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Balancing evolving logics: Business model change in the Leibniz research museums

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Abstract

This study shows how stakeholders' evolving logics drive business model change over time. Using secondary data from the Leibniz research museums in Germany in a longitudinal content analysis, we relate logics as drivers of business model change in a context that is shaped by the interests of multiple stakeholder groups. Our findings illustrate how stakeholders' varying emphases on economic, cultural, and political logics affect the content, structure and governance of the activities constituting the business models of the research museums. They lead to an increasing need for the demonstration of value creation and the identification of new sources of revenue. The strength of the impact of these logics depends on the individual abilities of the research museums to bargain for their business models. Overall, our study sheds light on the drivers of business model change in public organizations and the accompanying macro-level factors in the German science system.

Key words: business model change; logics; research museums; value creation; science policy

1. Introduction

Museums are institutions that collect, archive, conserve, interpret, and exhibit a society's culture (DeFillippi et al. 2007). For some decades, market-driven thinking has been nurturing the idea that museums must engage in strategic and entrepreneurial activities (Griffin 2008; Oakes et al. 1998). There is an increasing tension between the need to preserve cultural goods and the requirement to create value for diverse stakeholder groups (Alexander 1996; Coblence and Sabatier 2014; Eikhof and Haunschild 2007). Our knowledge on how this tension affects business model change—i.e. how the museums' activities and responses to their stakeholders' demands evolve (Foss and Saebi 2017)—is limited. We explore the drivers of business model change in the Leibniz research museums, which are important organizations in the German science system.

A business model is a configuration of interdependent activities that enable a museum to create and capture value (Coblence et al. 2014; Zott and Amit 2010). Existing studies mainly focus on business models in for-profit organizations and their potential to create economic value for customers (Zott et al. 2011). However, value creation can address diverse stakeholders—i.e. any person, group or organization with an interest in the organization—and it is not limited to business corporations (Massa et al. 2017). The business models of public museums, which are non-profit organizations, are a case in point (Coblence and Sabatier 2014; Greffe et al. 2017). These have been subject to change in the last decades. A turn from a traditional focus on curatorship and the exhibition of cultural goods towards entrepreneurialism is discernible (e.g. Camarero and Garrido 2008; Coblence et al. 2014; Scott 2009). All over the world, public expenditures for museums have come under sharp scrutiny because of budgetary constraints. Public museums must find additional sources of funding and ways to cut costs without lowering the quality of their cultural outputs (Camarero et al. 2011; Schmidt et al. 2017). This development leads to an increasing need to provide evidence for value creation (Eikenberry and Kluver 2004; Scott 2009; Vicente et al. 2012). The perception of value generally depends on stakeholder logics, i.e. beliefs and assumptions about how a museum should behave. Thereby, museums are embedded in a political-administrative context comprising multiple stakeholder groups (Alexander 1996; Oakes et al. 1998; Schmidt et al. 2017). Over time, their evolving logics require re-configurations of the activities that constitute a business model (Berends et al. 2016). However, our knowledge on the drivers of business model change is limited (Foss and Saebi 2017). We fill this gap by investigating how evolving stakeholder logics drive business model change in public museums.

The empirical setting in this study is that of the eight research museums in the German Leibniz Association, a registered association named after the German philosopher Gottfried Wilhelm Leibniz (1646–1716). It connects more than 80 non-university

research institutes that cover a broad range of disciplines, among them eight museums in the fields of history of the Earth, biodiversity, cultural history and history of technology. These produce and disseminate scientific knowledge (Leibniz 2016c). In contrast to other museums, they conduct rigorous collection-based research, which is capital-intensive and relevant for society (Leibniz 2014a). Based on a longitudinal content analysis of secondary data, we make two contributions. First, we examine the constraints that affect the internal decisions of the research museums and show that stakeholders' evolving logics are influential drivers of business model change. Secondly, prior literature points to a misalignment of cultural and economic logics (Eikhof and Haunschild 2007; Heidenreich and Plaza 2015). Our analysis illustrates that these logics are not necessarily contradictory. We observe a political logic which bears the potential for conflicts and promising opportunities for value creation.

The study proceeds as follows: firstly, we outline the components of business models, the drivers of change and the value created by museums. Secondly, we elaborate on our data and methods. Finally, we report our findings and discuss their implications.

2. Background

Business models are studied in various contexts that go beyond profit-oriented business settings. Like for-profit organizations, museums have business models (Massa et al. 2017). For example, Coblence et al. (2014) studied business model evolution in the Montreal Museum of Fine Arts. Coblence and Sabatier (2014) describe the Louvre's business model revision, and Greffe and colleagues (2017) specify types of business models in French museums.

Museums can purposively change their business models and thereby adapt to evolving circumstances and introduce novel ways to create value for stakeholders (Foss and Saebi 2017). Specifying a configuration of activities consisting of *design elements* and *design themes*, a business model explains how a museum creates and captures value from its outputs (Teece 2010; Zott and Amit 2007; Zott et al. 2011). Referring to design elements, activity content describes what fields of expertise a museum covers. Activity structure specifies how these fields are related. Activity governance defines who contributes to value creation and where. Four design themes generally connect these design elements and drive the perceived value that the business model generates: novelty (e.g. re-using the content of cultural goods for different purposes), lock-in (e.g. retaining sponsors and donors), complementarities (e.g. generating synergies across a museum's fields of expertise), and efficiency (e.g. cutting costs) (Zott and Amit 2010). These reflect an *economic logic* underlying customers' requirements to profit-oriented companies (Zott et al. 2011). They imply market-driven thinking, nurturing efficiency, and the production of goods and services with quantifiable outcomes, such as revenues, costs, and profits (Eikhof and Haunschild 2007; Teece 2010; Townley et al. 2003).

However, museums contribute to 'the preservation and interpretation of artefacts and sites that are viewed as unique and irreplaceable because the curators and historians say they are unique and irreplaceable' (Oakes et al. 1998: 268). They collect, preserve and study what they collect without any need for an external economic or political legitimization of these activities (Heidenreich and Plaza 2015). Like other public organizations, museums require a broader view on value, which exceeds a primarily economic logic (Massa et al. 2017; Reay and Hinings 2009). Consistent with a *cultural logic*, the value of a museum's output depends on its symbolic meaning (DeFillippi et al. 2007; Oakes et al. 1998). Museums can be seen as an engine of societal progress in terms of knowledge production, education, and innovation. They attract diverse audiences for various reasons. The outputs that museums produce rely on costly and ill-defined resources from many different origins. Their value depends on subjective experiences and individual conceptions of quality and originality (Townley et al. 2003). Museums create a regional identity, nurture cohesion among social groups and provide a public creative space that promotes knowledge exchange. They can improve health and well-being, increase the understanding of cultures and international relationships, and contribute to urban development (Camarero et al. 2011; Heidenreich and Plaza 2015).

