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Sustainability objectives and collaboration lifecycle in cluster organizations

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Abstract
In our paper, we combine two issues, collaboration in cluster organizations and sustainability, aiming to answer the question: Does complex governance structure of cluster organizations support members in formulating and reaching sustainability objectives? Based on four case studies of cluster organizations and a still novel abductive approach, we present the ways in which sustainability was executed in their functioning. Our study shows that the role of cluster organizations in formulating and reaching sustainability objectives varied with regard to their collaboration life cycle. The "Formation" stage laid the foundations for collaboration and relational governance, the "Growth" stage aimed at improving the economic performance of cluster members, while the "Extension" stage impacted more cluster stakeholders with regard to the economic, social and environmental sustainability objectives. Nevertheless, stakeholders' self-interest induced collaboration, whereas relational governance was its essential feature. Moreover, the potential of cluster organizations' governance structures was not fully exploited in the context of sustainability, their structures have played a role in raising awareness, but it was more the competitive factors that drove companies to engage in an activity because they wanted to stay in the market, change the conditions and keep up with trends. Our research also provides practical implications for various cluster organizations' stakeholders.

Keywords Cluster organizations · Collaboration lifecycle · Governance structures · Stakeholder theory · Sustainability · Sustainable development

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1 Introduction

Sustainability is a growing concern in global research, which is reflected, among other things, in the number of published papers in various disciplines that tackle the issue. Around 12,000 scientific papers on the phenomenon are published annually, with a widely-shared belief that "sustainability science is expected to play an important role in establishing expertise and contributing to the realization of a sustainable society" (Kajikawa et al. 2014, p. 431). Although much has been written about sustainability, it is unquestionable that nowadays, faced with environmental pollution, climate change, the pandemic etc., we need to pay even more attention to it than ever before (Ranjbari et al. 2021). Sustainability may simply be seen as the ability to survive and persist. In normative terms, it reflects the pursuit of a system towards "maintaining or improving desirable conditions, and more broadly strengthening the capacity to do so" (Butler Harrington 2016, p. 371). It is an attempt to achieve balance among social, economic and ecological objectives, i.e. the so-called triple bottom line objectives/pillars (Moles et al. 2008; Mousavi et al. 2018). This definition is used in our research. Sustainability science is multi-, inter- and transdisciplinary, whereas sustainability issues are context-dependent and socially mediated (Kajikawa et al. 2014; Maher et al. 2018). We apply the perspective of the management discipline to research sustainability in the context of cluster organizations (COs), rather than the territory, because we have found that the issue of sustainability in COs from this perspective is underdeveloped, requires more theoretically oriented studies, and our research aims to fill the gap. Such knowledge can benefit various stakeholders in cluster organizations by helping them make evidence-based decisions about what might motivate COs to integrate sustainability goals into their operations.

Sustainability-related problems are compound and require more complex governance structures. A multi-level governance system can help develop collaboration between stakeholders and facilitate the combination of resources and capabilities located outside the boundaries of companies (Niesten et al. 2017). COs may be perceived as a form of complex governance. Over years, COs have grown substantially in number around the world as they have been used to improve regional competitiveness and mediate the potential advantages of clustering, since their aim is to support cluster members. They may play the role of brokers to develop a cluster and its members by various forms of assistance (Klofsten et al. 2015; Venugopal et al. 2018; Wältermann et al. 2019). Functioning in COs supports access to information about environmental or social concerns and enables spreading sustainability standards (Berkowitz 2018; Ratten 2018). COs are examples of meta-organizations (Lupova-Henry et al. 2021), which are pivotal in the governance of sustainable practices due to their certain attributes, such as serving as a platform where different stakeholders meet, ensuring reporting and accountability mechanisms, or facilitating cooperation and social learning (Berkowitzs 2018). Thus, COs appear to be a vital object of inquiry in the context of sustainability.

We stress that we intentionally make a distinction between clusters in general and COs as a peculiar type of cluster, resulting from the act of clustering (Andersson et al. 2004); however, this approach is less common in the literature (Hassan and Abu Talib 2015; Morgulis-Yakushev and Sölvell 2017). In our paper, the emphasis is on the organizational and managerial aspects of clustering (i.e. governance structures and collaboration); thus, the division between clusters and COs is crucial. Clustering can be perceived as an artificial

tool to improve firm performance (Andersson et al. 2004). As formally established meta-organizations, COs are more aggregated, and therefore complex with regard to the decision making and collective identity processes (Berkowitz et al. 2022; Lupova-Henry et al. 2021), they consist of other organizations that purposefully form a cluster to achieve certain objectives (Lis 2019; Lis and Lis 2021). Various authors indicate differences between COs and clusters, e.g. regarding life cycle phases or the ability to promote social relationships and linkages (Hassan and Abu Talib 2015; Lis and Rozkwitalska 2020; Morgulis-Yakushev and Sölvell 2017; Richardson 2013; Sölvell et al. 2003). Putting it succinctly, COs are artificial structures formed to enhance and support competitiveness of clusters through collaboration, while the nature of clusters impacts on COs. There is a scarce research on sustainability in COs, especially regarding how governance structures and sustainability initiatives are aligned (Giglio et al. 2020) and we shall endeavor to fill these gaps. Moreover, understanding collaboration is key to the comprehension of how COs execute sustainability. Collaboration is more than a simple cooperative or coordinated efforts, it is the highest form of long-term, trust-based relationships that develop over time. Therefore, in the paper we attempt to answer the research question: Does complex governance structure of COs support members in formulating and reaching sustainability objectives? Based on four case studies of COs, we present how sustainability was actually executed in their functioning. We refer the findings to collaboration theory and discuss sustainability with regard to different CO lifecycle stages. Niesten et al. (2017) and Reficco et al. (2018) call for more research on governance and collaboration in regard to sustainability, and our study contributes to this domain. It also fills a gap in the literature on clustering through incorporating sustainability into research on COs. We propose a framework, concluded from an abductive approach, that shows the role of collaboration in COs and their governance structure at different lifecycle stages in addressing sustainability objectives.

