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Benefits and Drawbacks of Coopetition: The Roles of Scope and Durability in Coopetitive Relationships

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Abstract: The growing importance of cooperative relationships may currently be observed throughout the world. The vast majority of such relationships take the form of coopetition, i.e., the simultaneous existence of cooperation and competition between competitors. Previous research on coopetition characterizes these relationships mostly in the context of the benefits achieved. Researchers emphasize a number of benefits resulting from coopetition, e.g., stimulation of innovations of partners, development of the technology, obtaining complementary resources, entering new markets, or creating new products. However, when deciding to begin coopetition, companies should not only consider the benefits, but also the drawbacks associated with such relationships. This is due to the fact that disadvantages are inherent features of coopetitive relationships between competitors. The relationship between the duration of cooperative relationships in particular areas and the benefits and costs associated with these relationships is scarcely researched. Using a sample of 210 companies operating in the high-tech sector in Poland, we aimed to cover this gap in the knowledge base and to analyze this aspect of coopetition. Several research methods including multidimensional correspondence analysis, correlation analysis of qualitative variables, a chi-square test, multi-table analysis, and association rules were applied. The results of our research showed that coopetition is a viable strategy which contributes to the sustainable development of firms. We also found that the duration of coopetitive relationships in different areas of company activity is related to different types of benefits to collaboration partners.

Keywords: coopetition; benefits and drawbacks of coopetition; scope and durability of coopetition; competitors; sustainability

1. Introduction

Coopetition is regarded as a phenomenon of inter-organizational cooperation, both bilateral and multilateral, which developed intensively over recent years. As a relatively new research area, coopetition draws its roots from the field of cooperative strategies, both in the single (bilateral alliances) and multilateral dimensions (networks, clusters) [1]. The most recent decade was characterized by the dynamic growth of coopetition worldwide. New types of relationships (business, political, economic, and social) arose. It is anticipated that this phenomenon will become more and more important in the

future [2]. On the other hand, coopetition, as a multidimensional and multifaceted concept, is regarded as a somewhat peculiar object of research. Despite the growing number of publications, it is a relatively poorly known phenomenon, and a general understanding of the concept is still some way off.

Coopetition is defined as simultaneous cooperation and competition between competitors [3,4]. Coopetition belongs to the highest-cost inter-organizational relationships [5]. This results from the contradiction of the logic that coopetition is based on trust and conflict. In coopetition, trust is perceived through three dimensions: calculation (trust based on calculation), understanding (trust based on knowledge), and personal involvement (trust based on identification) [6]. Those dimensions change with the development of coopetitive relationships. Trust and the commonality of interests form the basis of effective cooperation [7]. Because of this, the tendency toward contact and mutual concessions increases [8]. On the other hand, rivalry is a result of competition for limited heterogenic resources and the race for the "favors" of the same customers [9]. Despite the low level of trust resulting from the competitive nature of cooperation, it arises in the framework of links between competitors [10]. Cooperation between competitors does not mean it weakens their rivalry. It only tends to increase the effects of relationships [11]. The level of trust between staff determines the direction of the firm's profitability, with trust expressed as the leading manager (trust in partners) which is indispensable for smooth operation and long-term existence [12].

Recent research aimed to study the links between the application of coopetition strategy and the sustainable development of firms [13,14]. Sustainability is defined as "meeting the needs of a firm's direct and indirect stakeholders (such as shareholders, employees, clients, pressure groups, communities, etc.), without compromising its ability to meet the needs of future stakeholders as well" [15] (p. 131). To achieve the sustainable development of business, firms concentrate on economic, social, and environmental improvements [16]. Many of these improvements cannot be achieved by individual firms alone due to resources, time, competence, and other barriers. Thus, firms need to collaborate with other firms and organizations, including competitors, to address social, environmental, and economic needs [17]. Furthermore, a coopetition-driven strategy helps both small [18] and large firms [13] to develop sustainable business. The issues surrounding coopetition strategies and the impact upon sustainability are largely neglected.

Coopetitive behavior is most frequently analyzed in the context of relationships between enterprises. Previous research showed the occurrence of simultaneous streams of cooperation and competition at the intra-organizational level, especially in transnational corporations [19–21], and networks [3,22–24], as well as in the social dimension between individuals [25–29]. Coopetition may also be distinguished horizontally (within the same sector) and vertically (within the value chain) [30]. The general level of trust positively influences not only the relationships and the collaboration between individuals in society and the management of enterprises in general, but also earnings before tax [31]. Thus, meeting both social and economic needs contributes to sustainability.

The coopetitive relationships between enterprises are usually considered overall through the prism of general benefits and costs. However, the analysis of cooperation between competitors in individual areas of the value chain will make it possible to distinguish the range of benefits and costs associated with coopetition. The duration of the relationship is also important. Competitive cooperation is characterized by the diversified dynamics of relationships. Thus, it is important to explore the link between the duration of cooperative relationships in particular areas and the size and scope of the benefits and costs associated with these relationships. Taking these research gaps into account, this study, based on an analysis of the high-tech industry in Poland, aimed to provide answers to the following three research questions:

(1) What role does time play in the creation of benefits and disadvantages in specific areas related to coopetition?
(2) Are there any individual benefits (or groups of benefits) leading to sustainability, and what are the corresponding costs?
(3) In which areas is the cost–benefit relationship most beneficial and why?

Given these facts, the goal of this paper was to analyze the benefits and drawbacks of coopetition in relation to the scope and duration of cooperation between competitors. The objective of the study was achieved based on the analysis of data gathered through a survey methodology. Analyses were carried out on a sample of 210 companies operating in the high-tech sector in Poland. Several research methods, including multidimensional correspondence analyses, correlation analysis of qualitative variables, a chi-square test, multi-table analysis, and association rules were applied to achieve the given objective. Such research would be interesting for scholars studying collaboration and coopetitive strategies. The results of the current research will also be useful for practitioners seeking to establish effective coopetitive relationships with other firms. Finally, the results might be useful for policymakers who might promote coopetition among national firms.