These outcomes have the character 'of what economists call "public goods"; a circumstance in which the economic activity in question generates positive externalities or "spill-overs". As there is no good (private) business model that can support value capture, government funding and/or philanthropy is required and provided' (Teece 2010: 185). Public museums raise funds from, for instance, companies, banks, foundations, donors, and sponsors, but they mainly depend on public funding. They produce knowledge, which serves the society and is of interest to science policy (Eikenberry and Kluver 2004; Teece 2010). Governmental and administrative bodies put pressures on the research museums and restrict the discretional power and independence of museum managers (Vicente et al. 2012), creating a *political logic*. Public funding and political support must be justified in terms of, for example, efficient financial management, visitor satisfaction and recognition from peers (Camarero et al. 2011; Scott, 2009; Townley et al. 2003). As depicted in Fig. 1, the business model-concept in museums thus comprises a multi-stakeholder perspective on value.

3. Methods

Drawing on longitudinal data from the Leibniz research museums in Germany, we study how museums re-assess their activities and find novel ways to create value for their stakeholders.

3.1 Empirical setting

Germany comprises 16 states (*Länder*). Competences referring to science, research and education are divided between ministries and agencies on the federal level and between the federal level (*Bund*) and the states (*Länder*). The Federal Ministry of Education and Research (*Bundesministerium für Bildung und Forschung*, BMBF) is responsible for R&D policy and funding. Liaising with the state governments, it engages in the institutional co-funding—i.e. funds jointly provided by the federal government and the states—of non-university research institutes. These are organized within four associations: Max Planck Society, Fraunhofer Society, Helmholtz Association and Leibniz Association. Reflecting the German federal governance system, the Leibniz Association is funded to equal parts by federal and state governments (Edler and Kuhlmann 2008; Grimpe 2012).

The origins of the Leibniz research museums can be traced back to the foundation of the German Federal Republic in 1949. The West German states signed the 'Königsstein Agreement' according to which research institutes of supra-regional importance would receive funds from both the states and the federal government—i.e. institutional co-funding—if their needs exceeded the means of a single

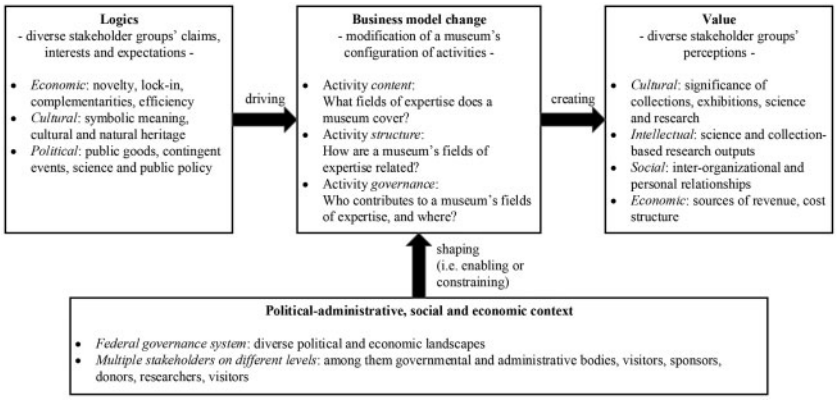

Figure 1. Business model change in museums.

state (section 91b German Basic Law). This agreement evolved into the 'Blue List Partnership' (according to the colour of a dossier). After the German reunification in 1990, many institutes in the former German Democratic Republic were included in the 'Blue List Partnership', which transformed itself in 'Gottfried Wilhelm Leibniz Science Association' (chiefly, Leibniz Association) in 1997. It financially supports and monitors the activities of its members, among them the research museums (Leibniz 2016a). The Senate of the Leibniz Association evaluates their performance every seven years. In case of underperformance, a museum loses its status as a Leibniz institute and its access to institutional co-funding (Leibniz 2016b).

We adopted a multiple case study design (Eisenhardt 1989) including all Leibniz research museums. The *Deutsches Schiffahrtsmuseum* (German Maritime Museum) in Bremerhaven concentrates on German maritime history. The *Germanisches Nationalmuseum* (Germanic National Museum) in Nuremburg presents the history of art and culture of the German-speaking countries. The *Römisch-Germanisches Zentralmuseum* (Roman-Germanic Central Museum) in Mainz concentrates on pre- and early history and archaeology. The *Deutsches Bergbau-Museum* (German Mining Museum) in Bochum focuses on the history of mining. The *Deutsches Museum* (German Museum) in Munich concentrates on the natural sciences and technology. The *Museum für Naturkunde* (Museum of Natural History) in Berlin focuses on natural history. The *Senckenberg Museums* (Senckenberg Museums of Natural History), located in Frankfurt am Main, Görlitz and Dresden, explore biodiversity in the 'System Earth'. The *Zoologisches Forschungsmuseum Alexander Koenig* (Zoological Research Museum Alexander Koenig) in Bonn is dedicated to natural history and zoology.

Although the business models of the research museums may differ in terms of, for example, market or product orientation (Camarero and Garrido 2008), they are comparable because of their high relevance for national science policy and their common aims and objectives. These are stated in a joint policy paper published by the German federal government and the governments of the federal states (GWK 2012). According to this policy paper, the collections of the research museums are unique. They are usable for scientists from Germany and abroad. The museums strengthen Germany's reputation as an international centre of research. They also aim to stimulate the interest in science and research among diverse social groups. Other types of museums in Germany are less regulated and have more leeway to experiment with diverse business models.

