder 1994; Walker et al. 2008). In sum, barriers identified on the individual level relate to barriers on the organizational level as well as to the external environment. Communication and education are central as strategies to reduce barriers on this level of analysis.

4.2.5 Innovation barriers across levels

The synthesis on the four levels of analysis indicates that not all studies investigated barriers on all levels of analysis. The emphasis is on the organizational and individual levels, whereas the research of the external environment and the group level seems fragmented. These results are confirmed by Fig. 4, which summarizes how the studies combine different levels of analysis. No study within our sample focuses only on group or external environment. The focus is on individual and organizational levels (58 studies) combined with external environment (64 studies) or combined with group level (20 studies). 16 studies identified innovation barriers on all levels of analysis.

These results raise a question: How interrelated is the innovation barrier research? Which of the analyzed studies relate to each other? Therefore, we conduct a citation analysis.

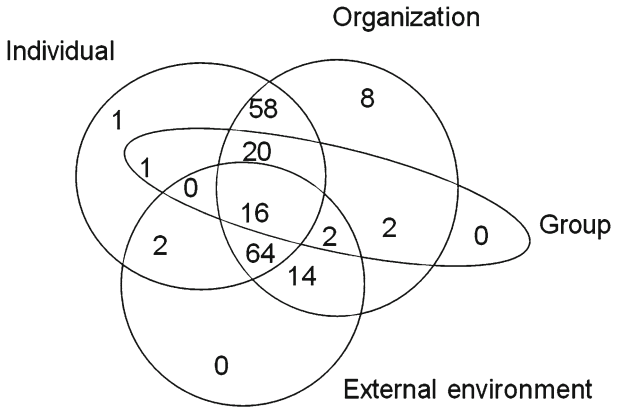

Fig. 4 Levels of analysis researched by the studies

4.3 Fragmented research

The citation analysis reveals that in 30 out of 188 studies the authors cite other studies of the sample; all other studies do not refer to any other barrier study within the sample. Fig. 5 shows the citation relationships between the reviewed studies.

The studies are ordered according to the year of publication beginning with the oldest studies on the top. Citation is shown by arrows. The majority of studies remain unrelated: 130 studies are neither cited nor cite any other studies within the sample. Eighteen studies are only related as pairs.

However, three arboreal constructs emerge. The first one, most left-hand in Fig. 5, is based on two studies analyzing innovation in small and medium-sized enterprises (Hadjimanolis 1999) and advanced technology adoption (Baldwin and Lin 2002), which are both cited four times within the sample. Some citing studies share the

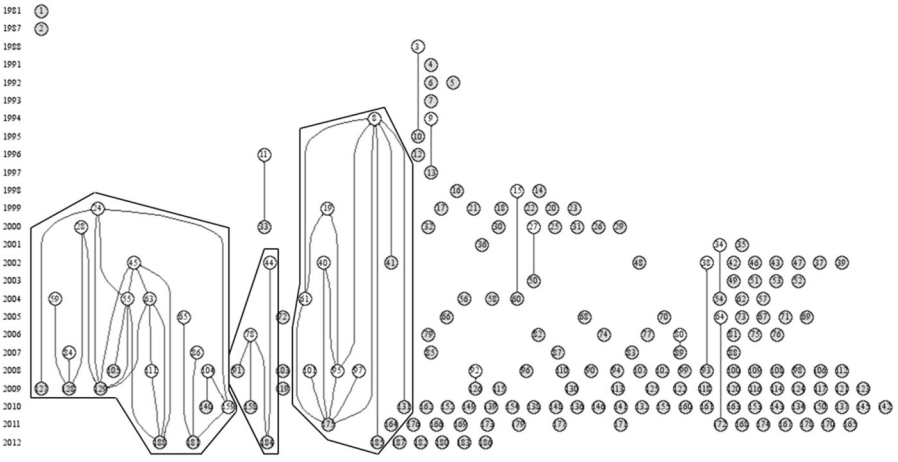

Fig. 5 Citation analysis graph

research interest on innovation in SMEs (Hadjimanolis 1999; MacGregor and Kartiwi 2010; Madrid-Guijarro et al. 2009; Radas and Božić 2009; Tourigny and Le 2004). Another aspect cited is the finding that barriers are not correlated to innovation (Hadjimanolis 1999; Radas and Božić 2009). Furthermore, like innovation in Cyprus (Hadjimanolis 1999), other citing studies focus on innovation barriers in a special country (Baldwin and Lin 2002; Doloreux and Melançon 2008; Galia and Legros 2004; Storey 2000). A current study (Al-Weshah and Al-Zubi 2012) within this network picks previous studies focusing on data from Asian countries (Al-Qirim 2007; MacGregor and Kartiwi 2010; Sun et al. 2011). Another current study (D'Este et al. 2012) references studies which identified innovation barriers based on national statistic surveys (Baldwin and Lin 2002; Galia and Legros 2004; Mohnen et al. 2008; Tourigny and Le 2004).