Our paper is structured as follows: Firstly, we describe the phenomenon of coopetition that is presented in the literature so far. The emphasis was concentrated on the benefits and disadvantages as a function of the scope of activity, as well as on the durability of coopetition. Secondly, we present the methodology that was applied in this research. The next part of our paper presents the research results and analyzes the results in detail. Finally, we present the conclusions and limitations of our study.

2. Theoretical Background of Coopetition

Coopetitive relationships are mainly interpreted in terms of three theoretical concepts: game theory, transaction costs theory, and the resource-based approach. In game theory, coopetitive relationships are treated as a positive-sum game, which gives all players the opportunity to gain benefits. Coopetition is perceived as a game in which the interests of the parties partially overlap. Coopetition in game theory is based on the classic analysis of the prisoner's dilemma [32]. In order to limit opportunistic behavior in the solution to the prisoner's dilemma, a "tit for tat" strategy is applied [33], which uses the principle of reciprocity in the actions of players, encouraging them to think strategically about the implementation of particular movements. The payout structure, the timeframe of the activities, and the number of players affect the nature of activities in the direction of cooperation [34]. The tendency of players toward cooperation also increases with the importance of future movements and payments (i.e., the shadow of the future) and the durability of the relationship [33]. Brandenburger and Nalebuff [9,35] created the so-called Value Net Model belonging to game theory and the PARTS model of coopetition. Numerous horizontal and vertical links in the value network generate added value (a pie to be shared). In turn, the competition phenomenon arises in the case of sharing this value between network members.

The transaction costs theory suggests three forms of organizational functionality, i.e., market transactions, hierarchical structures, and hybrid relationships [36]. Companies choose coopetitive relationships (hybrid) as a response to the generation of additional transaction costs resulting from market imperfections [37,38] and hierarchic structures [39,40]. Coopetition belongs to the hybrid forms that are mostly affected by transaction costs. This typically results in the competitive nature of cooperation between rivals, an increase in the uncertainty of the parties' actions, and the complexity of the relationship [41]. The level of trust between partners in coopetitive relationships is also relatively low, which leads to the creation of so-called opportunistic cooperation [42]. Maintaining a stream of competitive relationships among the partners increases the likelihood of conflict occurring, which, in addition to opportunism, is the result of free-riding activities and limited rationality [43].

In the resource-based concept, enterprises decide to cooperate with organizations that have complementary and strategic resources. Cooperation with companies (including competitors) that hold complementary assets may generate benefits resulting in the synergy of joint resources (which are the subject of cooperation) with the resources available to the company [44,45]. The limitation of access to deficit resources for companies outside of the relationship may be regarded as an advantage of coopetition [46]. Coopetitive relationships are also created to form resources: developing new technologies, creating or jointly acquiring information and knowledge, and acquiring significant competences, including coopetition competences [47].

In addition to the three main theoretical concepts, the phenomenon of coopetition is increasingly being analyzed through the prism of the concept of strategic alliances [48,49], and network theory [3,23,50–52]. There are also references to philosophy [53,54], biology [55], and legal sciences [56,57]. Despite the diversity of scientific inspirations that make it possible to explore the complexity of coopetition, the state of knowledge of this phenomenon should be regarded as "in transition" [58,59]. It is a relatively poorly known phenomenon, and a general understanding of the concept is still some way off [60].

2.1. Benefits of Coopetition

An increased interest in coopetitive relationships results mainly from the complexity of the environment, resulting primarily in the development of the phenomenon of hyper-competition [61], the globalization processes of the sectors [62–64] and their technological advancement—mainly due to the short product–technology life cycle, technology convergence, and R&D costs [65–67]. In situations in which one of these three phenomena appears in the environment, the conditions in which enterprises operate will be sufficient to create coopetitive relationships. Considering the specifics of technologically advanced sectors, in the overwhelming majority of cases, the phenomenon of susceptibility to globalization and hyper-competition will occur at the same time. In addition, many firms nowadays are concerned with sustainability issues and aim to achieve economic, social, and environmental benefits. Thus, coopetition arises in which coopetitive relationships are the condition for survival and sustainability.

The analysis of the benefits of coopetition draws its inspiration not only from theoretical foundations (transaction cost theory, game theory, and the resource-based approach), but also from cooperation experiences and strategic alliances (especially horizontal ones) [48,68–73].

The decision on simultaneous cooperation and competition with a competitor is one of the most difficult decisions which managers in the modern business world face. Most of them choose this type of relationship due to the significant benefits derived from coopetition [74–76]. Bengtsson and Kock [3] even treat coopetition as a strategy with enormous development potential for enterprises. Considering the growing complexity of the environment, in many cases, coopetition becomes the only chance for the company's survival and sustainable development. In other words, coopetition seems to be the only solution.

Enterprises declare their willingness to create coopetitive relationships to obtain complementary resources [77,78], especially non-tangible ones or those that are otherwise unavailable. Synergy effects take place between complementary resources, which make the systems of these resources more valuable and more difficult for other competitors to imitate [54]. Zineldin [79] even treats the complementary resources possessed by the parties as a prerequisite for the success of coopetitive relationships.

Coopetition also stimulates the innovation of partners [80,81] and the development of technology [82,83]. In accordance with the resource-based concept, enterprises declare their will to create coopetitive relationships in order to jointly create intangible assets, including the ability to transfer and use their knowledge, cooperation, and skills to increase the efficiency of the organization. The exchange of knowledge and experience also helps in terms of entering new markets (especially those with increased investment risk) through, among other things, the reduction of entry barriers [48,84], as well as creating new products [66].

Competitive cooperation allows companies to achieve economies of scale and range [9,48,60]. The benefits of coverage, not only in the geographical sense, but also in terms of the expansion of the market, are also increasingly indicated [85]. Coopetition reduces operational costs [5,86], among others, by reducing the risk of functioning [78,87].