3.2 Data analysis

We collected data on the business models of the research museums by codifying their annual reports. These are suitable because, first, they provide comparable information through time and support our interest in the evolution of business models (Demil and Lecocq 2010). Secondly, this interest requires information on previous business models and changes made in the past. Interviews with executives may have been biased by retroactive sense-making and less reliable (Duriau et al. 2007). Third, because executives invest much time and effort in outlining the content of annual reports and use them to interact with external stakeholders (Dirsmith and Covalevski 1983), their validity is higher than that of primary sources (Duriau et al. 2007). Because this advantage also bears the risks of post-rationalization of events, self-promotion, and impression management (Arndt and Bigelow 2000; Demil and Lecocq 2010), we complemented the annual reports with the evaluation reports by the Senate of the Leibniz Association including the responses of the research museums. Table 1 presents information on the research museums and the available data.

We content-analysed all documents, using the software MAXQDA and following the steps suggested by Kuckartz (2014). First, we read all available documents, added notes and conceived of ideas for the coding scheme. It was based on the literatures on business models (e.g. Zott and Amit 2010), value (e.g. Townley et al. 2009) and museums (e.g. Alexander 1996; Camarero et al. 2011). It benefited from conversations with members of the museums, workshops in the *Deutsches Schiffahrtsmuseum* and the Leibniz Association in 2015, 2016, and 2017 and two expert interviews in July 2016. Second, drawing on the identified research gap, we developed first-order concepts for categorizing the data. We used the aforementioned literatures for structuring and interpreting the data. The longitudinal data allowed for the identification of contingent events and stakeholder influence. Third, referring to the first-order concepts, we coded the data for the first time. We analysed the reports clause by clause to capture multiple codes embedded within single paragraphs or sentences. Fourth, we compiled the paragraphs and sentences that we had coded based on the same first-order concepts. Fifth, drawing on these compilations, we refined our coding scheme before and during the computer-aided content analysis and inductively developed subcategories (second-order themes). Finally, we re-coded the data and applied our refined coding scheme. After having analysed the business models of the research museums and their dynamics in isolation, we compared them in order to specify similarities and differences.

Table 1. Overview on the Leibniz Research Museums.

Museum (federal state)	Founding year	Employees	Topical focus	Institutional co-funding	Observation window	Annual reports	Leibniz evaluation reports (recommendation)
Deutsches Schiffahrtsmuseum – Leibniz-Institut für Deutsche Schifffahrtsgeschichte, Bremerhaven (Bremen)	1971 (opening in 1975)	2005: 77 2013: 73	German shipping history and maritime archaeology	1980 Blue List, 2000 Leibniz	1979–2015	35 (excl. 2001 and 2002)	2007 (further funding), 2014 (further funding but with reservations), next evaluation in 2018 (earlier than usual)
Germanisches Nationalmuseum, Nuremburg (Bavaria)	1852	2006: 206 2013: 211	history of art and culture of the German-speaking countries	1977 Blue List, 2000 Leibniz	2013	1 (incl. chronicle and press releases)	2008 (further funding), 2015 (further funding), next evaluation in 2021
Römisch-Germanisches Zentralmuseum – Leibniz-Forschungsinstitut für Archäologie, Mainz (Rhine-Palatinate)	1852	2005: 153 2012: 171	pre- and early history	1977 Blue List, 2000 Leibniz	1998–2015	16 (excl. 2013 and 2014)	2007 (further funding), 2013 (further funding but with reservations), next evaluation in 2016 (earlier than usual)
Deutsches Bergbau-Museum - Leibniz Forschungsmuseum für Georessourcen, Bochum (North Rhine-Westphalia)	1930	2005: 84 2012: 143	history of mining	1977 Blue List, 2000 Leibniz	2000–2012	13	2007 (further funding), 2014 (further funding), next evaluation in 2021
Deutsches Museum, Munich (Bavaria)	1903	2001: 378 2009: 479	natural sciences and technology	1950 Königsstein Agreement, 1977 Blue List, 2000 Leibniz	1999–2014	15	2003 (further funding), 2010 (further funding), next evaluation in 2017
Museum für Naturkunde – Leibniz-Institut für Evolutions- und Biodiversitätsforschung, Berlin	1810	2011: 252 2016: 250	natural history	2009 Leibniz	2002–2015	11 (excl. 2010)	2013 (further funding), next evaluation in 2019
Senckenberg Gesellschaft für Naturforschung, Frankfurt (Hesse), Görlitz and Dresden (Saxony)	1817	2004: 258 2012: 745	biodiversity in the 'System Earth'	1954 Königsstein Agreement, 1977 Blue List, 2000 Leibniz	2004–2014	11	2006 (further funding, integration of newly acquired entities), 2014 (further funding), next evaluation in 2020
Zoologisches Forschungsmuseum Alexander Koenig – Leibniz-Institut für Biodiversität der Tiere, Bonn (North Rhine-Westphalia)	1912 (opening in 1934)	2005: 101 2012: 108	natural history and zoology	1950 Königsstein Agreement, 1977 Blue List, 2000 Leibniz	2004–2014	11	2007 (further funding), 2013 (further funding), next evaluation in 2020

Based on our data, three periods are discernible. In the 1990s, the research museums promoted growth and expansion. They invested in large-scale projects and extended their collections and areas of expertise. In the 2000s, new challenges emerged, such as new technologies and an increasing demand for relevance. This decade was a period of changes in organizational structures, profiles, and facilities. Since 2010, these changes have led to the claim for a new identity as a research museum, novel approaches to research and knowledge transfer, and the adjustment of governance structures and missions.

4. Logics as drivers of business model change

Over time, three logics and evolving emphases on them are discernible. The Supplementary Table S1 provides illustrative examples from the data for cultural, economic, and political logics in the three pre-specified periods.

4.1 Cultural and economic logics

Consistent with a *cultural logic*, the research museums view themselves as collective memories. They contribute to social integration and the formation of a cultural identity. For decades, these aspects have taken centre-stage in their missions. Since the mid-2000s, the cultural logic, which is anchored in the missions of the research museums that were originally formulated at the time of their foundation, has become more future-oriented and market-driven, as, for example, the mission statements in the more recent annual reports of the *Deutsches Museum*, the *Museum für Naturkunde* and the *Senckenberg Gesellschaft für Naturforschung* reveal. The *Zoologisches Forschungsmuseum Alexander Koenig* emphasizes the social impact of its research, and the *Deutsches Schiffahrtsmuseum* stresses the importance of its collections for future generations.