In the paper, we first present a literature review concerning sustainability and governance with regard to COs and the theoretical inspiration for the study. Subsequently, we describe the methods used in the research and report its findings. Finally, we discuss the results, referring to the theoretical background applied to the analytical process, and describe contributions, limitations and directions for future research.

2 Literature review

2.1 Sustainability triple bottom-line objectives

Sustainability is mainly perceived as a management ideal that incorporates economic, social and environmental concerns simultaneously and interdependently to the benefit of current and future generations (Confetto and Covucci 2021; Giglio et al. 2020; Ranjbari et al. 2021; Weidner et al. 2021). It is known as triple bottom-line objectives that have been implemented in business as a high priority (Confetto and Covucci 2021; Weidner et al. 2021). The term ‘triple bottom-line objectives’ encompasses three pillars: 1. economic sustainability directed toward profitable performance; 2. social sustainability directed toward employee and society welfare; and 3. environmental sustainability directed toward responsible consumption of resources (Khan et al. 2021). For example, improving productivity and competitiveness or fair procurement practices support economic sustainability; waste management,

addressing climate change issue and eco-design enhance environmental sustainability; educational programs, reasonable job design or better job prospects foster social sustainability (Confetto and Covucci 2021). Furthermore, sustainability assumes transparency, accountability and ethical conduct and can be achieved through sustainable innovation (Weidner et al. 2021). In addition, collaboration enables achieving sustainability (Coletti and Landoni 2018; Soosay and Hyland 2015; To 2016; Ucler 2017; Wondirad et al. 2020). Yet, Confetto and Covucci (2021) claim that the triple bottom-line approach lacks governance component essential to pursue sustainability, whereas Giglio et al. (2020) indicate that studies concerning governance structures and sustainability practices are insufficiently developed.

To recap, we equate sustainability with triple bottom-line objectives and intend to contribute to the debate on the issue with the study on inter-organizational collaboration and governance structures in COs.

2.2 Cluster organizations and sustainability

COs are an idiosyncratic form of clusters resulting from the act of clustering (Andersson et al. 2004). Since 1990, their number has significantly increased in Europe. Henceforth, the literature concerning COs has also been extensively augmented; however, it is strictly connected with general studies on clusters (for an overview, see e.g. Morgulis-Yakushev and Sölvell 2017), mainly by economists or geographers, which, due to the differences between clusters and COs, is a shortcoming. Clusters are concentrations of companies and other entities in certain regions, linked through related industries (Porter 1998, 2000; 2008), whereas COs are intermediary organizations which implement and coordinate special joint projects by businesses, authorities and/or other organizations to develop clusters (Klofsten et al. 2015; Morgulis-Yakushev and Sölvell 2017; Porter and Ketels 2009; Smorodinskaya and Katukov 2019; Lis and Lis 2021). COs provide formal and informal mechanisms of organization which may determine the effectiveness and competitiveness of clusters. COs function on the basis of collective self-governance "and a horizontal way of consensus-building, backed by mutual economic benefits of the cluster agents" (Smorodinskaya and Katukov 2019, p. 82). Their governance structure typically includes an executive director, administrative staff and a board that consists of representatives of CO members (Wältermann et al. 2019; Klofsten et al. 2015) highlight that COs "perform work that would not normally occur under commercial conditions" (p. 69). They should enforce collaboration in pursuit of agglomeration effects that clusters offer (Giest 2016; Morgulis-Yakushev and Sölvell 2017). Yet, this potential may remain unfulfilled if collaboration is insufficient. Therefore, understanding collaboration is critical for the comprehension of how COs execute sustainability.

The review of clustering literature conducted "to identify the most important themes of the current and future research" (Lazzeretti et al. 2019, p. 12) revealed that sustainability had been attracting growing interest among academics. However, the main themes covered include sustainable innovation and cluster resilience. In the context of COs, the topic of sustainability remains rather undocumented. Our literature search with the use of the following criteria: 'cleantech cluster/cluster initiative/organization', 'green/green energy cluster/cluster initiative/organization', 'regional sustainability cluster/cluster initiative/organization', 'sustainable energy cluster/cluster initiative/organization', and the pair of keywords 'sustainability' and 'cluster initiatives/organizations' 'sustainable innovation' and 'cluster/cluster initiative/organization', concerning titles, abstracts and keywords in the Web of Sciences

and Scopus databases (June 2020), resulted in the identification of a few relevant papers and a gap regarding COs. It appears that the topic may be more vital in praxis than in the scientific discourse of top-tier journals. For example, McCauley and Stephens (2012) notice insufficient recognition of the role of COs in the socio-technical transition process that supports sustainability, though they emphasize that the role is important. Ratten (2018), in her study of wine clusters confirms enhancing role of clusters in spreading information about environmental or social concerns and sustainability standards. Berkowitz (2018) considers clusters as meta-organizations critical in the governance of sustainable business practices. They serve as a platform for meeting various stakeholders and can support reporting and accountability mechanisms, or facilitate collaboration on sustainability objectives.

Summarizing, COs are unique governance structures established to improve cluster functioning, enforce networking and coordinate members' efforts. Sustainability in COs, from the perspective of the management discipline, requires more theoretically-oriented studies, and our research may fill the gap. The theoretical substantiation for our study is grounded in collaboration theory.