Coopetitive relationships contribute to the creation of values [88], the dynamic development of companies, and an increase in the value of coopetitors [49]. Often, coopetitive relationships are made of a defensive nature; in addition to strengthening market position, coopetitive relationships also protect market position and increase entry barriers for non-system entities (e.g., companies in the

European Union). One may then emphasize that coopetition generates benefits in the market, financial, management, and technological dimensions. Thus, the following hypothesis can be derived:

Hypothesis 1 (**H1**). *The benefits of cooperation with a competitor are greater than the losses incurred.*

2.2. Drawbacks of Coopetition

However, there are threats and risks related to coopetitive inter-organizational relationships. Several publications devoted to these relationships labeled them "sleeping with the enemy" [89,90]. The competitive nature of coopetitive relationships gives rise to the occurrence of opportunistic behavior in the system. The level of this behavior is greater than in the case of alliances formed with non-competitive organizations and other hybrid links [91]. Unethical behavior occurs as companies break the rules of the market "game" (e.g., market, price, and tender conspiracy). A low level of trust becomes an opportunity to treat coopetitive relationships in terms of temporality. Companies are keenly interested in achieving their goals in the shortest possible time, and when firms achieve their goals, they lose the will to cooperate further.

The uncontrolled leakage of information (and other intangible assets) by a partner, or even economic espionage [92], is an additional risk. As a consequence, there is a real risk of losing control over a firm's own resources [93]. The asymmetry of benefits derived from the coopetitive relationship may appear during joint work on technological development that may result in a loss of control by one of the parties over common technology and one's own activity.

Coopetition also leads to the asymmetry of benefits derived from the relationship and distorts the pillars of stable cooperation, i.e., maintaining the relationship between benefits derived and one's own contribution to the system [60]. Asymmetric access to resources may also arise [23].

Coopetitive relationships are characterized as having a high degree of conflict. This is mainly due to the coexistence and interaction of streams of cooperation and competition in the relationship between the parties. This results in increased transaction costs for the entire project. The continuing high level of conflict between the parties may reduce the effectiveness of cooperation and the effectiveness of both individual and common goals of the parties involved.

The specificity of coopetition causes parties to attempt to protect their interests through agreements of exclusivity. This means that any decision to cooperate with one competitor limits the possibilities of cooperation with the others (coopetitive negative blocks) [94].

A loss of organizational independence and decision-making is an equally dangerous threat stemming from competitive cooperation. Contractual clauses limit the possibility of choosing another partner to cooperate with. At the same time, the complexity of coopetition forces parties to take the requirements of competitive cooperation into account in their strategic decisions. This limits the freedom of a company's decision-making, which is particularly troublesome when creating multiple coopetitive links. Limiting the autonomy of decision-making becomes the price of functioning in coopetitive networks [55].

Coopetitive systems also cause the weakening of existing sources of competitive advantages and key competences [95]. Aggressive and opportunistic behavior threatens a sense of community fostered by cooperation. The high costs of settlement mean that parties strive for domination in coopetitive relationships. There is a danger of transforming the relationships into a zero-sum game. As a result of continuous conflict and the aggressiveness of mutual activities, the parties are weakened, which has both organizational and market consequences. In the case of organizational consequences, frequent attempts were made by stronger units to take over weak partners, bringing about a subsequent loss of organizational independence. Conflict in a coopetitive relationship brings about a decrease in the quality of relationships with other members of a business ecosystem. This may result in a loss of trust (particularly customers) and deterioration in market position.

The disadvantages of coopetition also cover the sphere of a company's image. Any reports of conflicts with a coopetitor or problems in cooperation cast a shadow on the company's image.

They may have their own consequences in the perception of the company by the business environment, particularly by the market and financial institutions. In drastic cases, the occurrence of troublesome relationships with a competitor may have an impact on the value of the company's shares.

A study conducted by Ritala et al. [96] also showed that cooperation with competitors might generate above-average costs of functioning, beyond the financial capabilities of the company. For example, Porter [97] (p. 613) argues that alliances "always involve significant costs in terms of coordination, reconciling goals with an independent entity, creating a competitor, and giving up profits". Importantly, alliances with competitors should be terminated on time if coopetitive relationships cease to satisfy their strategic goals and outlive their effectiveness [98]. Another reason for terminating coopetition is associated with the high costs related to alliance management, time costs, and threats from a competitor that might offset the benefits from cooperation [99]. As a consequence, coopetitive relationships may lead to threats to the company's continued existence. Vaidya [48] emphasizes cultural differences as a platform for misunderstandings and conflicts in coopetitive relationships.

Coopetitive relationships take diverse forms due to the characteristics of cooperation and competition [5]. The stratification of coopetitive relationships depends not only on the existence of streams of cooperation between rivals, but also on the internal structure that is expressed by the areas of cooperation. Most frequently, individual activities in the value chain of enterprises that are involved in competitive cooperation are analyzed for this purpose. Cygler and Sroka [1] showed that cooperation between competitors could cover all activities of the value chain. Most often, however, competitors decide to cooperate in at least two areas of a mixed nature (both primary and support activities). The competitive nature of cooperation between rivals causes the emergence of threats to be treated as an inherent feature of these relationships. This discussion leads to the following hypothesis:

Hypothesis 2 (**H2**). *The types of benefits obtained and losses suffered are associated with the specificity of the area of coopetition.*

2.3. Duration of Coopetition

An analysis of the literature devoted to coopetition shows that a paradox exists here. On one hand, the uncertainty of the future encourages cooperation in order to acquire benefits [83,100]. On the other hand, coopetitive relationships are characterized by a high level of opportunistic behavior [99], sudden twists [101], tensions [102], the pursuit of private benefits [103], and the short-term horizon of actions [104]. The issue of the time required to generate benefits and costs occurring in particular areas of the value chain then arises. For example, strategic alliances where one observes the occurrence of coopetitive relationships are characterized by high levels of instability [105]. Though strategic alliances are temporary organization structures a priori, and terminations are planned from the beginning [106], some alliances dissolve or change partner structure before the joint goals are achieved [17], i.e., before the planned alliance horizon is reached. Internal tensions are responsible for instabilities in the coopetitive relationships. Bengtsson and Kock [3] argued that tensions are higher when competitors cooperate than in pure cooperative relationships. Tensions in coopetitive relationships are inevitable [65]. They occur, on one hand, because of attractive opportunities that cooperation might bring, and, on the other hand, because of a possible threat from the predatory behavior of a competitor [107]. Another reason for tensions is the partially convergent goals of involved parties [108]. Coopetitive tensions are negatively and significantly associated with the performance of coopetitive relationships [109].