The local and spatial character of the research museums has gained in importance. For example, the *Römisch-Germanisches Zentralmuseum* outlines in its annual report in 2015 that it aims to be a place of tranquillity and encounter. The *Museum für Naturkunde* views itself as an innovative centre of communication that shapes the scientific and social dialogue about the future of the planet and as an extraordinary location for events. The *Deutsches Museum* wants to be seen as an outstanding cultural event. The *Römisch-Germanisches Zentralmuseum* fosters the creation of a discernible trademark for archaeology. These examples illustrate that an *economic logic* has penetrated the cultural logic over time (Heidenreich and Plaza 2015).

The business models of all research museums are clearly novelty-centred (Zott and Amit 2007), because 'showcasing science' (Leibniz 2016c) relies on creativity and innovation (Coblence and Sabatier 2014). Since their foundation, the success of the research museums has depended on novelty. However, the emphasis on innovation has become more pronounced and market-driven over time. The *Deutsches Museum* is an illustrative case. Compared to the other research museums, it began early to emphasize an economic logic for its activities. In 1999, for example, the *Deutsches Museum* reported that it tried to reduce the costs for the development of its exhibitions by forming alliances with renowned technology companies. Cooperation with industrial corporations and research institutes in Germany and abroad became part of its growth strategy and allowed the development of temporary exhibitions pertaining to new technologies. In the following years (2004–2010), which were characterized by the uncertain inflow of public funds, the *Deutsches Museum* maintained numerous alliances with companies and funding organizations. These were often jointly developed with the partner firms' marketing departments and used for advertising purposes. In recent years, new technologies for digitization have nurtured the re-use of archival data. For instance, because the library of the *Deutsches Museum* has invested in a scanner to produce digital copies of fragile documents, it attracts additional users and visitors. This investment may create new sources of revenue. The *Deutsches Museum* thus illustrates that cultural and economic logics do not necessarily conflict with each other as Eikhof and Haunschild (2007) suggest. Instead, since the beginning of the 2000s, they have led to an extension of the activities of the research museums and higher pressures to justify their existence.

4.2 Political logic

Contingent events throughout the history of the research museums reflect an evolving political logic. In the late 1970s and early 1980s, a major *political change* for most museums was their membership in the Blue List Partnership. It implied joint funding by federal and state governments and a recognized status as a non-university research institute in Germany and abroad. The Blue List Partnership was only valid for museums in the Federal Republic of Germany. The *Museum für Naturkunde* was not included, because it was located in the German Democratic Republic. After the German reunification, the *Museum für Naturkunde* did not become member of the Leibniz Association before 2009.

Throughout their history, the research museums were influenced by political position papers. In 2006, the International Council of Museums (ICOM) published the *ICOM Code of Ethics for Museums*. It provides a broad definition of museums and guidelines for their conduct and performance (ICOM 2016). The ICOM standards though not legally binding provide guidance, but they do not differentiate between different types of museums. In 2009, the German museologist Bernhard Graf published a paper referring to the roles and tasks of the German research museums. It specifies guidelines for the work of the eight research museums and their funding by the Leibniz Association. The research museums serve the purposes of any other museum. To maintain their status as Leibniz institutes, they must be of supra-regional importance and of interest to national science policy. They are required to position themselves as the subject leaders in their research themes in Germany and abroad (Graf 2009). This article has become the central guideline for strategic planning and performance evaluation. Harnessing science and technology to increase international reputation, developing collections into research infrastructures with specific access rights for diverse stakeholder groups, and bridging research and education have become salient demands. These were explicitly stated in another influential agenda published in 2012 by the Joint Science Conference (*Gemeinsame Wissenschaftskonferenz*, GWK) of the Federal Government and the states (*Länder*), a leading institution in German science policy (Edler and Kuhlmann 2008). These examples show that the political logic has become especially influential in the periods emphasizing the demonstration of relevance and a stronger focus on research.

Investments in construction and renovation have also affected the museums. The *Museum für Naturkunde* illustrates that opportunities to renew buildings and exhibition spaces largely depend on political contingencies and coordination challenges on and between the federal and the state level. Because of its location in the former German Democratic Republic, the *Museum für Naturkunde* could

not start before 1990 to improve the infrastructure needed for its collections which had been neglected for decades due to a lack of financial resources. Since the German reunification, intense construction and renovation works have continuously increased the exhibition areas and research facilities. Another example is the *Römisch-Germanisches Zentralmuseum*. In 2007, it was surprised by the unexpected announcement of the Ministry for Science of the state of Rhineland-Palatinate to erect a new building for the archaeological exhibitions. In 2011, the Economic Stimulus Package (*Konjunkturpaket II*) of the Federal Government allowed the *Römisch-Germanisches Zentralmuseum* investments in construction and renovation, but it also caused a temporary closure of the exhibition.

Sudden public-sector deficits constrain construction and renovation. For example, in 2005, the *Deutsches Museum* had to cope with an unexpected reduction of 6 per cent of the funding originally guaranteed by the Federal Government. Because of contractual agreements binding the yearly amount of funding provided by the state of Bavaria to that guaranteed by the Federal Government, this led to a further reduction of 6 per cent of funds provided by Bavaria. The loss of half a million euros hampered the development of the exhibitions of the *Deutsches Museum*.

Leading executive positions in the research museums have traditionally been characterized by long tenures of up to 30 years. In the last two decades, tenures have become shorter. *Executive succession events* have triggered change in all research museums over time. The *Römisch-Germanisches Zentralmuseum*, for example, used management successions in 2003 and 2004 to re-assess its six areas of competence and promote changes in its activities. The *Deutsches Bergbau-Museum* reported two changes in the management of the museum in 2012, namely the appointment of a new director and of a new head of the department of mining history. It also created a position as a head of knowledge transfer, leading to a new interface between research and public relations in a centralized department. These changes can be seen as a means to prepare the *Deutsches Bergbau-Museum* for a new era determined by the exit from subsidized coal mining in the state of North Rhine-Westphalia in 2018, which will require a redefinition of the identity of the *Deutsches Bergbau-Museum* as a research museum. Moreover, since the beginning of the 2010s, the museums have increasingly been encouraged to appoint directors who simultaneously hold chairs at local universities, such as the *Deutsches Schiffahrtsmuseum*. These developments reflect the claim for a stronger focus on research that characterizes the 2010s and which is especially driven by a political logic.

5. Business models

The impact of the logics is reflected by changes in the business models over time. The Supplementary Table S2 includes examples for how the business models evolved in the last decades.

