State-of-the-practice in analyzing enterprises' business ecosystems

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Abstract. Business ecosystems are gaining more relevance both in research and in practice. The analysis of business ecosystems is thereby a data intense process. To better understand the current state-of-the-practice within enterprises addressing the analysis of business ecosystem we conducted an online survey asking participants about their division of labor, collection, documentation and processing of business ecosystem related data. 52 experts from mainly German based companies completed the questionnaire stating, inter alia, that the main data sources in use are internal company information sources and online search engines, and additionally that the time-consuming process of collecting and documenting business ecosystem related information is perceived as a major challenge in the context of business ecosystem analysis.

Keywords: Business Ecosystem, State-of-the-Practice, Competitor Analysis

1 Introduction

Undoubtedly, companies increasingly recognize the relevance of their complex business environment, which is also referred to as business ecosystem and which is already reality for most companies nowadays [1]. One aspect of the growing relevance of business ecosystems is the perceived shift of the competitive environment between no longer single companies and their supply chains but towards ecosystems competing against each other [2].

Thereby, a business ecosystem enlarges the classic supply chain, consisting of suppliers and customer, by also including other entities within the business environment of the enterprise. We define ***business ecosystems*** *as the holistic environment of a company covering current and potential future business partners, customers, suppliers, competitors, regulatory institutions, and innovative start-ups. It exhibits a high dynamic as continuously entities enter and leave the ecosystem.* For a comprehensive definition we refer to [1]. Analogously to the metaphor of a biological ecosystem, which served as a basis for the initial definition of business ecosystems, the economic success of an enterprise can therefore depend on the health and ability to evolve their business ecosystem. The role of the enterprise within its ecosystem can range from a

keystone to a niche player, contributing with or to products or services developed, produced and distributed within this ecosystem.

Due to the influence on the economic success of the enterprise and the dynamic characteristic, enterprises increasingly realize the need to analyze their business ecosystem continuously, in order to identify and address changes within their ecosystem, adapt own business activities accordingly and to "learn what makes the environment tick" [3].

Through qualitative interviews with industry partners, we extracted a high-level understanding of the business ecosystem analysis process and the challenges perceived by enterprise stakeholders. The analysis is a data-intense process, consisting of the steps of a) *data collection*; b) *data documentation*; and c) *data processing and reporting* using heterogeneous data sources within and beyond the enterprise. To achieve a holistic picture of the business ecosystem, several stakeholders within an enterprise in different roles and responsibilities should contribute with their knowledge, but also by communicating their requirement towards the analysis outcomes. Succeeding in such a holistic ecosystem analysis would enable enterprises to play a more active role within its business ecosystem.

With the here presented survey results, we aim at a contribution to capture the current state-of-the-practice how enterprises analyze their business ecosystem as part of their daily business. Thus, the subsequent research questions are addressed in this work:

RQ1. What is relevant business ecosystem related information and how do German companies organize the work associated with the analysis of their business ecosystem?

RQ2. How do German enterprises collect, document and process this business ecosystem related information?

RQ3. Which challenges do German organizations perceive within the analysis of their business ecosystem?

To answer these questions, we set up an online-based questionnaire inviting German experts to share their working experience analyzing their companies' business ecosystem. Particularly interesting for us were the sources the responsible stakeholders within the enterprise currently use and where they conceive the biggest challenges.

The paper is organized as follows: in Section 2 related works in literature covering business ecosystems are presented. Section 3 describes the survey and presents the survey results; this is followed by a discussion covering the limitations of the survey but also presenting results of additional workshops/feedback talks conducted prior and during the survey in Section 4. The work ends with an outlook in Section 5.