The more cooperative or more competitive mindsets of partners influence the duration of coopetitive ventures, as well as the mutual benefits or losses that partners achieve. Trust, a widely discussed factor in collaboration research [99], facilitates cooperation, and distrust enables competition in coopetitive relationships [110]. Notably, the formalization of coopetitive relationships secures long-term cooperation. For example, the respondents of Tomski's [111] study signaled that 52% of

formalized coopetitive relationships will be long-term, and only 19% of non-formalized coopetitive arrangements will have a long-term nature.

Flexibility is related to the ability of competing firms to change the structural arrangements in the strategic alliance with the aim of adapting to changing market conditions. The flexibility of coopetitive partners contributes to the longevity of the strategic alliance.

In coopetition between a small firm and a large firm, as a rule, the former will aim to secure long-term cooperation in order to have enduring contracts, as well as to overcome the liability of smallness and/or newness [112]. In other words, the longer the coopetitive alliance lasts, the bigger the reputational and other benefits a small firm might gain. Conversely, the larger coopetitive partner will tend to have a short-term orientation to achieve its goals as soon as possible and not to give the competitor the opportunity to learn and grow in the process of cooperation. In short-term alliances, resources will be exploited quickly in order to gain immediate results and terminate the alliance. By contrast, in long-term oriented coopetitive arrangements, short-term gains might be sacrificed in order to preserve/secure the sustainability of the alliance. Thus, coopetition is a profitable strategy; however, "strategic alliances are the sites in which conflicting forces develop" [105]. Namely, cooperation and competition are two conflicting forces in coopetition.

Though the previous research related to the time factor in coopetition is extant, surprisingly, the existing studies do not consider the relationship among the longevity of an alliance, the area of coopetition, and the benefits that such coopetition can bring. In order to cover this gap in the knowledge base, we tested the following hypotheses related to several coopetition areas (i.e., R&D, supply, production/services, sales/distribution/marketing, logistics, finance, IT, and human resources):

Hypothesis 3 (**H3**). *Coopetition effects are associated with the duration of cooperation between competitors in selected areas.*

Hypothesis 4 (**H4**). *Different types of benefits and losses that occur during coopetition are associated with the duration of cooperation with the competitor.*

3. Materials and Methods

A group of 210 companies from the high-tech sector which declared competitive cooperation was analyzed. The choice of the sectors in the research sample results from the fact that, in high-tech sectors, R&D expenditures are very high, exceeding the capabilities of an increasing number of enterprises. Also, these sectors are susceptible to the phenomenon of hyper-competition [61,113,114] and globalization [115], which causes an even greater increase in operating costs. One of the most effective ways of surviving in high-tech sectors is to join cooperative relationships with direct competitors. Therefore, many researchers focus on these sectors, because it is in these sectors that the phenomenon of coopetition occurs relatively often. However, researchers concentrate mainly on one selected sector, e.g. the telecom industry [24,66], the smart card industry [116], the simulator industry [117], the aviation industry [118], the automotive industry [119] and creative clusters [120]. In this article, the high-tech sector was defined according to the OECD classification [121]. These enterprises represented a diversified sample due to the different branches of the high-tech sector (Figure 1). The choice of the research sample was influenced by the characteristics of the sector and the commonality of the coopetitive relationships created therein. Data were collected directly by means of questionnaire surveys. The respondents were senior management executives or company owners. The research was conducted in 2013.

The selection of the research sample was conducted at several stages. The companies surveyed were classified into seven basic industries: processing and manufacturing (15 companies), the pharmaceutical sector (71), production of office equipment and computers (four), production of TV, radio, and communication equipment (27), medical equipment production (48), spaceship production (13), and high-tech services (32). With regards to size, the majority are small companies

(116), followed by medium-sized firms (64), and the least numerous group includes large companies (30). Taking the organizational form into account, there are 152 stand-alone companies, 44 corporations, 12 holdings, and two others. The majority of the companies analyzed are domestic organizations (147), while the remainder (63) operate on a transnational scale. The sample meets the requirements of representativeness of the population of companies operating in the high-tech sector in Poland.

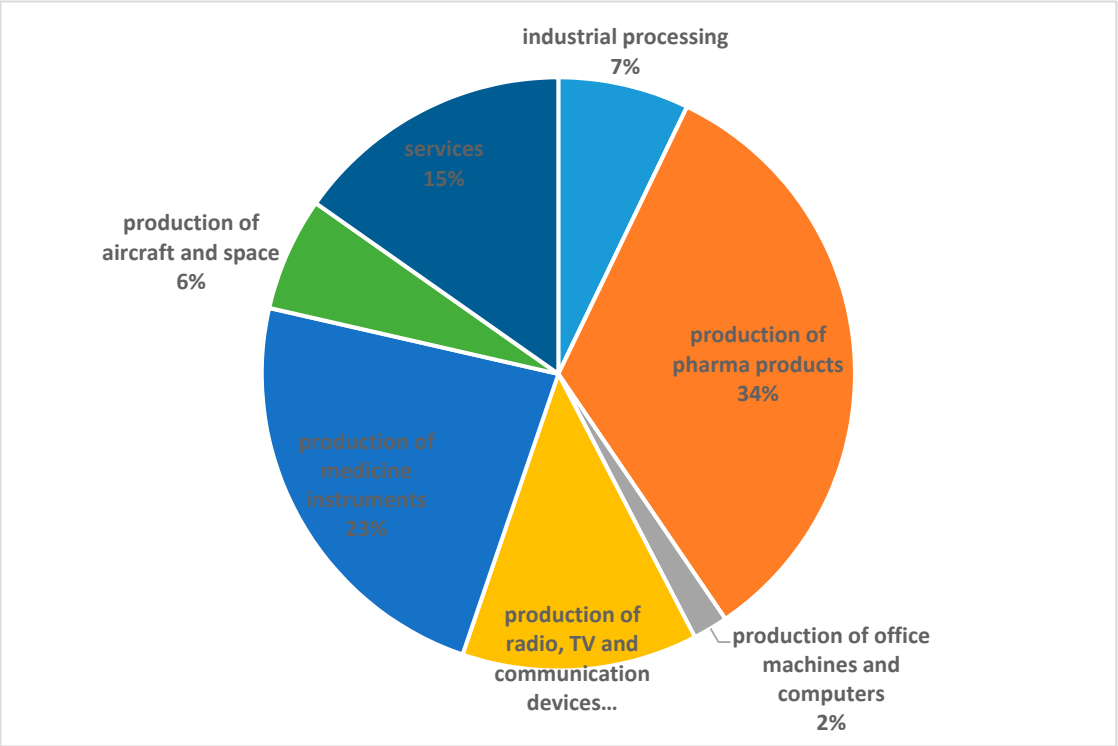


Figure 1. Sectors analyzed.