5.1 Activity content

In line with a cultural logic, the research museums fulfil the tasks of collecting cultural goods, doing research and transferring knowledge. They continuously expand their collections. The *Deutsches Schiffahrtsmuseum* heavily relied on purchases of all kinds of objects alluding to maritime history in the years subsequent to its foundation, thereby pursuing a purposive collection management. Similarly, since the 1980s the *Römisch-Germanisches Zentralmuseum* has bought many objects that researchers of the museum and other institutes have subsequently used, such as jewellery, books, journals, and photographs. The *Deutsches Bergbau-Museum* has benefited from the generosity of individuals and organizations in the mining industry in the last decades. These have transferred documents, objects, and artefacts to the museum by means of inheritance. The collections of the museums operating in natural history, the natural sciences or archaeology, such as the *Zoologisches Forschungsmuseum Alexander Koenig*, the *Museum für Naturkunde* or the *Römisch-Germanisches Zentralmuseum*, benefit from exploratory expeditions and discoveries. The *Museum für Naturkunde* acquired a paleontological collection from Berlin University of Technology in 2008. The *Senckenberg Gesellschaft für Naturforschung* considers the collection of cultural goods, the integration of the collections of other institutes (e.g. universities or other museums) and the provision of access for different stakeholder groups as national tasks.

The collections form the core of the activities of the museums that have never ceased to emphasize the importance of their collection-based research. The museums would also do research without being driven by the Leibniz Association. For example, the *Museum für Naturkunde* has been a renowned research institute for decades. Its newly acquired status as a Leibniz institute in 2009 was the starting-point for a re-assessment of its research, leading to a transformation into four areas (evolution and geo-processes, collection development and biodiversity, digital world and information science, and science communication and knowledge management) until 2013.

The *Deutsches Schiffahrtsmuseum* also reveals the strong influence that external, predominantly political actors exert on the evolution of the research activities of the museums. Since its foundation, the *Deutsches Schiffahrtsmuseum* has not been completely free in its decisions regarding research. The discovery of a medieval merchant cog in the Weser River near Bremen triggered its establishment in 1971. It pre-determined its focus on wet-wood conservation. In 1987, the German Science Council suggested an extension of research themes, leading to the development of four areas in 1994. According to a recommendation included in the subsequent evaluation provided by the Science Council in 2000, these four areas were merged into two central themes that determined the research program for the next decade. This development reflects the claim for relevance that characterizes the 2000s. While the subsequent evaluation by the Senate of the Leibniz Association in 2007 did not cause any problems, the evaluation in 2014 raised many critical issues. The projects referring to the merchant cog had nearly been completed. The Senate deemed a new focus on maritime archaeology as problematic because of the museum's lack of financial and human resources. The establishment of a cross-country competence centre for maritime archaeology would have been promising, but the *Deutsches Schiffahrtsmuseum* could not make this decision on its own. Governmental agencies on the state (*Senator for Education and Science* in the state of Bremen) and on the federal level (*Federal Ministry of Education and Research*) had to be involved but repeatedly delayed their decisions, although the Senate of the Leibniz Association encouraged the idea in its evaluation report in 2014. The *Deutsches Schiffahrtsmuseum* used this evaluation to re-assess its activities and adapt their content to the prevailing political logic. By introducing the concept 'People and the Sea' in 2014, it explicitly aimed at contributing to the politically driven public discourse on the Anthropocene, the youngest epoch in the geological timescale.

A typical task of each museum is knowledge transfer and education. However, the annual reports from the 1970s to the late 1990s

show that, in those decades, the museums conducted research without any 'mention of a responsibility to ensure that people attend' (Oakes et al. 1998: 267). In the last two decades, this situation changed, pointing to the need to demonstrate relevance and a strong focus on research. For example, in 2002, the *Senckenberg Gesellschaft für Naturforschung* established a communication and marketing department in order to create a brand for science, education, and culture. Market research aimed at enhancing the understanding of the visitors' preferences and the interests of stakeholders, donors, and sponsors. The *Zoologisches Forschungsmuseum Alexander Koenig* established a *Centre for Public Relations and Exhibitions*, dedicated to knowledge transfer.

More recently, pressures for using new media for presenting collections and research and strengthening knowledge transfer have become discernible. The Leibniz Association increasingly requires novel approaches to digitize collections, open access for researchers in Germany and abroad, and new forms of experiencing cultural goods for visitors (GWK 2012). The *Deutsches Museum* is a pioneer. It has put emphasis on transferring knowledge to different stakeholder groups and drawing on various channels and technologies for this purpose for decades. For example, it used the total solar eclipse in 1999 for advertising campaigns and increased media coverage, highlighting its research and its various competences. From early on, it has conceived of special events that allow for the active participation of the audience in experiments and other research-oriented activities in order to attract young visitors. For many years, young science journalists and curators have been invited to attend seminars focusing on the professional communication of science. The *Deutsches Museum* uses anniversaries, such as '100 Years of Driver's Licenses' (2009) or the 'Year of Energy' (2010), to organize special exhibitions and events for various target groups and stakeholders. Knowledge transfer has increasingly turned into a cultural event including the promise of a special experience for visitors.

5.2 Activity structure

The activity structure of the business models has been subject to considerable changes over time. Linking activities across departments and research themes did not take centre-stage in the 1980s and 1990s. However, after a period of growth, the museums had to restructure. The *Senckenberg Gesellschaft für Naturforschung*, for example, started planning and implementing projects spanning departments and research areas at the end of the 1990s. Until 2014, it was fundamentally reorganized. It established an internet-based collection management system that created a virtual network between nine geographically distant locations. Similarly, the *Deutsches Bergbau-Museum* and the *Deutsches Museum* pursued the creation of synergies and networks across research themes and functional areas.

According to the Senate of the Leibniz Association, other research museums were less successful in this regard. For example, this issue was raised in the evaluation of the *Germanisches Nationalmuseum* in 2015, although this museum had successfully expanded its collections, carried out innovative research projects and attracted diverse visitor groups in the years preceding this evaluation. In its evaluation of the *Römisch-Germanisches Zentralmuseum* in 2007, the Senate of the Leibniz Association criticized a lack of coherence between the research themes. It recommended institutionalizing knowledge exchange between internal research groups, reflecting the claim for relevance pertinent in that decade. Again, in 2013, the Senate observed incoherence between the collections, research projects and exhibitions because of a lack of an overarching strategy. The reaction of the *Römisch-Germanisches Zentralmuseum* illustrates the power of the political logic represented by the Leibniz Association and the increasing focus on research characterizing this period of time. In 2014, it reorganized its structures. Under the label 'RGZM-Archaeology', in 2015, it presented a concept, which combined the researchers' and the restorers' competences and the museum's infrastructure into a coherent program for science and education.