2.3 Collaboration in cluster organizations

The collaboration theory is fragmented and has been inspired by many paradigms, e.g. the resource-based view, organizational learning, the relationship-based perspective, and fields such as economics, marketing, tourism, urban studies or public affairs (Coletti and Landoni 2018; Shin and Shin 2016; Soosay and Hyland 2015; To 2016; Ucler 2017; Wondirad et al. 2020; Woodland and Hutton 2012). Correspondingly, there are numerous definitions of collaboration; nevertheless, it is the highest form of long-term, trust-based relationships, more so than cooperative or coordinated efforts. Collaboration is a process involving various actors who discuss issues of shared interest to reach a consensus (Soosay and Hyland 2015; Wondirad et al. 2020). Its principal characteristics include joint planning and decision-making, sharing resources, information and risk, mutual understanding and involvement in processes, and striving to achieve shared goals and optimal solutions (Soosay and Hyland 2015). As for multi-paradigms of collaboration theory, this paper adopts the relationship-based perspective on collaboration and its elaboration in stakeholder theory (Shin and Shin 2016).

To justify our theoretical background, we argue that COs are complex meta-organizations composed of multiple groups of various stakeholders. Complexity is an immanent feature of meta-organizations that must find the right balance between aligning and differentiating their members, that face multi-level inconsistencies in decision-making, and that experience a complex interaction of power and authority among its members (Berkowitz 2018; Berkowitz et al. 2022; Lupova-Henry et al. 2021). Stakeholder theory has been applied in studies on both sustainability and collaboration (Janssens and Seynaeve 2000; Shin and Shin 2016; Soosay and Hyland 2015; Wondirad et al. 2020). To a narrow extent, it has also been used in the clustering literature (Fulgencio 2017; Galli and Bassanini 2020; Gerke et al. 2015; Sánchez-Hernández et al., 2017). Hence, stakeholder theory can link these threads in our research. Furthermore, since collaboration is exposed in our findings, collaboration theory may offer insightful contributions to the understanding of how sustainability is executed in COs.

Stakeholder theory (Freeman 1984) highlights the importance of collaboration with various stakeholders to accomplish goals. Since stakeholders can impact or are impacted by organizational performance, organizations have to address their needs and interests in order to survive. Stakeholder theory delineates internal and external groups of stakeholders and recommends including the expectations of the relevant ones while making decisions, e.g. by involving them in collaboration. It acknowledges that self-interest is a primary motive for collaboration, while propensity to collaborate increases with the complexity of problems. Interdependencies and benefits determine the need for collaboration, while social relationships lay the foundation for its occurrence and later development (Pucci et al. 2020; Shin and Shin 2016; Wondirad et al. 2020). Furthermore, it is claimed that for collaboration each stakeholder's rights and capacity must be mutually accepted. Moreover, collaborating stakeholders should have necessary expertise, skills, or resources (Janssens and Seynaeve 2000). With regard to sustainability, prior research implies that stakeholders may motivate companies to implement its objectives in daily operations or engage in sustainable innovation (Hatch et al. 2017; Krivorotov et al. 2016; McCauley and Stephens 2012; Pucci et al. 2020).

Various authors agree that collaboration should result in positive outcomes for its participants such as improved relationships among organizations, their wider participation, enhanced problem solving and smoother implementation of joint decisions. However, it can also be fraught with challenges, e.g., cooperating partners may exhibit a lack of trust, opportunistic behavior, or insufficient commitment (Saukko et al. 2020). Moreover, collaboration is subject to a life cycle. Coletti and Landoni (2018) propose the three-phase life cycle of collaboration, including formation, development and extension. Furthermore, collaboration needs governance structures, such as COs. Collaboration governance structures play a crucial role in sustainability initiatives (Awan et al. 2018; Giglio et al. 2020) and encompass the relationships among participants that form the structure for deciding the objectives, delivering the means of achieving them and monitoring their execution (Tepic et al. 2011). Structural governance reflects the legal form of collaboration, while operational governance involves contractual governance, including relationships or relational governance (trust) (Coletti and Landoni 2018). Structural governance plays a pivotal role in the formation of collaboration and a stabilizing role during the development and extension phases, which, however, are mainly triggered by operational governance (Yström and Aspenberg 2017). Moreover, relational governance helps mitigate conflict and deter partners' opportunism (Awan et al. 2018; Giglio et al. 2020; Yeh 2016) explain that "sustainability-related activities create problems and opportunities for the members of a group, who need to get together to make a decision" (p. 2). It governs interactions "through relational norms in which both parties behave with the aim of achieving the joint objectives" (Awan et al. 2018, p. 2). It involves social processes in which relational norms are promoted and mutual obligations, promises and expectations are met as well as joint action are undertaken. It requires information sharing, fair exchange, balancing power between parties and developing collaboration. Structural governance, on the other hand, shows the incentive for partners to collaborate reflected in their drives or expectations of future benefits (Tepic et al. 2011). Relational governance is particularly emphasized in the relationship-based paradigm (Tepic et al. 2011).

To recap, we predict that multiple stakeholders engage in collaboration in COs motivated by their self-interest and the complexity of the faced problems. Their propensity to strengthen collaboration should increase if more benefits can be achieved with COs. COs

offer a complex governance structure, while the role of its two forms in formulating and reaching sustainability objectives varies with reflecting the collaboration life cycle. Deepening of collaboration in COs should transform members' objectives and sustainability pillars would be gradually addressed. Relational governance appears to be a decisive factor in reaching sustainability objectives.

3 Research methods

A case study research strategy (Yin 2014) was used to answer the research question of whether a CO's complex governance structure supports members in formulating and achieving sustainability objectives. Our intention was to capture sustainability in the operation of COs. Based on Yin's approach, we: (1) defined objects; (2) selected specific objects in the multiple-case study path; and (3) chose a theoretical concept to interpret our results.