2   Related Work

Since the conceptualization of business ecosystems by James Moore in the mid-1990s, who defined it as a collection of interacting companies [4], the concept has been widely studied (cf., [5], [6]). Thereby, ecosystems "are interconnected through a complex, global network of relationships" [7]. In a business ecosystem, firms take on roles such as „suppliers, distributors, outsourcing firms, makers of related products or services, technology providers, and a host of other organizations" [8], all affecting the

characteristics and boundaries of the ecosystem. As "firms continuously enter and leave the ecosystem" [5], they constantly evolve and exhibit a dynamic structure [1].

Research on business ecosystems has recently highlighted the role of novel challenges for ecosystem formation, including technology contexts, e.g., the Internet of Things (IoT) [9] or policy contexts, e.g., smart city [10]. This has focused researchers' attention on ecosystem modeling [6]. Current approaches focus on frameworks to grasp the scope of ecosystem complexity ([9], [10]), or on visualization to understand emerging structures and patterns ([11], [9]).

Thereby, to be informed about changes within the business environment at an early stage enterprises analyze their ecosystem in order to adjust its entrepreneurial actions to these changes. Already existing decision support systems in research provide interactive visualizations that are presented to users and decision makers with models, methods, and problem-related data with the aim of decision support ([12], [13]) . These systems are applied in various fields using different data.

The visualization currently available in science for the support of decision-makers in relation to business ecosystems use data collected from trade journals, industry publications, registers, or paid data collections. However, the amount of data used is always huge and the data is diverse and often inaccurate [7]. To date, there are few scientific contributions to address this challenge or the inclusion of internal data with a focus on business ecosystem data ([9], [14]).

To understand the business ecosystem both the rather static network of entities (firms, technologies), and the dynamic network characteristics, i.e., the relationships between entities, and activities, all changing over time, must be part of the analysis process. Entities comprise "small firms, large corporations, universities, research centers, public sector organizations, (...) other parties [and human actors], which influence the system" [1] must be taken into account. They are linked through a variety of different relationship types, such as (past) cooperations, negotiations or personnel changes.

Which entities and relationship types need to be analyzed depends on the requirements put forward by the (business) stakeholders. Their needs and demands that define which (visual) views are relevant, and which insights are vital, are fundamental for generating and adapting the model as a possible result of the analysis process.

3 Survey

As the relevance of business ecosystems is often discussed in research (as described in Section 2), with our survey, we aim to contribute to a better understanding on how enterprises analyze their ecosystems as part of their daily business. This includes how the work is distributed within the enterprise, how data is collected, which sources are used, how data is documented and reported upon using various available tools and what main challenges of the business ecosystem analysis are considered. In addition, we try to identify where responsible stakeholders conceive challenges which can be addressed in future work.

3.1 Research design

After designing the questionnaire following [15], we performed a pre-test consisting of its completion by three independent and non-related researchers. The questionnaire was adapted according to the received feedback. The final version of the questionnaire was published as an online survey available between beginnings of July to end of August 2017. In total, we contacted 51 industry partners from various fields of business activity via e-mail and published an open call for participation using social media[1]. All contacts were approached twice via e-mail whereby the survey was also posted once using LinkedIn[2]. Within the e-mails, we briefly explained the concept of business ecosystems and the relevance for enterprises due to technological innovations. The completion time of the questionnaire was estimated with 15 to 20 minutes.

The online questionnaire consisted of seven sections, starting with questions covering the participants' and enterprises' details and if the enterprise is active in analyzing their business ecosystem (section one and two of the questionnaire), followed by the participants' role and the division of labor (section three). The fourth section addressed the business ecosystem related data collection, followed by the process step of data documentation and processing (section five), the perceived challenges within the analysis process (in section six) and finally the reasons why companies are not active in analyzing their business ecosystems (section seven).

After the question if companies are active in analyzing their business ecosystem in the second part of the questionnaire, the questionnaire was split into two paths. One path following for participants and enterprises active in the business ecosystem analysis (covering the section four to six with an overall of 21 questions) and one for the others (only comprising of section seven asking for the reasons of inactivity with an overall of 8 questions). This allowed skipping questions not fitting to a certain group of participants.