The analysis of the results obtained during this study was carried out using statistical methods, suitable for the specifics of the results achieved. Such methods allow researchers to study the relationship between two or several non-measurable variables: multidimensional correspondence analysis, correlation analysis of qualitative variables (a chi-square test), multi-table analysis, and association rules. The computer package Statistica was used in the calculations.

The correspondence analysis is a descriptive, exploratory technique of multivariate statistical analysis, allowing one to define the nature and structure of the relationship between qualitative variables, measured in nominal and ordinal scales [122]. The correspondence analysis belongs to the group of incomplete taxonomic methods. This method is widely used in studies related to collaboration and coopetition [123]. This technique, as well as multidimensional scaling and principal component analysis, leads to an increase in the transparency of data and simplifies the interpretation. The use of statistics and charts specific to that method provides the researcher with easy, intuitive reasoning related to the interaction between the analyzed variables. In general, correspondence analysis is a method for deconstructing the overall chi-square statistics by defining a system with a small number of dimensions, in which the deviations from the expected values are presented.

The main aim of plotting the correspondence map is to reduce the number of analyzed space dimensions by choosing such a low-dimensional subspace in which the chi-square distances between points are shown with the greatest accuracy [124]. In this process, the singular value decomposition (SVD) algorithm of the matrix decomposition, with respect to specific values, is used [125]. The interpretation of the correspondence map allows the researcher to find the diversity within the analyzed variable profiles, as well as the co-occurrence of different categories.

It should be noted that correspondence analysis is an exploratory technique. In fact, the development of this method emphasizes the search for models that describe empirical data rather than rejecting hypotheses regarding lack of fit (see Benzecri's "second rule" that "this model should fit the data, not the other way round"). Therefore, there are no statistical significance tests that would normally apply to the results of the correspondence analysis. The original purpose of this technique is to create simplified (in a space with a small number of dimensions) mapping information contained in a large contingency table (or analogous tables containing measures of the relationship between feature variants).

In the analysis of the results, the significance of the correlation between non-measurable variables was examined. The chi-square test was used for this purpose, and, in situations where the correlation was found to be statistically stable, the strength of this correlation was determined using the Cramer measure. In addition, relationships between variables were graphically presented using charts created on the basis of cross-fertilization tables.

The basket analysis method [126] is one of the best-established approaches to data mining. This method was used to find the relationships (associations) between the co-occurrence of results. The result of the association process in the data is a set of association rules describing the dependencies found in the following form: if event X occurs, then event Y occurs. Symbolically, an association rule can be written as

IF X [predecessor] then Y [consequent],

$$X \rightarrow Y.$$

If the element of the dataset "fits" the rule, that is, it fulfils all the conditions of the predecessor and successor, it means that the rule contains this element; otherwise, the element supports the association rule.

The following measures are used to assess the association rules [127]:

Support of rule ($X \rightarrow Y$) means the ratio of the number of cases containing a given rule to all cases:

$$s(X \rightarrow Y) = \frac{\text{number of occurrences of X and Y}}{\text{the number of all observations}}.$$

Confidence of rule ($X \rightarrow Y$) means the ratio of the number of cases containing the rule to the incidence of the variant X:

$$c(X \rightarrow Y) = \frac{\text{number of occurrences of X andY}}{\text{the number of X observations in the set}}.$$

Before setting the association rules, minimum levels of support and confidence coefficients should be determined, which results in finding only those rules that meet the given conditions.

4. Results and Discussion

In the first step of the analysis of the survey results, we identified relationships among the duration of coopetition, its repeatability, the impact of coopetition on the development of the company, and the assessment of the potential benefits. For this purpose, we used the correspondence analysis method, which allows for the analysis of relationships between qualitative variables. In this part of the study, the following variables and their variants were adopted:

X1— duration of coopetition: $t < 1$, $1 \leq t < 3$, $3 \leq t < 5$, $5 \leq t < 7$, $t \geq 7$;
X2— repeatability of coopetition: very frequent, frequent, medium frequency, rare, one-time;
X3— the impact of coopetition on company development: strongly facilitating, facilitating, impeding, strongly impeding, without affecting the development of the company;
X4— benefits of coopetition: very beneficial, beneficial, moderately beneficial, unfavorable.

Using correspondence analysis, we identified four groups of enterprises on the correspondence map (Figure 2).