First, only those COs that operated in Poland in a formalized manner were eligible for the study. We decided to focus on the Polish economy because of its developed cluster policy and, as a result, the high availability of COs, the object of the research. Second, we used the extreme case method to create a diverse sample and obtain a broad view of the phenomenon under analysis. Third, we qualified COs according to the following criteria: (1) a minimum of five years of existence; (2) a minimum of 20 members; (3) at least regional coverage. These criteria were set to eliminate those COs that were too small in scale or scope or too young to develop meaningful collaborations. Finally, two COs from the ICT sector (ICT CO1, ICT CO2) and two from the metal sector (Metal CO1, Metal CO2) were selected for the study to compare differences and similarities between COs. As for similarities, they are mature organizations, at least 10 years old, they have the majority share of companies among all their members, they operate regionally and shape relationships internally (e.g. in the form of human resources development, joint marketing) and externally (e.g. through supporting the regional education system). The COs differed in terms of location (Central Poland – ICT CO1, Northern Poland – ICT CO2, Eastern Poland – Metal CO1, and Western Poland – Metal CO2) and size (ICT CO1–200 members, ICT CO2–130 members, Metal CO1–78 members, and Metal CO2–35 members). The majority of members in the studied COs were enterprises, but the COs also included universities, educational institutes or business environment support organizations. With regard to the third step recommended by Yin (2014), while interpreting the results we referred to collaboration theory.

We conducted a longitudinal study to capture the dynamics around the issue and confirm our initial findings (Fig. 1).

We conducted the first phase of the study in 2016. It was based on 35 individual in-depth interviews (7 in Metal CO1, 11 in Metal CO2, 6 in ICT CO1, and 11 in ICT CO2) lasting an average of 75 min with individuals representing CO coordinators and different CO members, conducted at the offices of the entities studied. In the first phase of the study, each of the selected entities was represented by at least one person, and in four cases by two people. Respondents were mainly directors and owners, or individuals delegated to represent the company in COs, usually senior managers or specialists. The questions we asked, concerned the phases of CO development and the activities typical of each phase, the degree of involvement of CO members, and the benefits obtained from COs. Since sustainability was rarely mentioned by our interviewees in 2016, we added questions that directly addressed the topic

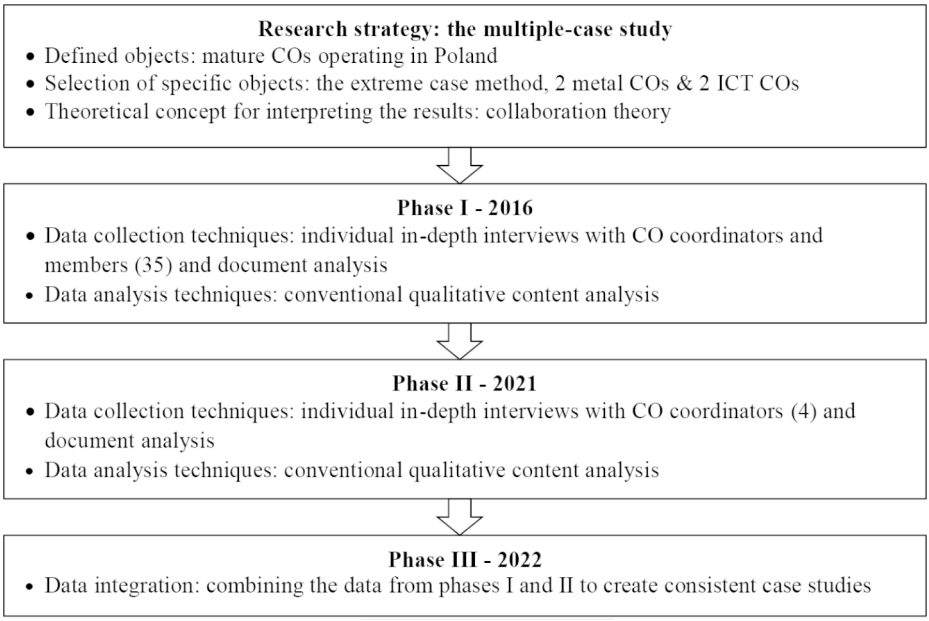

Fig. 1 Research process

in the next phase. We asked what economic, social and environmental goals and initiatives were formulated and implemented in each phase by which stakeholders and how and why they were involved. Due to the pandemic, the second phase of the research was therefore conducted in 2021, in the form of individual in-depth online interviews (lasting an average of 90 min) with four representatives (coordinators) of the pre-selected COs (in Metal CO1 and ICT CO2, we interviewed the same COs' representatives as in 2016, unlike in Metal CO2 and ICT CO1, where interviews were carried out with different people than in 2016). We asked about whether sustainability was consciously taken care of in the COs' activities, which stakeholders showed the most commitment to sustainability, and what benefits CO members achieved by engaging in sustainability activities. Furthermore, in the first and second phases, we obtained additional data by analyzing documents (CO reports, expert opinions, promotional materials, internal documents, websites, etc.) In the third phase (2022), we integrated the analyzed data, creating coherent case studies.

We used a conventional qualitative content analysis procedure (Hsieh and Shannon 2005) to analyze the interviews. In interpreting the results, we used an abductive approach (Peirce 1931; 1958; Chamberlain 2006; Bruscaglioni 2016) and coding (Glaser and Strauss 1999) to relate the phases of the CO life cycle to sustainability goals. Coding consisted of three phases, i.e., open coding, axial coding, and selective coding. Open coding involved identifying common themes emerging from the interviews (e.g., promoting sustainable solutions, lobbying). In axial coding, each theme was mapped to five identified categories and their specific characteristics (Appendix 1). Finally, in selective coding, categories and their characteristics were grouped horizontally to distinguish sustainability pillars, practices, and stakeholders at each stage of collaboration in the CO (Appendix 2).

Moreover, we obtained data through the analysis of the documents (CO reports, expert opinions, promotional materials, internal documents, websites, etc.).

4 Empirical findings

4.1 The "Formation" stage

Based on the similarity of activities in COs, we identified the collaboration life cycle, which included the "Formation", "Growth" and "Extension" stages. Each stage can be portrayed by its main objectives and a degree of collaboration.