The only mandatory question for participants to answer within the questionnaire was if the company is active in analyzing its business ecosystem in section two, whereby the remaining other questions could be omitted by the participants. Whenever a question allowed multiple answers this was explicitly stated, for questions with exclusive options the used tool provided a suitable feature only allowing one answer to be given. Wherever feasible the answer option *other* allowed the participants to enter additional information as free text. For each question addressing business ecosystems, the definition of business ecosystem was displayed in the header of each questionnaire page.

3.2 Results

Upon survey closure, we received input from 52 survey participants of overall 86 survey participants opening and 61 survey participants starting but not finishing the

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[1] For this survey, we used the survey software questback (https://www.questback.com). The full survey is accessible on https://tinyurl.com/ybgwgbgy

[2] https://www.linkedin.com/

questionnaire. The answers of the different questionnaire sections are described in detail in the according section below.

Participants' details. The participating companies are active in a broad variety of business areas, ranging from Information Technology (IT) Providers (25%), Automotive Manufacturer (17%) to Public Institution (10%). Most of the participants described their job as Enterprise Architect (34%) or Innovation Manager (21%). Out of these, 25% worked as external consultant. Descriptive statistics of the responses of the participants' details are presented in Table 1.

Table 1. Participants' details

Company information							
Auto-motive OEM	Mobility Service/ Platform Provider	IT Pro-vider	Parts Supplier	Insurance Provider	Energy Pro-vider	Public Insti-tution	Other
9	7	13	2	3	1	5	12
Number of employees							
1 - 100		100 – 1.000		1.001 – 30.000		> 30.000	
8		5		16		23	
Current job position							
Enterprise Architect	Market (Intelligence) Analyst	Market Research Analyst	Business Value Analyst	Compe-titor Analyst	Innovation Manager		Other
18	2	1	3	0	11		17
External consultant							
Yes				No			
13				39			

Active in business ecosystem analysis. We asked if the company is active in analyzing its business ecosystem, which was answered by 88% with yes, i.e., 46 participants.

Division of labor. Aiming to understand the participants' roles within the analysis process, and how the work is divided within the company, we ask three questions. When asked for the responsibilities within the business ecosystem analysis, multiple answers were possible. 27% answered with *data and information collection*; 19% each with *information processing* or u*sing (processed) information for strategic decisions*; *answering to higher management level* were chosen by 17%; *responsibilities not clearly defined* 13%, and 5% answered with *other*. The business ecosystem related tasks are performed *full-time* by 42%, *part-time* 12% work *on a daily basis*, 24% *on a weekly basis* and 10% *on a monthly basis*. The final single-answer question of this section addressed the potential existing teamwork within the enterprise and no participant answered that she is working *alone, no other responsible colleague known*. 56% stated they work *collaboratively in a team and the responsibilities are clearly defined*, 32%

selected *not alone, but work is rather uncoordinated between me and other colleagues*, and 12% chose *other* as answer.

This indicates that enterprises realize the importance of analyzing their business ecosystem as they already invest manpower with more than 40% of the participants working full time in this area and more than half working collaboratively in a team.
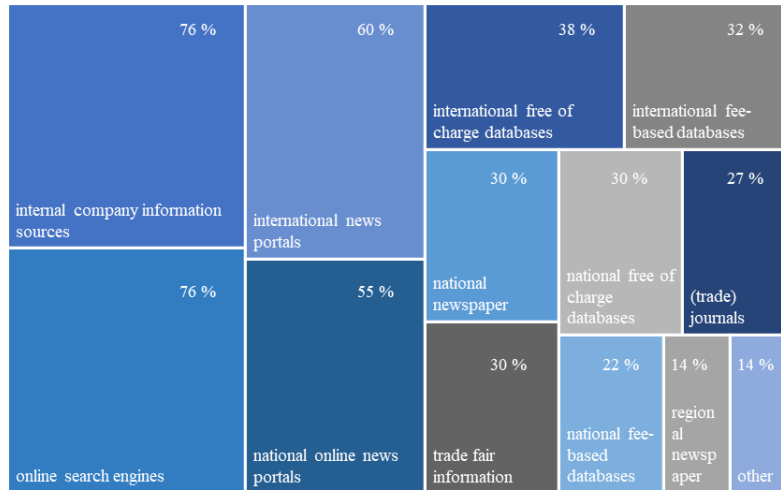