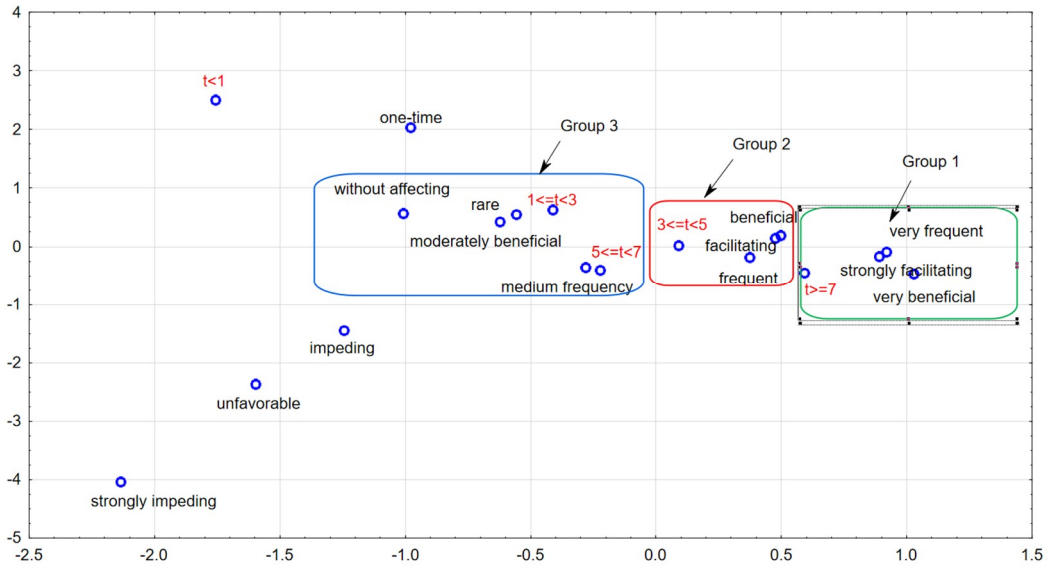


Figure 2. Correspondence map of relationships among variables characterizing the specificity of coopetition.

The first group includes the enterprises that were involved in coopetition for the longest period (over seven years), and whose cooperation can be characterized as frequent. These enterprises indicate the highly beneficial effects of such cooperation, which strongly facilitate the functioning of the company. The second group consists of enterprises which were operating in coopetition for three to five years with frequent repeatability of coopetition. These companies often point to the beneficial effects of such cooperation, which facilitate the functioning of the company. In the third group, the effects of coopetition are moderately favorable. These companies include entities that rarely or medium-frequently cooperate with coopetitors (from one to three years, or from five to seven years). For these enterprises, coopetition has no impact on their development.

The results of the correspondence analysis indicate the relationships among the duration of coopetition, its repetition, and the evaluation of the benefits of cooperation, which, in turn, influence the development of the enterprise.

The area of cooperation is important from the coopetition point of view. The researchers analyzed nine areas of coopetition: R&D, supply, production or services, sales or distribution, marketing, logistics, finance, IT, and human resources. In each area, the influence of time on the effects of coopetition was examined.

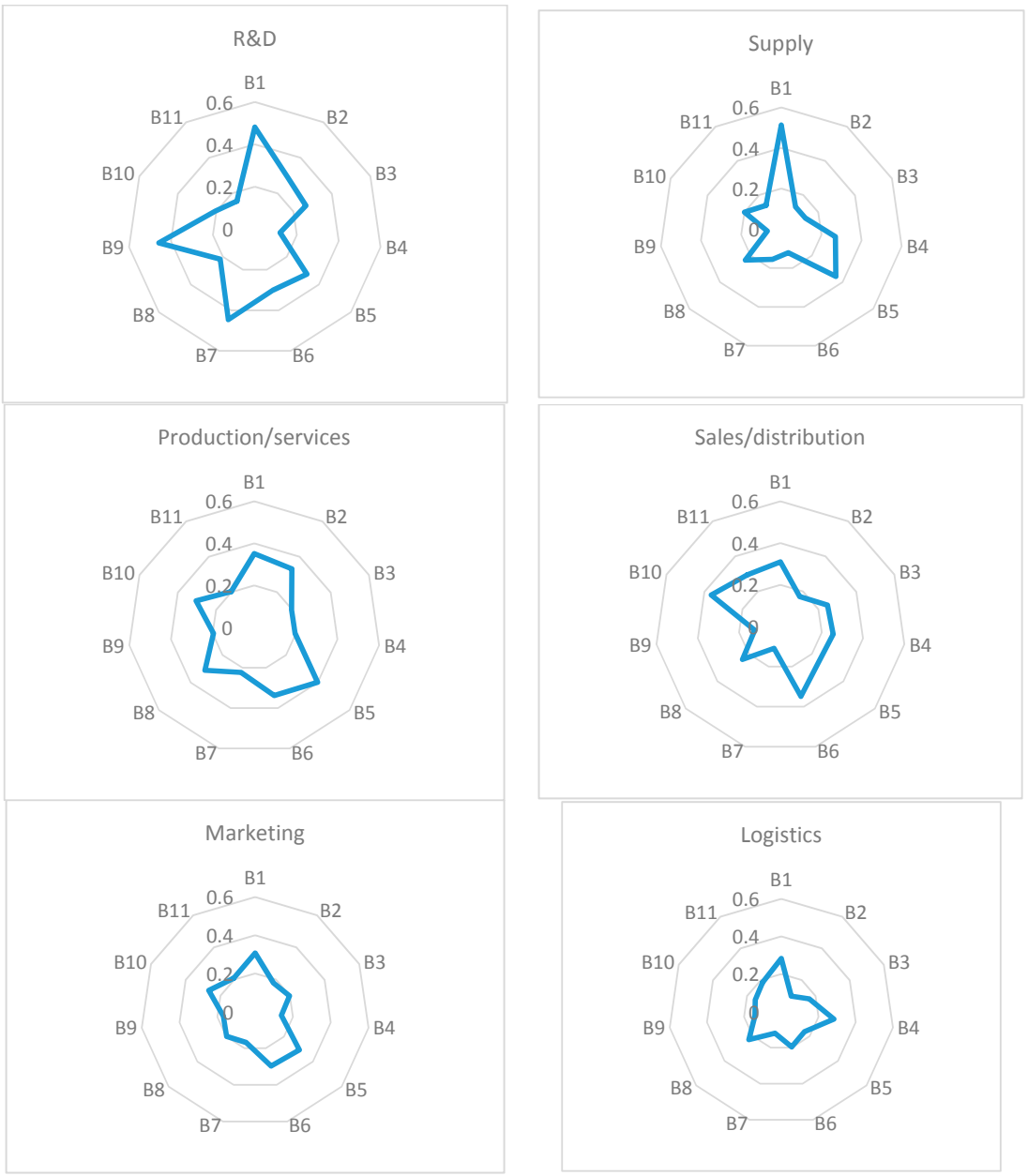
The companies surveyed indicated specific benefits and losses in different areas occurring during coopetition (Figures 3 and 4). The most frequently indicated benefits in R&D (reported by half of the respondents) were the acquisition of unique knowledge, development of innovation, and cost reduction. In the supply area of coopetition, the most frequently indicated benefit (51% of respondents) was the reduction of costs, followed by access to resources (36% of respondents). The dominant benefits (indicated by more than 30% of respondents) in the area of production/services were cost reduction, specialization, access to resources, strengthening the position against other competitors, and more efficient use of opportunities. Apart from the extension of the scale of operations and the reduction of costs, the respondents most frequently reported the strengthening of the position against competitors as the main benefit of coopetition in the area of sales/distribution.