In the "Formation" stage, most cluster members had no previous contact with one another, so the COs were mainly reducing their anonymity and supported the development of relationships between CO partners. The CO members attended meetings organized by the CO coordinators or hosted by entities from outside the COs. They included formal and informal components with adequate time devoted to networking and integration. The formal part was designed to bring participants together and allow them to overcome the barrier of anonymity, while the informal part was designed to strengthen the relationships that were formed. Integration meetings (on and off-site) and fairs and conferences were the most popular forms of networking, especially in ICT CO2 and Metal CO1. In ICT CO2, there were regular afternoon teas and business breakfasts, and an annual conference, which fostered the development of direct relationships between their participants.

"At the business breakfasts, we established our first partnership with a company that we are still working with today. Our director evaluates them very positively, because there, without boring others, the companies could briefly talk about themselves, what they did and what they were looking for." (ICT CO2 – R5).

ICT CO2 independently initiated and organized most activities (thus concentrating on internal stakeholders), whereas Metal CO1 was more involved in events organized by external entities. Their members went on study visits, economic missions, fairs and trade exhibitions. Our interviewees also appreciated the integration-related function of such events. With an increase of intimacy, the members were more open to share their views and problems. Overcoming the barrier of distrust facilitated a debate about possible collaboration, and the common ground identified created the potential for collaboration.

"During trips we find out what problems other people have, what they have to do, what worries them." (Metal CO1 – R12).

Additionally, Metal CO1 participants valued integration trips dedicated solely to establishing new relationships and nurturing the existing ones.

"Once a year the cluster organizes a meeting, on the Bug. There we summarize the year, something happens, we discuss it, but most of all we can sit down and just talk, completely informally. […] thanks to such meetings, we gain trust in each other." (Metal CO1 – R6).

The list of stakeholders attending the meetings and benefiting from the outcomes of the collaboration established through those meetings was relatively short. These were the coordinators and CO members (especially those who were an active audience during the meetings). The latter were also the main beneficiaries of activities undertaken. These benefits provided a healthy basis for establishing advanced relationships, including collaboration at further stages.

Regarding sustainability, the analyzed stage loosely corresponds to the social pillar. The integration of initially anonymous members into a relatively cohesive whole was a step toward creating a community focused on common goals, which was associated with a reduced likelihood of opportunistic behavior of its members. Such integration also implies, to some extent, the realization of the ideal of social equality. It also supported the development of the next collaboration stage, since partial integration achieved at the "Formation" stage, enhanced collaboration based on fair exchange or ethical conduct.

4.2 The "Growth" stage

At this stage, some CO entities made their first attempts at cooperation. Most often it came down to complementing deficiencies in resources with surplus resources of CO partners or increasing the effectiveness of resource management, which the entity already had. Activities undertaken in the "Growth" phase were initiated mainly in small groups set up for a particular purpose (e.g. lowering costs of a particular service).

Collaboration through task forces was observed in all COs in the study, nevertheless, certain differences occurred. The ICT COs were involved in creating or obtaining certain services and knowledge, while Metal COs were focused more on ensuring delivery of goods required for production. Consequently, ICT CO2 had a task force responsible for developing a catalog of machines and equipment owned by individual companies. The most important objective of this activity was to create a platform for the development of collaboration within CO and to facilitate mutual lending of equipment. The potential for resource exchange turned out to be very high; entrepreneurs realized that they were not fully utilizing their own resources, and at the same time they often felt the need for other resources.

"Many of the CO's have lab equipment that is not as often used in labs, but it is good equipment. There was an idea to create a catalog of equipment so that if someone in the cluster wanted to use it, they would know who to contact." (ICT CO2 – R7).

In the same CO, efforts were taken to reduce the cost of equipment calibration for companies and another task force was formed. It was to identify a single provider of calibration services for member companies, which resulted in better prices negotiated for all participants using such services, resulting in savings.

"At the beginning or in the middle of the selection process of a calibration company, each company received three bids from three different companies and they were more favorable than before […] the companies exchanged contact information and those that were interested in doing business received bids from specific bidders." (ICT CO2 – R6).

In Metal COs, numerous and diverse meetings were used, among other things, as channels for the flow of information regarding needs for and surplus of resources, which naturally accounted for collaboration among selected member companies. Metal entrepreneurs cared more about material inputs than ICT companies, as these resources provided them with a competitive advantage. Therefore, metal companies were striving for self-sufficiency, at least in areas concerning their core competencies. In other areas, they were willing to forgo purchasing resources if they had the opportunity to obtain them through collaboration with others in the market, thus lowering their purchasing costs. Companies exchanged resources, and companies with the necessary resources acted as subcontractors or made equipment, machinery, or facilities available to others.

"I don't have a plasma cutter, and my colleagues do, because they need it for production. They use it for 1.5 shifts, and provide services during the rest. For me, there is no point buying the machine because I am a service company and I subcontract plasma cutting works to them. […] In such situations we outsource work to one another." (Metal CO2 – R1).

The "Growth" stage still did not involve a wide range of stakeholders. Directly involved stakeholders were even fewer than in the "Formation" stage, where coordinators tried to activate all members. Task forces at the "Growth" stage and collaboration in the form of, for example, developing common standards of conduct involved only a few COs. Similarly, the number of beneficiaries of such cooperation was smaller, as it included only parties involved in a specific action.

We can see that cooperation at this stage, although not as a deliberate action, supported the economic pillar of sustainability by managing resources more efficiently or making up for its own shortages. The exchange of goods and services with CO partners provided a solid foundation for lower operating costs, higher profits, and thus increased the potential for the company engaged in such collaboration. Building relationships during the "Growth" stage maximized the chances of establishing a collaboration in which all partners adhered to certain ethical principles.

4.3 The "Extension" stage

The "Extension" stage was the most mature area of COs' collaboration. Activities undertaken at this stage could have an impact on three pillars of sustainability. Activities at this stage were oriented externally and internally.