Figure 1. Sources used for Information Gathering within the Business Ecosystem Analysis

Data collection. The fourth section of the questionnaire entailed questions about the data collection process, the information gathered and the sources used. It comprised of seven questions, which could all be answered by the participants choosing multiple answers. 81% of the participants answered that they collect the information *actively, by searching for relevant information*, compared to 38% *collecting only by chance, i.e., passively*. When asked for time related development of the market as part of the analysis, 92% responded with *current development of the market and existing business relations*, 76% with *future development of the market and business relations within the next five years*, and 30% with *future development of the market and business relations exceeding the next 5 years*. As an increasing amount of information is now available in digital format, we asked participants which format of data is used, which was replied by 92% with *digital information, e.g., news feeds*, and 32% with *digital information, such as brochures*. The next two questions aimed at the data sources in use when collecting business ecosystem data, visualized in Figure 1 and Figure 2. The main data sources in use are *internal company information sources* and *online search engine* (both 76%), followed by *internal news portals* (60%) and *national online news portals* (55%).

When asked to name three sources according to their order of usage, *internal sources* were stated most as first source (9 participants) and *online search engine* as second or third source (4 participants or rather 2 participants). Often used are also *multi client market research studies*, e.g., published by Gartner, stated by 3 participants as first source, and by one as second and third source in each case.
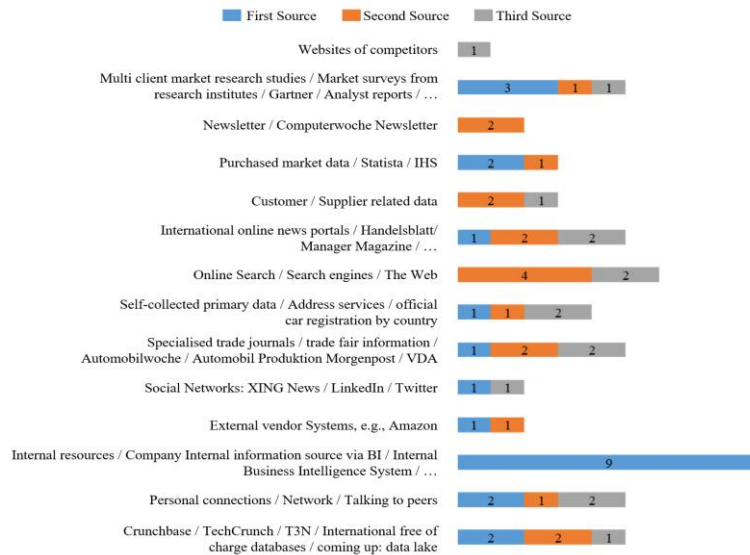
Figure 2. Main Sources for the Business Ecosystem Analysis

Using these data sources, the next questions addressed the information collected. Within the business ecosystem analysis, 81% of the participants are interested in information about *competitors*, 84% in *business partners*, 62% in *start-ups*, 59% in *suppliers*, 43% in *public regulatory institutions*, 22% in *public regulatory institutions*, and 11% stated *other*. Thus, besides the classic competitor analysis, enterprises also analyze their direct and indirect environment. As companies of the business ecosystem can be described using various attributes, we asked for company related information interesting for stakeholders analyzing the business ecosystem. 81% answered with *Business Model*, 76% with *Business Area*, and 70% with *Strategic Decision*. For a comprehensive list of answers, see also Figure 3.