In terms of marketing, the most popular benefits were access to resources, reduction of costs, and the strengthening of one's position against competitors. In turn, in the area of logistics, a significant

benefit for enterprises was the reduction of costs, including transaction costs. In the area of finance, coopetitors indicated benefits associated with increasing the company's value and reducing costs.

In the next area of coopetition, namely IT, five quite frequently indicated benefits can be distinguished: access to resources, strengthening the position against competitors, gaining unique knowledge, reducing costs, and increasing innovation. Finally, in human-resources coopetition, the most commonly indicated benefit was access to resources.

The frequency of the losses indicated in individual areas of coopetition was much lower than the corresponding benefits (Figure 4). When analyzing the frequency of indications of particular losses in the R&D area, one can distinguish two losses indicated by slightly more than 10% of enterprises: the low effectiveness of jointly implemented processes and objectives, as well as a loss of cooperation opportunities due to the exclusivity clause. In the case of the supply area, 10% of respondents pointed to the low effectiveness of jointly implemented processes and goals, as well as the partner's opportunism—unethical behavior.



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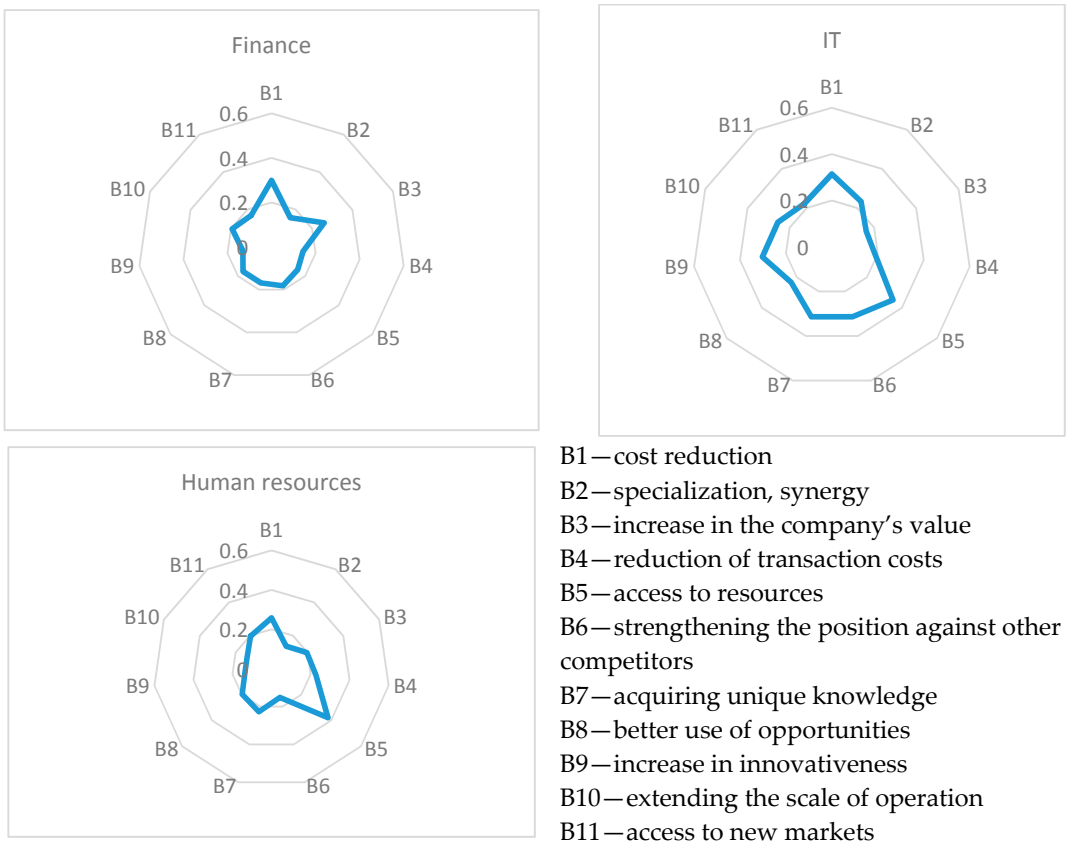


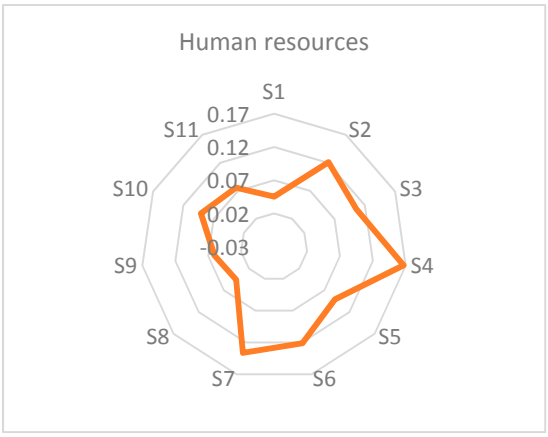
Figure 3. The frequency of benefits in the areas of coopetition.

According to entrepreneurs, the main loss that occurred during coopetition in the area of sales/distribution was partner opportunism, i.e., unethical behavior; a quarter of all enterprises indicated this loss. Coopetition in the marketing area brought losses mainly in the form of loss of organizational and decision-making independence, as well as the low effectiveness of jointly implemented processes and objectives (20% of indications each). In logistics, about 15% of respondents claimed that losses resulted from investing in specific resources, i.e., those which were atypical for the company and would be used only for this cooperation. In addition, 10% of respondents indicated a loss of organizational and decision-making independence. In the area of finance, coopetition mostly brought about three types of losses: the low efficiency of jointly implemented processes and objectives, the decrease in the value of the company, and the weakening of the market position. This finding indicates that companies entering coopetitive relationships should be careful when investing in specific resources that they will not be able to use in the future without their competitor.