Externally oriented activities influenced the CO environment in different dimensions: social, economic, environmental. These activities were quite similar in all COs, but adapted to the conditions of the industry and the region in which they operated. All COs were involved in lobbying activities, including the shaping of business conditions both at the central and regional levels. At the central level, this included the involvement of some CO members in legislative work to introduce more favorable legislation. COs supported public authorities in shaping economic policy, while creating opportunities for the development for entities in a given industry. They also acted as consultants for local authorities in creating strategic action plans.

"We function for the environment. […] clusters can take certain ideas to the next level, whereas individual companies don't have that power of influence; it's easier for a minister to meet with a cluster." (ICT CO1 – R2).

At the regional level, COs were even more active in undertaking various operations for the benefit of the industry, the effects of which served primarily the interests of their members and indirectly the regional economy. An example is their involvement in the process of selecting regional smart specializations. In Poland, smart specializations were selected at the national level and at the level of individual regions (voivodeships). Since smart specialization strategies should not be defined top-down by public administration bodies, the process of defining them was conducted from the bottom up, with the participation of various entities, including entrepreneurs, research units and other organizations, which jointly identified priority areas. The COs significantly defined smart specializations in the regions in which they operated, especially ICT CO2 and Metal CO2. Both formal and informal CO structures have increasingly become starting points in identifying priority areas and design-

ing and implementing innovation strategies. Clusters can indicate significant geographic and sectoral concentrations that determine a region's innovation potential and competitive advantage (smart specialization identification level), while COs, as governance structures, can support the development of regional industries with growth potential (strategy implementation level).

"We have been able to work out a compromise in the CO where, on the one hand, companies that actively participate and devote their time to the development of smart specializations can feel secure that they can benefit from it. On the other hand, other companies that don't even know about the CO can benefit from smart specializations." (ICT CO2 – R7).

"In addition, what we managed to get for the CO when creating regional strategies and the so-called key industry strategies in relation to new EU subsidies was the inclusion of the metal industry in smart specializations. It was very difficult; it took us about 1.5 years." (Metal CO2 – R2).

Another joint action of the entities was created in response to the progressing demographic decline in Poland and the increasingly noticeable lack of people with appropriate education (including the vocational one). Problems in the education sector and labor market prompted Metal CO2 members to take corrective actions that would benefit both the CO and the entire industry in the region. The CO members have taken steps to work with educational institutions. They attempted to align curricula with the needs of the local and regional economy and to help organize secondary and tertiary education.

"We engage in the educational process and accept students for internships. We wanted the local environment to be enriched with education to ensure a supply of workers and be best prepared for the job market." (Metal CO2 – R1).

Another example of a successful project initiated at Metal CO2 as a result of a dialogue between entrepreneurs and the education sector was a proposal submitted to the Ministry of the Family, Labor and Social Policy to introduce the welder profession to the classification of professions.

"There is no such profession as a welder, which is important in the metal industry. […] The cluster has applied to the ministry for its recognition as a separate profession based on our opinion." (Metal CO2 – R10).

Complementing the above initiative was the idea of establishing a training center to prepare personnel for the member companies. This concerned the training of welders, whose shortage was increasingly felt by entrepreneurs in the metal industry.

"Establishing a training center for welders here is a very important goal for the industry; a training center for CNC machine operators would probably be a good common goal for cluster companies as well." (Metal CO2 – R10).

The externally oriented activities identified in the Extension stage represent a significant expansion of the list of stakeholders, those directly involved in as well as those who benefit from these activities. None of the other stages of the CO lifecycle affected such a broad spectrum of stakeholders. Among the stakeholders we can distinguish coordinators, selected cluster companies and various types of external institutions that were not part of the COs, but were necessary for the effective implementation of activities initiated by the CO, such as educational and research institutions and state administration at the central and regional level. The list of stakeholders that could potentially be affected by the CO cooperation was even broader – in addition to the companies directly involved, there were other companies in the industry (both affiliated and not affiliated with a particular CO), companies from the

region, its labor market (and also, depending on the scale of changes, the national labor market), and finally the local community or even society as a whole. Changes initiated in one CO could spread into the entire industry, region, and even economy. The externally oriented activities of the "Extension" stage resonated across all three pillars of sustainable development. The economic pillar was supported by an attempt to create optimal legal and economic conditions on a regional and/or national scale, which positively influenced companies' profits, consequently strengthening their propensity to spend on R&D and thus increasing the chance of boosting the regional/national economy. The social pillar was developed through tailored education and active creation of the labor market, which could translate into improved quality of life in the region. A positive resonance also came from the environmental pillar, as a number of national and regional smart specializations focused on "green" technologies, reducing the burden on the natural environment and promoting sustainable innovations.

Internally oriented activities during the "Expansion" stage enabled synergies, increasing the competitiveness and innovation of those members who succeeded in reaching this stage. Members initiated collaborations mainly through the formation of different groups, as well as by entering into broader consortia to implement more extensive projects, including the innovative ones.

In Metal COs, attempts at this kind of cooperation have not been successful. To some extent, this can be explained by the nature of operations in the metal industry, which deals with the processing of raw materials and the production of tangible goods. Due to the fact that companies in this industry control every link in the value chains, this made the emergence of effective cooperation much more difficult. In contrast, the ICT industry, which is mainly focused on services or the production of intangible goods (e.g. applications), was less limited in terms of conducting their projects. The ICT COs analyzed were not able to initiate value chain collaborations that would integrate selected members around a common product, but some project activities were successfully completed. In addition, some members defined their participation in COs only through the lens of joint projects, which were perceived by respondents as a key form of engagement in COs from an innovation perspective. Project groups became a platform for mutual inspiration and knowledge exchange. They also provided an opportunity for teammates to adapt solutions developed in the project. Project cooperation in ICT CO2 took place mainly within project consortia, whereas in ICT CO1 the so-called competence groups functioned, bringing together entities similar in terms of their industry profile. At this most mature stage, both ICT COs were involved in the development of start-ups, investing in innovative and pro-ecological projects.