5.3 Activity governance

Changes in activity governance did not attract much attention before the 2000s. Being member of the Blue List Partnership and later on of the Leibniz Association as its successor organization implies clear requirements to activity governance. A separation of leadership and control is warranted by the establishment of separate executive and supervisory boards according to the standards of the Leibniz Association. The *Museum für Naturkunde* is a case in point. Prior to its inclusion in the Leibniz Association, the state of Berlin had to create a legal framework that guaranteed its status as an independent foundation (*Gesetz über die Stiftung Museum für Naturkunde Berlin*). The museum aligned its governance to the standards set by the Leibniz Association. It established a Scientific Council monitoring the museum's activities in science and research and a Foundation Council. These councils and the newly appointed leading executives jointly developed a new organizational structure and by-laws that specified the principles underlying this structure.

The *Zoologisches Forschungsmuseum Alexander Koenig* illustrates that changes in activity governance can involve a change of organizational identity. Until December 2012, it had been an institute of the state of North Rhine-Westphalia. With its transformation into a public law foundation, it had to re-organize its governance systems that were to include representatives of the responsible federal and state ministries, the University of Bonn and a Scientific Advisory Board comprising scientists from Germany and abroad. The members of the Directorate had to be appointed by an independent Foundation Board. With this transformation, the *Zoologisches Forschungsmuseum Alexander Koenig* underlined its endeavour to evolve into an institute of high importance to national science policy, illustrating the claim for a clear focus on research pertinent in the 2010s.

Governance systems that do not meet the expectations of the Leibniz Association can jeopardize the status as a Leibniz institute. For instance, in 2013, the Senate of the Leibniz Association criticized that the *Römisch-Germanisches Zentralmuseum* had not managed to sufficiently separate boards for advisory and supervision purposes. This lack of compliance fostered the decision that the *Römisch-Germanisches Zentralmuseum* would be re-evaluated in three instead seven years.

6. Value creation

The research museums design and change their business models to increase the value of their outputs for multiple stakeholder groups. The analysis focuses on the evolution of cultural, intellectual, social, and economic dimensions of value (Townley et al. 2009). Cultural value describes the symbolic meaning, authority, and expertise that stakeholders attribute to the museums' collections, exhibitions, and engagement in science and research and their significance for society. Intellectual value denotes the ideas and creative outputs

generated by the research museums. It is the outcome of purposive creative endeavour and intellectual effort. Its creation requires considerable investments in money, time, and personnel. Social value results from the networks and collaborative relationships that a research museum establishes and maintains. Economic value is the transformation of these three dimensions of value in measurable and quantifiable revenue streams. The Supplementary Table S3 reports exemplary indicators for each dimension.

6.1 Cultural value

A museum's cultural value consists of its capacity to innovate, outreach and education programs. For decades, visitors have been of limited importance to most research museums. The *Deutsches Museum* is an exception, as revealed by its efforts to transfer knowledge into the society. In recent years, however, political forces claiming a stronger connection between science, research and the demands of different stakeholders have led to a reconsideration of the tasks and identities of the research museums. For example, a decreasing number of visitors forces the *Deutsches Schiffahrtsmuseum* to conceive of new strategies to increase its attractiveness. The *Museum für Naturkunde* proudly presents its growing visitor numbers. The *Senckenberg Gesellschaft für Naturforschung* discusses their evolution. The *Deutsches Bergbau-Museum* has begun to promote itself as part of the Ruhr Metropolis. The *Zoologisches Forschungsmuseum Alexander Koenig* emphasizes its new status as an institute of supra-regional importance. In doing so, the *Deutsches Bergbau-Museum* and the *Zoologisches Forschungsmuseum Alexander Koenig* re-define their organizational identities. They stress the symbolic meaning of their research themes and their attractiveness and relevance for society. Thereby, it is important to note that the museums' efforts to stress cultural value have become especially pertinent in the periods placing relevance (the 2000s) and a focus on research (the 2010s) at centre-stage. Both an economic and a political logic act as strong drivers behind these efforts.

6.2 Intellectual value

A museum's intellectual value comprises, for example, publications and the number of PhD students. The growing demand for enhancing the research museums' international reputation have led to pressures to increase the efforts to publish in refereed journals. A comparison of the changes in the number of articles in refereed journals between two evaluations of the Leibniz Senate reveals that the *Deutsches Museum*, the *Römisch-Germanisches Zentralmuseum* and the *Zoologisches Forschungsmuseum Alexander Koenig* are particularly successful in meeting this expectation. The *Senckenberg Gesellschaft für Naturforschung* is a special case. The increase in its publications can be due to its acquisition strategy. Both the *Deutsches Schiffahrtsmuseum* and the *Germanisches Nationalmuseum* have relatively low numbers, whereby the *Germanisches Nationalmuseum* shows a considerable increase in the number of articles in refereed journals. The *Deutsches Bergbau-Museum* reveals a decrease. Books, articles in non-refereed journals and publications for local stakeholders or touristic purposes have become less important over time. This development reflects the political logic represented by the Leibniz Association and its definition of desirable research outputs.

The research ifty-tomuseums have increased their investments in young researchers, as the *Deutsches Bergbau-Museum* illustrates. The criticism of the Senate of the Leibniz Association that there had been just one doctoral student at the end of 2005, nurtured an increase in the number of doctoral students of up to ten in 2012. Cooperating with the Ruhr University of Bochum, the *Deutsches Bergbau-Museum* successfully applied for funding by the Leibniz Association of a graduate school focusing on raw materials, innovation, and technology of former cultures. It opened in 2011 and started with eleven doctoral students. The other research museums also increased their numbers of PhD students over time. For example, the *Deutsches Schiffahrtsmuseum* reported one doctoral student in 1991, three doctoral students in 1997, ten in 2007, and twelve in 2015. In the *Römisch-Germanisches Zentralmuseum*, this number ranged from ten in 2005 to twenty-five in 2013. The *Museum für Naturkunde* increased the number of doctoral students from forty-seven in 2011 to fifty-two in 2015. As these developments started at the beginning of the 2000s and have since then been driven by the Leibniz Association, they reflect the increasing impact of the political logic.