Data documentation and reporting. Section five of the questionnaire comprised five questions about the current state-of-the-practice in documentation and processing of business ecosystem related data. Multiple answers were allowed for all questions. When asked how the participants document the collected information, 16% answered *with pen, paper and non-electronical document storage*, 73% selected *as digital documents in a (shared) file system*, 38% *transfer the information into a standard tool*, 16% *into a dedicated commercial tool* and 14% *into a custom -developed tool providing business ecosystem related features*, 8% chose *other*. Within this questions the participants were able to state the tool in used in a free text field for the different answer options. Thereby, the *standard tools* in use appear to be Microsoft Office software such as Word, Excel, PowerPoint, OneNote, but also Google Drive; as
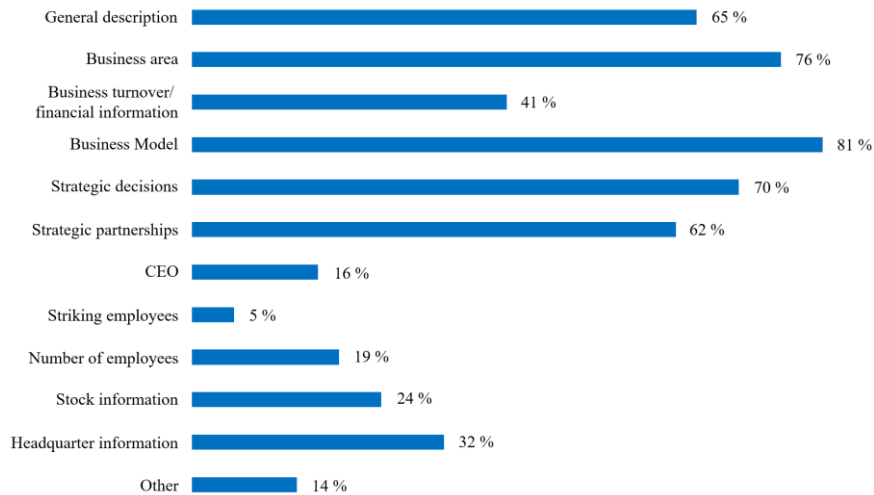
Figure 3. Company-related Information for Business Ecosystem Analysis of interest

commercial tools SugarCRM[3] and SAM CRM[4]; and as *custom-developed tools* Tableau[5], Qlik Sense[6], and PoolParty[7].

The next questions targeted at the reporting of the collected and processed business ecosystem information whereby 51% of the participants *notify colleagues ad hoc whenever information is available*, 41% *notify colleagues according to an agreed reporting schedule*, 51% *provide access to information, but perform no active notification*, 11% *carry out no reporting or sharing of information*, and 8% selected *other*. Based on this, the results of the processed business ecosystem analysis information are an *updated and accessible database* (30%), *a list of current / potential future competitors, business partners and innovative start-ups* (43%), *(economic) figures / performance indicators* (29,7%), *visualizations* (49%), *collected data is not processed* (19%), and *other* (14%). The answers of the questions which visualization types are already provided and in use and which are interesting for future usage is pictured in Figure 4. *Networks* are currently used by 19% and would be interesting for future use by 52%, *treemap visualizations* are used by 24% compared to 49% interested in this kind of visualization. 30% stated that *no visualizations are currently provided or in use*.
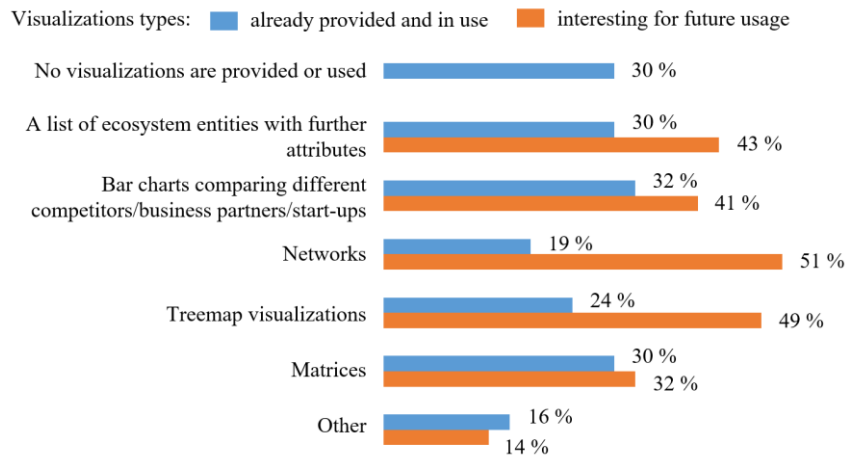
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[3] https://www.sugarcrm.com