"Our investment fund launched within the cluster invests in highly innovative, eco-friendly start-ups." (ICT CO1– R7).

"The consortia, the projects that we have are mainly about innovative activities […] Here, technologies are created that are used in companies to create products." (ICT CO2 – R1).

Collaboration based on internally oriented activities in the "Extension" stage had a high potential to translate into innovations with broader effects on the external environment. This was reflected in the list of stakeholders; while not as broad as the externally-focused activities undertaken in the same phase, it was still larger than in the previous two phases. Stakeholders directly involved in the internally oriented activities during the "Extension" stage include coordinators and members of a specific project group, consortium or competency

group both internal and external to the CO. Stakeholders affected by these activities include all internal and external stakeholders involved and, especially in the case of innovation, potentially, society as a whole.

At this stage, internal activities similar to the external ones stood out in terms of the pillars of sustainability. Successful implementation of project activities strengthened the potential of the participants, although to a different degree in each case. Innovative projects were important, as their finalization offered the greatest chances for profits or strengthening the R&D sphere. Cooperation in the area of innovation was also related to the environmental and social pillars. This refers to innovations that had social and environmental impact.

4.4 Awareness of sustainability

The awareness of COs and their members about sustainability has increased. The sustainable practices we identified in the first phase of our research were not directly associated by respondents with sustainability goals. Rather, they stemmed from COs' desire to pursue individual or collective interests. In the second phase of the survey, CO companies showed much more awareness in this regard. This was especially true for companies in the ICT sector, which not only implemented specific sustainable practices, but also incorporated sustainability goals into their strategies.

"Our sustainability efforts are definitely dedicated, especially when it comes to energy issues. […] The concept of sustainability is one of the priorities of our cluster and most of its members. The current cluster strategy includes a lot of content related to sustainability, energy and the environment". (ICT CO1 – R7)

"I think we strive for sustainable development and it stems from our awareness, but also looking at our mission, strategic documents, one of our statutory goals is to conduct such activities." (ICT CO2 – R2).

This awareness was not present in Metal COs, even though they were taking actions closely related to the three pillars of sustainability.

"We were not aware of and never talked about sustainability. Because I thought we were doing certain things, and it was obvious. Our companies were doing most of these things before." (Metal CO1 – R5).

"In our cluster, the topic of sustainability is not so prominent; you just have to follow the trends when implementing different activities." (Metal CO2 – R12).

In both groups of COs it is possible to distinguish similar factors that motivated their actions in the three discussed stages. In both groups the "Formation" phase was used to build relationships between cluster members, which resulted from the internal beliefs of cluster companies and their desire to establish contacts with other companies in the industry or region. In the "Growth" phase, the efforts of cluster companies were motivated by both internal factors (cost reduction, quality increase) and external factors (adjusting to regulations, market trends, etc.), but less by the need to achieve sustainability goals.

"Recently, it can be seen that manufacturing companies are looking for various ways to increase energy efficiency. It would be good to say that this is due to their desire to achieve sustainability, but it is more due to external factors such as the large increase in electricity prices, the requirements of a low-carbon economy, etc." (ICT CO2 – R2).

"We have companies in the cluster that cooperate with partners from Scandinavia and cannot do business with them unless they have environmental certificates. The situation on

the market forces them to take actions related to sustainable development." (Metal CO2 – R12).

Finally, in the last phase of "Extension", our companies showed a more conscious, albeit instrumental, concern for sustainability in each of the three pillars, stemming primarily from their efforts to safeguard their own interests (related to the labor market, regional skills or innovation projects). Their motivation was additionally reinforced by coordinators, other cluster entities and public authorities. The need to apply sustainable practices also resulted from the implementation of EU projects and their requirements related to sustainability.

"Some companies from our cluster show great care for the local community. It is such a mix of all dimensions of sustainable development." (Metal CO1 – R5).

"In our cluster, the technological center is the most involved in sustainable practices in the environmental dimension: it develops environmental technologies and inspires others". (Metal CO2 – R12)

"A large number of our cluster companies are involved in R&D projects that are now supposed to be environmentally neutral." (ICT CO1– R7).

"I think that in terms of sustainable development, the role of local governments and projects such as the development of regional smart specializations, where much of the activity is on this topic, is important." (ICT CO2 – R2).

5 Discussion and conclusions

5.1 Theoretical and research implications

Similarly to prior research inspired by the stakeholder theory (Pucci et al. 2020; Shin and Shin 2016; Wondirad et al. 2020), we have also observed that the self-interest of CO participants was a primary motive for establishing collaboration, yet we have only partially confirmed that the propensity to collaborate increases with the complexity of a given problem. Collaboration at the "Extension" stage was constituted to deal with increasingly complex problems that required more specific and sophisticated competences. Nevertheless, such problems integrated only selected stakeholders, leaving others outside these groups. In conformity with the theory and the aforementioned studies, we have also documented that social relationships at the "Formation" stage laid the foundation for collaboration and its later development stages.

Regarding collaboration theory, we have observed that certain characteristics of collaboration (Soosay and Hyland 2015) gradually appeared at various levels. The "Formation" stage offered merely sharing the information. The "Growth" stage contributed to the development of collaboration and the participants started to exchange resources. The "Extension" stage intensified collaboration in the form of various groups which were both inner- and outer-directed. They required joint planning and decision-making, the sharing of resources, information and risk, involvement in processes as well as the pursuit of achieving shared goals and finding optimal solutions.