The second arboreal construct focuses on barriers to strategy implementation (Ali and Hadi 2012; Harms and Meierkord 2008; Hrebiniak 2006; Pucko and Cater 2008; Pucko and Cater 2008).

The third and oldest citation stream roots in a study on managing the environmental change process (Post and Altman 1994), which is cited by six other studies and thereby the most frequently cited study within the sample. Barriers to environmental innovation are categorized into industrial and organizational barriers (Post and Altman 1994), which is adopted by citing studies (Chan 2008; Delgado-Ceballos et al. 2012; González-Torre et al. 2010; Harris and Crane 2002; Zutshi and Sohal 2004). Studies which reference this root study (Post and Altman 1994) also cited two other studies (Quazi 1999; van Hemel and Cramer 2002) in a similar context. A current study on adoption of proactive environmental strategies (Murillo-Luna et al. 2011) enlarges the citation relationship by referring to those studies (Chan 2008; Post and Altman 1994; Zutshi and Sohal 2004) and by linking other studies concerned with environmental issues (Shi et al. 2008; Walker et al. 2008).

This systematic review and the EOGI barrier model developed in this article contribute to overcoming this fragmentation of barrier research. It can provide guidance for further studies to identify innovation barriers in a more comprehensive and systematic manner.

5 Conclusion and implications

Minimizing innovation barriers is "key to innovative success" (Hall and Martin 2005, p. 274). Learning from mistakes motivates learning more than success (Eisenhardt and Martin 2000). The variety of identified innovation barriers stresses the fact that innovation barriers need to be acknowledged during the innovation process. Despite its relevance for researchers and practitioners, our citation analysis exposes the fragmentation of this stream of research. Therefore, our first contribution is the synthesis of 188 empirical innovation barrier studies, which are conducted over a period of more than 30 years in a multiplicity of different contexts. Thereby we summarize the state of the art and demonstrate the multiplicity of innovation barriers. Beside the fact that the citation analysis revealed the fragmentation of this stream of research, four citation streams demonstrate that previous findings can inform future research.

Second, we adopted a systematic review method followed by a synthesis (Fink 2010; Tranfield et al. 2003), which remains still relatively rare (Crossan and Apaydin 2010). Even though the reviewed studies are multifaceted with regards to their research design and level of analysis, they can inform each other about their findings concerning innovation barriers and how they manifest themselves (Hueske et al. 2014). As with other reviews, the limitation of this study is that even though we used several renowned databases, the selection of databases and some chosen selection criteria may have omitted some potential studies. The rigorous review method should counteract and reduce the probability that critical information is not included in the review which would substantially alter our results. This is exemplarily proven by the fact that removing the studies written in German would not change our conclusion to a large extent.

Our third contribution is the proposed multilevel EOGI barrier model (see Fig. 1), which classifies manifestations of innovation barriers in external environment, organization, group, and individual levels. Furthermore, we distinguish sub-categories of those levels of analysis grounded on stakeholder theory and managerial levers of dynamic capabilities as well as on empirical findings in innovation barrier research. Those theoretical lenses allow the analysis from different perspectives towards a more encompassing identification of innovation barriers. The reviewed studies research a variety of barriers in multiple settings. Therefore, the EOGI barrier model is not limited to a special type of innovation in a special setting, but is transferable to research driven by the question: What hampers innovation?

Beyond the identification of innovation barriers and directions for future research, the fourth contribution of this paper addresses strategies to overcome those barriers. Although 96 studies mention strategies to deal with innovation barriers, there are findings which indicate that organizations tend to ignore or live with innovation barriers; however, more awareness of the cause and effects could have prevented several crisis situations (Larsen and Lewis 2007).

As a fifth contribution we provide five directions for future barrier research and implications for managers.

5.1 Implications for future research

This paper demonstrates that barrier research benefits from building on previous empirical findings as well as on conceptual work. Scholars can use the EOGI barrier model as a guideline to (1) identify innovation barriers with regard to four levels of analysis grounded on a theoretical basis and (2) how barriers manifest themselves in the specific research context. In sum, the proposed EOGI barrier model enriches future research by a multilevel perspective grounded on theory. The general barrier research question: "What hampers innovation?" is specified aiming at more encompassing barrier identification: "Which barriers arise on each sub-category of each level of analysis?"

Our research synthesis indicates the following directions for future research: (1) multiple levels of analysis, (2) multiple sub-categories of each level of analysis based on theory, (3) interaction of innovation barriers, (4) context specificity, and (5) origin of data.