6.3 Social value

Over the three specified periods of time, all logics have fostered the need for the creation of social value. Inter-organizational and personal relationships with local universities and other research institutes in Germany and abroad are at the core of a museum's social value creation. Over time, the research museums have maintained more or less intense external relationships, ranging from collaborative research and lectures to the joint appointment of scientific personnel. The *Römisch-Germanisches Zentralmuseum*, for example, has never ceased to conduct archaeological excavations with researchers and students of the University of Mainz and the Universities of Applied Sciences in its neighbourhood. Teaching at universities has a long tradition for the *Deutsches Schiffahrtsmuseum*. Examples range from lectures on maritime archaeology and the arming of medieval ships at the universities of Gießen and Hamburg in 1980 to seminars on wet-wood conservation in Hamburg and Oslo in 1999. The current managing director of the *Deutsches Schiffahrtsmuseum* holds a position as a professor of maritime history at the University of Bremen. The *Germanisches Nationalmuseum*, that has established ties with local economic and scientific networks in Nuremburg and other neighbouring areas for years, was criticized for a lack of cooperation. In the evaluation report (2015), the Leibniz Association recommends joint appointments of chaired professors at local universities. The *Deutsches Museum*, though having been one of the most renowned museums of technology and natural sciences all over the world for decades, is to increase the number of international exchanges of researchers.

On a local level, relationships with companies and banks in the same region are pertinent. These organizations often have a long tradition in providing financial and non-financial support. The industry in which a company operates and the topical focus of a research museum are related, as the *Deutsches Bergbau-Museum* with its partnerships with companies in the mining industry, the *Deutsches Museum* with its alliances with high-technology firms and the *Deutsches Schiffahrtsmuseum* with its relationships with shipyards in Northern Germany illustrate. The influence of local actors is stable across all museums over time, but the need to emphasize the effectiveness of these relationships for strategic purposes has increased since the end of the 1990s. An economic logic is discernible. It supports the pursuit of a cultural logic. For example, in 2000, the DM cooperated with the airport operator Flughafen München GmbH to provide an 'aviation ticket', permitting visitors a price reduction for the entry into the museum, its flight wharf

Schleißheim and its special exhibition on aviation at Munich airport.

The importance of local supporters' associations varies among the research museums. For instance, the supporters' association of the *Deutsches Schiffahrtsmuseum* was reported to be one of the largest associations of that kind in Germany in 2009. Several local associations of smaller sizes support the *Senckenberg Gesellschaft für Naturforschung*. The *Zoologisches Forschungsmuseum Alexander Koenig* relies on two associations with different focal points. One of them has been providing support for research projects and the museum's library since its foundation in 1978. The other association was established in the 2000s, supporting the development of a new permanent exhibition entitled 'Our Blue Planet'.

6.4 Economic value

All research museums rely on institutional co-funding. The economic viability of the research museums also depends on third-party funding (see Supplementary Table S3, part D (a) and (b)). According to the Leibniz Association, third-party funding indicates the capacity to innovate and strengthens the reputation of a research museum as a non-university research institute (Leibniz 2014b). It enhances productivity, efficiency, and opportunities for collaborative projects (Grimpe 2012). Third-party funding is thus important for the creation of intellectual value and reflects both an economic and a political logic.

The impact of public funding organizations in Germany (e.g. *Deutsche Forschungsgemeinschaft*, which is the main funding body for academic research in Germany, cf. Grimpe 2012) and abroad (e.g. grants provided by the European Research Council) has steadily increased in the last two decades. The *Museum für Naturkunde* and the *Senckenberg Gesellschaft für Naturforschung* show considerable increases in third-party funding over time, whereas the *Zoologisches Forschungsmuseum Alexander Koenig* and the *Deutsches Museum* reveal decreases. The *Deutsches Museum*, though having an outstanding reputation and not suffering from a lack of financial resources as its total revenue illustrates, is expected to increase its efforts to apply for third-party funding. It has high miscellaneous revenues, which have steadily grown for years. The *Germanisches Nationalmuseum* and the *Senckenberg Gesellschaft für Naturforschung* also report an above-average increase in their miscellaneous revenues. For these three research museums, this may mean that they can offset a lack of institutional and third-party funding with financial resources from alternative sources.

The impact of foundations does not differ across the research museums over time. Providing financial resources for specific projects, exhibitions, or dedicated personnel, they range from small and locally based foundations that follow a mainly cultural logic (e.g. Prinz Maximilian zu Wied-Foundation supporting the *Römisch-Germanisches Zentralmuseum*, Wolfgang Ritter-Foundation concentrating on the *Deutsches Schiffahrtsmuseum*) to large and financially powerful foundations. The latter are of supra-regional importance and have their own political agendas, which are reflected by their diverse funding programs for research and science (e.g. Volkswagen Foundation, Fritz-Thyssen-Foundation).

The examples illustrate that economic value creation has been driven by a growing pursuit of a political logic since the end of the 2000s. An increasing influence of the economic logic has been discernible since the end of the 1990s. The cultural logic exerts a minor impact over time.

7. Interdependencies and bargaining power

The analysis of the evaluation reports provided by the Senate of the Leibniz Association in conjunction with the responses of the museums to these reports reveals differences in bargaining power. These responses are attached to the evaluation reports. They show that, within the Leibniz Association, some research museums are more likely to bargain for their business models than other ones because of differences in interdependence and their embeddedness in diverse political and economic settings (Pfeffer and Salancik 1978). The research museums apply different strategies to cope with the recommendations and critique of the Leibniz Association.

A comparison of the *Deutsches Schiffahrtsmuseum*, the *Germanisches Nationalmuseum* and the *Deutsches Museum* illustrates this point. The *Deutsches Schiffahrtsmuseum*is located in the state of Bremen, one of the poorest federal states in Northern Germany. The *Germanisches Nationalmuseum* and the *Deutsches Museum* are based in economically prospering Bavaria in Southern Germany. The *Deutsches Museum* is embedded in the well-developed scientific and industrial landscape in Munich, the Bavarian capital. In 2014, the *Deutsches Museum* had a budget of approx. 86 million euros. A negative evaluation would not decrease its reputation. Its survival would not be at risk without the Leibniz Association. The *Deutsches Schiffahrtsmuseum*, having a yearly budget of about five million euros and suffering from severe budgetary constraints on the state level, needs the Leibniz Association to sustain its reputation as a non-university research institute and the inflow of financial resources. In its responses to the evaluations, it is markedly defensive referring to the recommendations of the Leibniz Association, carefully re-assesses its activities and promotes substantial changes based on the recommendations. The *Germanisches Nationalmuseum*, which was repeatedly criticized for not being fully compliant with the standards set by the Leibniz Association, is less defensive. Indeed, the *Germanisches Nationalmuseum* is successful, for example, in terms of the relevance of its collections for local stakeholders and the attraction of diverse visitor groups, which has led to an increase in miscellaneous revenues, such as donations.