As with Yström and Aspenberg (2017) and Coletti and Landoni (2018), we have indicated in our findings that trust (relational governance) is a prerequisite in collaboration as it could be observed at stage I, where eliminating distrust occurred. With respect to other determinants of collaboration (Wondirad et al. 2020), we also highlighted the role of orga-

nizational support, i.e., CO coordinators, in initiating and developing collaboration during the "Formation" and "Growth" stages. At the "Extension" stage, the organizational support from other stakeholders, e.g., the institutions involved or company managements, was even more important than the efforts of the CO coordinators. At each level, however, it was the possibility of benefits, first individual and then collective, that motivated stakeholders to cooperate. Moreover, our results documented organizational inertia in the CO at the Extension stage among those stakeholders who did not participate in projects or dedicated groups. Such collaborative inefficiency has been suggested by Coletti and Landoni (2018).

Prior research highlights the fact that stakeholders may motivate companies to implement sustainability objectives into daily operations (Hatch et al. 2017; Krivorotov et al. 2016; McCauley and Stephens 2012; Pucci et al. 2020). We found that the complex governance structure of the studied COs partially supported members in formulating and achieving sustainability goals, mainly by creating appropriate conditions for the development of collaboration. Through collaboration in COs, companies became more aware of social issues that were important to other CO members or their external stakeholders. As the social awareness of the actors in the analyzed COs increased, the list of stakeholders gradually expanded to include those who were somehow involved in the process (i.e., influenced by it) or were affected by the consequences of the cooperation (i.e., were its beneficiaries). During the "Formation" and "Growth" stages, the list of stakeholders was limited to the CO actors who pursued their vested interests, such as breaking the barrier of anonymity, establishing relationships, and engaging in individual acts of collaboration. This commonality was still evident during the "Expansion" stage, when some members broadened their perspective and invited non-CO entities to collaborate.

Furthermore, our research revealed that the stages differed in terms of the three pillars of sustainability. The first stage created an unconscious link to single pillar of sustainability, the social one. It laid the foundation for the subsequent stages because without a successful attempt to integrate CO members and making them more than the sum of their parts, it would be impossible to stimulate the collaboration in the subsequent stages. Therefore, the social pillar, in addition to reducing anonymity, opened the CO entities to cooperation. In turn, the "Growth" stage was linked to the economic pillar. In this stage, through resource sharing, the combined strengths of CO partners resulted in increased individual economic potential. Finally, the "Extension" stage made a breakthrough by taking action in all spheres of sustainability, still, at times, as a byproduct of the companies' quest for competitiveness. Moreover, this stage not only encompassed all pillars of sustainability, but also laid the foundation for sustainable innovation. It is worth noting that many of the sustainable practices identified in our study were not consciously associated with sustainability by COs and their members. Moreover, they were mainly initiated by the companies themselves, which, while pursuing goals in each dimension of sustainability, were driven by self-interest, adapting to changing environments (Fig. 2).

Our research revealed only minor differences between Metal COs and ICT COs, mainly related to sustainability awareness, which was present in the ICT companies, but not in the metal firms. In addition, we found more ICT companies in the "Extension" phase than in Metal COs.

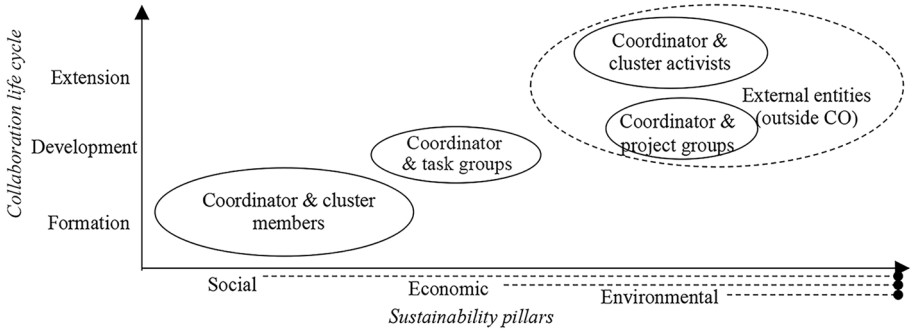

Fig. 2 Sustainable pillars and CO stakeholders

5.2 Practical implications

There are some practical implications from the study. It shows that COs should be considered as actors that can support the implementation of sustainability in different areas. To do this in the most effective way, CO members may plan the target areas of their cooperation by recognizing their main motivations. In this way, they will be able to design the main sustainability pillars of their collaboration. Additionally, in each of the selected pillars, they are advised to consider the full set of stakeholders, especially those who can support the CO in achieving its goals, so that the results of the collaborative efforts would serve the beneficiaries to the greatest extent possible. The role of CO coordinators is to support and develop those collaborations (practices) that are assigned to each pillar of sustainability and to motivate members to move to the most mature stage of collaboration. These efforts would culminate in collaboration based on common goals, reflected in the social, economic, and environmental pillars.

5.3 Research limitations and future research

Our study has some limitations mainly due to the nature of qualitative research. This is primarily a relatively small and unrepresentative sample and subjectivity, resulting from the techniques of data collection and analysis used in the study. Nevertheless, the assumptions made at the stage of sample selection allow us to expect a broader universality of the found regularities. In addition, subjectivity has been limited by adherence to the methodological regime.

In our study we have only marginally tackled – or not tackled at all – certain issues that the previous research identified as determinants of collaboration such as partner selection, power, interdependency among actors, genuine and inclusive participation, and participant awareness (Wondirad et al. 2020; Ysträm and Aspenberg 2017). These issues can be addressed in future research. Furthermore, we have portrayed activities and objectives with regard to sustainability; yet further study could additionally evaluate the actual long-term impact of collaboration within COs on the regional/national economy, society and the natural environment. Finally, our study has focused on the intra-CO collaboration that supports sustainability, and we have not investigated the intra-CO collaboration. This gap can be filled by subsequent research.

In conclusion, COs can be considered artificial tools to facilitate clustering and improve the competitiveness and sustainability of companies, as they can nurture common activities and goals, even if our research does not fully confirm this observation. CO collaboration was multifaceted and involved a variety of internal and external stakeholders. The awareness of sustainability goals increased in part due to relational governance in the COs. However, self-interest and external pressures were the main drivers of sustainability-oriented activities.

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