[4] http://www.netzon.se/?portfolio=sam-crm

[5] https://www.tableau.com

[6] http://www.qlik.com

[7] https://www.poolparty.biz/analytics-visualization/

Figure 4. Visualization types already in use (blue) versus visualizations interesting for future usage (orange)

Perceived challenges. The final question of section six of the questionnaire addressed the perceived challenges within the business ecosystem analysis. More than half of the participants (65%) stated the *time-consuming processing of collected and documented data*. 46% selected that *several business units are involved, working rather uncoordinated*. No participant stated that *no challenge is perceived* within the business ecosystem analysis. All results are pictured in Figure 5.
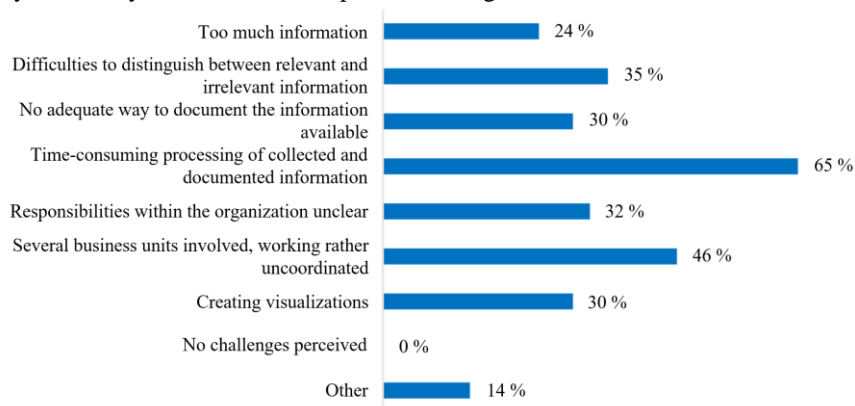

Figure 5. Main Challenges within the Business Ecosystem Analysis perceived by survey participants

Valuable insight also delivered two statements within the free text field attached to the answer option *other*, stating a *lack of understanding in the higher management,* and *identify possible stakeholders for the Data/I'm collecting for completeness of EAM*.

Reasons for inactivity. The four participants completing the questionnaire not active in the analysis of their business ecosystem were asked three questions addressing their

reasons for inactivity and their potential interests. When asked for the reason why the enterprise the participant works for is not active in analyzing its business ecosystem, 25% replied that the *responsibilities within the company are unclear*. 25% selected *information gathering not possible / too difficult*, 25% chose *no free capacities*, and the remaining participant answered in the free text in the answer option *other* that there is no holistic approach. According to the participants' answers information of the following entities would be interesting, *business partners*, *suppliers*, and *public regulatory institutes* (all 75%), *start-ups* (50%), and *competitors*, *public research institutions* (both 25%). The final question addressed in which area support within the business ecosystem analysis would be interesting for the participants. 75% answered *provision of information visualizations*, 50% selected *provision of relevant information*, also 50% chose *tool support for the processing of information, e.g., providing a list of competitors / business partners / start-ups or calculated figures*, and 25% said *tool support for the documentation of information*. That indicates a perceived need to address the enterprises' business ecosystem analysis.