The responses of the research museums to the evaluation reports of the Senate of the Leibniz Association reveal weaknesses in the German science system (Edler and Kuhlmann 2008), which impede value creation and capture. For instance, in its response to the evaluation report (2007), the *Deutsches Bergbau-Museum* explains that, due to the constraints imposed by the German federal governance system, it cannot freely choose a candidate for a leading position, such as the chairperson of the Scientific Council. It had to follow the demands of the government of North-Rhine Westphalia. In its response to the evaluation report (2014), the *Deutsches Bergbau-Museum* agrees to the claim to increase third-party funding, but it has difficulties in securing funds for interdisciplinary research. German funding organizations prefer applications, which do not challenge the borders of disciplines. Similarly, in its response to the evaluation report (2008), the *Germanisches Nationalmuseum* complains that organizations providing third-party funding for museum-specific projects or cultural history hardly exist.

Resource scarcity prevents the research museums from meeting the expectations of the Leibniz Association regarding activity content. Digitization is a case in point. In its response to the evaluation report (2013), the *Zoologisches Forschungsmuseum Alexander Koenig* explains that it would need funds for ten full-time employees for 40 years to achieve a complete digitization of its collections. Other recommendations of the Leibniz Association do not fully

reflect the disciplinary particularities of a research museum, as illustrated by the response of the *Römisch-Germanisches Zentralmuseum* to the evaluation report (2013). Generally, the collections enable research. However, the well-documented archaeological collections of the *Römisch-Germanisches Zentralmuseum* are an outcome of research. In contrast to the other research museums, it hardly relies on its own collections in its ongoing projects but seizes opportunities to increase its collection of copies of archaeological finds from all over the world.

8. Discussion and implications

The goal of this study was to examine logics as drivers of business model change. The findings show that, in the 1990s, a cultural logic was dominant. It nurtured the use of business models that stressed cultural and social value. The 2000s were a period characterized by an increasing demand for relevance, the introduction of new technologies and uncertainty in public funding. These issues enabled the questioning of the prevailing cultural logic, which was increasingly penetrated by an economic logic. The alignment of these logics provided new opportunities for value creation and mitigated financial uncertainty. In this period, a political logic emerged. It shaped the understanding and importance of intellectual value. In conjunction with the increasingly pertinent economic logic, it promoted cultural and economic value creation. Since 2010, the museums have been urged to strengthen their focus on cutting-edge research. This development has been driven by an increasingly dominant political logic. The importance of the cultural and economic logics and their interplay has not changed. The business models still aim at cultural, intellectual, and economic value. Throughout the three periods, social value has been important. The analysis shows that this dimension of value is special, because it facilitates the creation of cultural, intellectual and economic value. This circumstance explains that business models aiming at social value creation are in line with all identified logics.

Overall, the study makes two contributions. First, it adds to the discussion on macro-level factors affecting business model change (Foss and Saebi, 2017) and sheds light on the political-administrative context in which business model change takes place (Schmidt et al. 2017). The embeddedness in diverse political and economic landscapes as an outcome of a federal governance system shapes their leeway to change their business models. The latter 'depends on multiple factors such as the characteristics of the museums themselves (size, type of collection, available human and financial resources, etc.) as well as the institutional, legal and social environment in which they operate' (Vicente et al. 2012: 651).

Secondly, cultural and economic logics do not necessarily conflict with each other. Possibly, on the individual level, concomitant logics create unsolvable conflicts (Eikhof and Haunschild 2007; Reay and Hinings 2009). On a superordinate level, their combination provides chances to seize novel opportunities for value creation. This insight may reveal an opportunity for business corporations to re-assess their understanding of value creation. If they do not only address customers as the main stakeholder group but adopt a holistic view that considers societal challenges which go beyond an economic logic, their business models will embrace a wider audience's claims and may be more sustainable. However, a political logic can cause conflicts either by determining a direction of business model change that contradicts the actual needs of an organization or by impeding necessary change.

This study also has limitations. First, it does not probe potentially circular relationships. Possibly, the research museums do not only react to the logics which are pertinent in their environment. One of their salient tasks is the production of knowledge and innovation, which enables them to progressively change their business models (Coblence and Sabatier 2014) and which in turn may shape their stakeholders' logics. Longitudinal case studies including multiple data sources could be revealing in this regard. Secondly, this study concentrates on the organizational level of analysis. It does not allow examining how individual members of the research museums perceive the logics and their impact. Business model change 'produces both winners and losers internally' (Foss and Saebi 2017: 219). Future research could use multi-level analyses including primary data. These could show how logics create tensions on and between the individual and the organizational level and reveal how their interplay on different levels affects business model change.

The study illustrates that cultural and economic logics can complement each other. The political logic implies challenges for museum management. On the one hand, political stakeholders have demands that drive business model change. On the other hand, sometimes they do not fully embrace the particularities of the research museums. They outline expectations that the museums cannot meet, for example, because they lack the necessary financial resources. In addition, the vertical coordination between the federal and the state level in Germany can hamper promising initiatives. It shows the weaknesses of the German multi-layered science system, which reflects the federal governance system in this country (Edler and Kuhlmann 2008).

Finally, the Leibniz Association emphasizes the importance of the pursuit of collective objectives over individual goals. Traditionally, the Leibniz research museums hardly collaborate among each other, although working together more closely would help them 'retain their unique values, focus on service and advocacy, and maintain civic involvement' (Eikenberry and Kluver 2004: 138). Reay and Hinings (2009) show that collaboration effectively promotes the stable co-existence of competing logics. Museum managers should discuss their needs and contributions with policy-makers and executives in the Leibniz Association. This could lead to an increasing fit between the association and the research museums. It may also help the research museums identify promising avenues for future collaborative activities.

Supplementary data

Supplementary data is available at *SCIPOL* online.

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