The first direction for future research is that innovation barriers are a multilevel phenomenon. However, only 16 of 188 studies identified manifestations of barriers on the four levels of analysis: external environment, organization, group, and individual. The high amount of studies which do not explicitly address multilevel research is contrasted by innovation barriers identified on four levels of analysis. This provides empirical evidence that innovation barriers can arise on all four analyzed levels. Consequently, limiting the analysis to one level of analysis tends to neglect potential innovation barriers. Referring to the claim for multilevel approaches in innovation research (e.g., Anderson et al. 2004; Crossan and Apaydin 2010; Mirow et al. 2007), we call for multilevel research for identifying barriers to innovation.

Furthermore, these levels of analysis are characterized by several sub-categories. The manifestations of innovation barriers investigated by 188 empirical studies are classified in the EOGI barrier model. Aside from the individual level, no study identified innovation barriers on all sub-categories of a certain level. The review indicates that the three most frequently researched innovation barriers are related to the organizational level: resources, structure, and strategy. Ranks four to six are related to the individual level: managers' and employees' attitudes and employees' abilities. Those are followed by external innovation barriers related to the external stakeholder state. This raises the questions: What about the group level and its sub-categories? What about the other sub-categories of the different levels of analysis? The analysis of the external environment could be complemented by acknowledging all external stakeholders. The identification of barriers on the organizational level can go beyond strategy, structure, and resources. Viewing the organizational level through the lenses of dynamic capabilities complements the analysis of strategy, structure, and resources by two other important aspects: organizational learning and organizational culture, which are vital for innovation (Crossan and Apaydin 2010). However, size should not be neglected (Anderson et al. 2004). There are only a few studies on the group level and those fall short of encompassing all sub-categories. Similarly, the analysis on the individual level could be enhanced by acknowledging managers and employees with their attitudes and abilities. Applying the five factor model (McCrae and Costa 2004) could detail this classification on the individual level driven by the question: How do the characteristics of organizational members', i.e. internal stakeholders, hamper innovation?

This individual level approach could be enriched by the group level: How does the composition of individual members with their characteristics influence the perception of innovation barriers? Future research in this direction could enrich our understanding of barriers on the individual and group levels and how they interact with each other. As no study is conceptualized as a multilevel study, this review is limited to the identification of barriers. The third direction for future research focuses on the interactions of innovation barriers within and across levels of analysis: How do innovation barriers on the same as well as on different levels of analysis influence each other?

The fourth direction for future research is the context specificity of innovation barriers. Classifying the innovation barriers in the levels of analysis with their subcategories of the EOGI barrier model identified a variety of manifestations of barriers and revealed, at first glance, ambiguous findings. Customers as drivers of innovation

are contrasted by findings that customers hamper innovation. Looking into the context, the simple statement needs to be clarified. There seems to be a mismatch between innovation and customer demand. Similar findings are revealed for innovation barriers related to the state. Either too strict regulation or no regulation is claimed as innovation barrier. These findings reveal context-specificity regarding how innovation barriers manifest themselves. This has important implications for future questionnaire-based surveys. Context specificity is difficult to capture in general items; thus, those items need to be interpreted with caution. Further clarification and specification to the setting, for example through workshops or interviews, is needed to develop strategies to reduce and overcome the identified innovation barriers.

The fifth direction for future research goes beyond the EOGI barrier model and concerns the origin of the data. There is little research in South America and Africa. Future studies should ask: What are the differences between developing, newly industrialized, and developed countries? In addition, findings reveal differences in the perception of barriers and in strategies to reduce them depending on the national culture (Jun et al. 2004; van den Berg et al. 2000). How does national culture influence the perception of innovation barriers? How do strategies to overcome innovation barriers need to be adapted to the specific context?

Another aspect of origin of the data is the level of innovativeness of the investigated organization. Only a minority of studies consider that the level of innovativeness might influence the perception of innovation barriers (e.g. Baldwin and Lin 2002; D'Este et al. 2012; Galia and Legros 2004) and those provide ambiguous findings. Therefore, future research should investigate: How are innovation barriers perceived depending on the level of innovativeness of the investigated organization? What is the relationship between innovativeness of the organization and the perception of barriers?

5.2 Implications for managers

Practitioners can use the proposed EOGI barrier model to analyze their specific context. The classification of innovation barriers and their manifestations within a specific context demonstrate how to apply the EOGI barrier model. This guides practitioners to attend to the external environment, the organization, the group and the individual with regard to their sub-categories. The results of this analysis can be discussed with the involved individuals and with consultants to evaluate the identified barriers.

Multiple strategies tailored to the specific situation are needed to reduce the barriers (Okumus and Hemmington 1998). The EOGI barrier model with its four levels of analysis and their respective sub-categories provides multiple starting points to develop appropriate strategies to deal with the identified barriers. Complementary, the strategies derived from the here synthesized studies can inspire practitioners to adapt them to their specific case.

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