4 Discussion

Obviously, the number of survey participants limits the generalizability of the survey results presented. Also, the survey - as it is presented here - targeted mainly German enterprises. Thus, further work could distribute the survey to a broader, international audience. As an additional limitation, the usage of the survey tool must be stated. As participants completed the survey remotely, full transparency within the response process is not provided. Offering participants with predefined answer options might have led to a biased result as participants face specific choices instead of open questions, which we tried to counteract with the free text answer option "other" whenever feasible. Finally, a shared understanding of analyzing business ecosystems amongst all participants might be missing.

With regard to the five in depth semi-structured interviews we conducted prior, and during the execution of the survey, all interviewed participants stated that they are active in analyzing the company's business ecosystems or at least focus areas of interest within the business ecosystems. The reasons for conducting the business ecosystem analysis were very diverse among the interview participants. Ranging from networking purposes to pure competitor analysis to gain a better understanding of all existing business relations with external partners. Of these five interviews, three representatives also completed the questionnaire. All five representatives stated that the greatest part of knowledge of the business ecosystem is bound to individuals within the company and not further documented. All were dissatisfied with the current tool support in use, ranging from Customer-Relationship-Management tools, to Microsoft Office Products (which were in use mainly), such as Microsoft Excel or Microsoft PowerPoint. These insights confirm the results we gained from our survey.

Considering the results of the survey, we can answer the aforementioned research questions: Participants stated that relevant business ecosystem information is the business model (81%), the business area (75%) and strategic decisions (70%) of the

analyzed ecosystem entity. Even though more than half of the participants work collaboratively in teams when analyzing their business ecosystem, a third of the survey participants stated that they do not work alone but rather uncoordinatedly within the enterprise, which recurs as a major challenge as responsibilities within the enterprise are unclear (32%) [**RQ1.**, **RQ3.**]. The survey participants use mainly internal company information sources or online search engines (both 76%), but more than half of all participants notify colleagues on an ad-hoc basis (51%), which indicated a missing alignment in the process of communicating and discussing changes within the business ecosystems [**RQ2.**]. This is reflected in the identified major challenge of time-consuming processing of collected and documented information [**RQ3.**].

By analyzing their business ecosystem, enterprises can identify and address changes within their environment and adapt own business activities accordingly which could lead to a business benefit for these enterprises. According to the survey results, the growing influence of business ecosystems on the economic success of an enterprise is increasingly perceived by enterprises. Nevertheless, enterprises are facing multiple challenges when analyzing their business ecosystem due to the data intense process it is based upon.

5 Conclusion

With this work, we provide a state-of-the-practice in how enterprises in Germany analyze their business ecosystem and which challenges to be addressed by research to support enterprises in their efforts.

For future work, besides the above-mentioned limitations of the presented survey, tasks and questions in the context of business ecosystem analysis could be identified in close collaboration with enterprises within future research. These could be the basis to identify stakeholders to be integrated in a collaborative process to achieve a holistic model of the enterprise business ecosystems. In a next step, suitable data sources could be selected for the analysis.

To address the identified challenges within the data collection process step, potential future research could address automated data analysis of heterogeneous data sources both enterprise internal but also external, such as in use CRM tools or news feeds.

For the challenges of data documentation and processing, current results in research already proved that visualizations help support business ecosystem stakeholders in their decision ([12], [13]). Future research could analyze suitable visualizations for the identified tasks and questions, the provided features of these visualizations, and how the visualizations could be provided within a collaborative process of analysis and modelling in an enterprise.

Therefore, we are developing a prototype that facilitates data collection and implements findings from existing work on ecosystem visualization to support companies in this complex task. Future work will evaluate and improve this prototype.

6   Acknowledgments

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