Unfavorable relationships between the effects of and expenditures on cooperation in relation to a competitor were the most frequently reported losses in the area of IT. In turn, coopetition in the area of human resources brought about a loss in the opinion of about 20% of respondents. This loss was based on investment in specific resources, i.e., those that were atypical for the company and would only be used for this cooperation.

Considering the quoted distributions of indicated benefits and losses which occurred during coopetition in particular areas, it can definitely be emphasized that the benefits outweigh the losses when cooperating with a competitor. However, the specific types of losses and benefits are determined by the area of cooperation. Thus, Hypotheses 1 and 2 are supported.

Figure 4. *Cont.*



Losses:
S1—Loss of control over the activity
S2—Unfavorable relationship between the effects of cooperation and expenditures on it in relation to a competitor
S3—Opportunism of the partner—unethical behavior
S4—Investments in specific resources, i.e., those that are atypical for the company and will be used only for this cooperation, while requiring investment
S5—Loss of cooperation opportunities with others due to the exclusivity clause
S6—Strong conflicts which paralyze work
S7—Low efficiency of jointly implemented processes and goals
S8—Decrease in the value of the enterprise
S9—Weakening of the market position
S10—Weakening the company's image
S11—Loss of organizational and decision-making independence

Figure 4. The frequency of losses in the areas of coopetition.

When seeking a statistically significant relationship between duration of coopetition and an evaluation of its effects in particular areas of cooperation, the chi-square test was used to verify the hypotheses on the absence of a statistically significant relationship between qualitative variables. We adopted the following indicators in this part of the analysis:

X1i—duration of coopetition in the i-th (i = 1, 2, . . . , 9) area: $t < 1$, $1 \leq t < 3$, $3 \leq t < 5$, $5 \leq t < 7$, $t \geq 7$;
Y1i—result of coopetition in the i-th (i = 1, 2, . . . , 9) area: very large benefit, very little benefit, zero effect, very little loss, very big loss.

Statistically, a significant relationship between the duration of coopetition and an evaluation of its effects occurred in five areas: R&D, supply, sales/distribution, marketing, and finance (Table 1). However, a statistically significant dependence (with a significance level of less than 0.05) occurred in the case of supply and marketing. In the remaining areas, the p level was not greater than 0.10. The measure of the relationship between non-measurable variables was Cramer's V coefficient, which indicated moderately strong dependence in the case of the areas where the relationship was statistically significant.

Table 1. Dependence on the duration of coopetition and its effects in particular areas—chi-square test, critical level of significance, Cramer's V coefficient.

Area of Coopetition	Chi-Square	p-Value	Cramer's V Coefficient
R&D	20.9040	$p = 0.0518$	0.2897
Supply	38.6112	$p = 0.0075$	0.2897
Production/services	19.8615	$p = 0.2265$	no significant dependence
Sales/distribution	24.2292	$p = 0.0846$	0.2166
Marketing	23.5530	$p = 0.0234$	0.2788
Logistics	12.6121	$p = 0.3979$	no significant dependence
Finance	24.1711	$p = 0.0858$	0.2801
IT	20.5317	$p = 0.1972$	no significant dependence
Human resources	17.9265	$p = 0.3282$	no significant dependence

In order to identify dependences on the duration of cooperation and the assessment of its effects, maps of correspondences for particular areas were created. In the case of areas of coopetition where the dependence was statistically significant, the identified relationships were marked (Figure 5).

Enterprises that were cooperating with competitors in the R&D area the longest (from five to seven years, or more than seven years) more often reported very large benefits. However, those enterprises that cooperated with rivals for a period of less than one year reported zero effects of coopetition. This is in line with the results of previous research related to R&D coopetition [128].

Those enterprises that cooperated the longest in terms of supply reported very large benefits from coopetition (a chi-square test revealed a statistically significant difference in the map of correspondence). Those enterprises that were cooperating from one to three years more often reported very little benefit, while coopetition in the supply area lasting from three to five years often brought zero effect to those enterprises.

In the production area, relationships between the duration of cooperation and an assessment of the effects were not observed on the correspondence map (chi-square test results are reported in Table 1).

In the sales/distribution area, we may notice that those enterprises that were cooperating for the shortest period of time (under one year) more often reported zero effects of coopetition. When coopetition lasted from three to five years in this area, firms reported both very little and very significant benefit; however, in periods of cooperation lasting from five to seven years, the enterprises often registered minimal loss.

In the marketing area, the assessment of the effects of coopetition was extremely interesting, because, in terms of relatively short coopetition lasting from one to three years, its effect was considered to bring very little benefit. In the following time period (from three to five years), coopetition brought zero effect; however, coopetition lasting the longest (over seven years) brought the enterprises significant benefits.

In the logistics area, a clear relationship between the duration of coopetition and the assessment of effects was not observed. This means that the enterprises cooperating in coopetition in terms of logistics had different assessments that did not depend on the duration of cooperation (variants of the assessment of coopetition effects were spread throughout the map of correspondence).

Rival firms cooperating in the finance area for periods of between three and five years often reported a very minor loss. However, if coopetition in the finance area lasted over seven years, it brought highly significant benefits to the enterprises. Those enterprises that cooperated with others from one to three years observed very little benefit in this area.

In the other two areas, i.e., IT and human resources, there was no statistically significant relationship between the duration of coopetition and the evaluation of its effects, as demonstrated by the chi-square test. However, from the correspondence maps we can see that enterprises cooperating in the IT area for over seven years often assessed the effects of coopetition as highly beneficial, while zero effects were more often indicated by enterprises that were cooperating for three to five years.

In the area of human resources, companies which were cooperating for one to three years and for over seven years reported very large benefits. Zero effect of coopetition in the area of human resources was indicated by enterprises which were cooperating from three to five years, while enterprises which were cooperating for less than one year often indicated very little benefit.

The examination of statistically significant correlations between the duration of coopetition and the assessment of effects, and a detailed correspondence analysis of coopetition assessments over time in all areas, indicated differences in the assessment of coopetition depending on duration in different areas of coopetition. Therefore, Hypothesis 3 is supported.

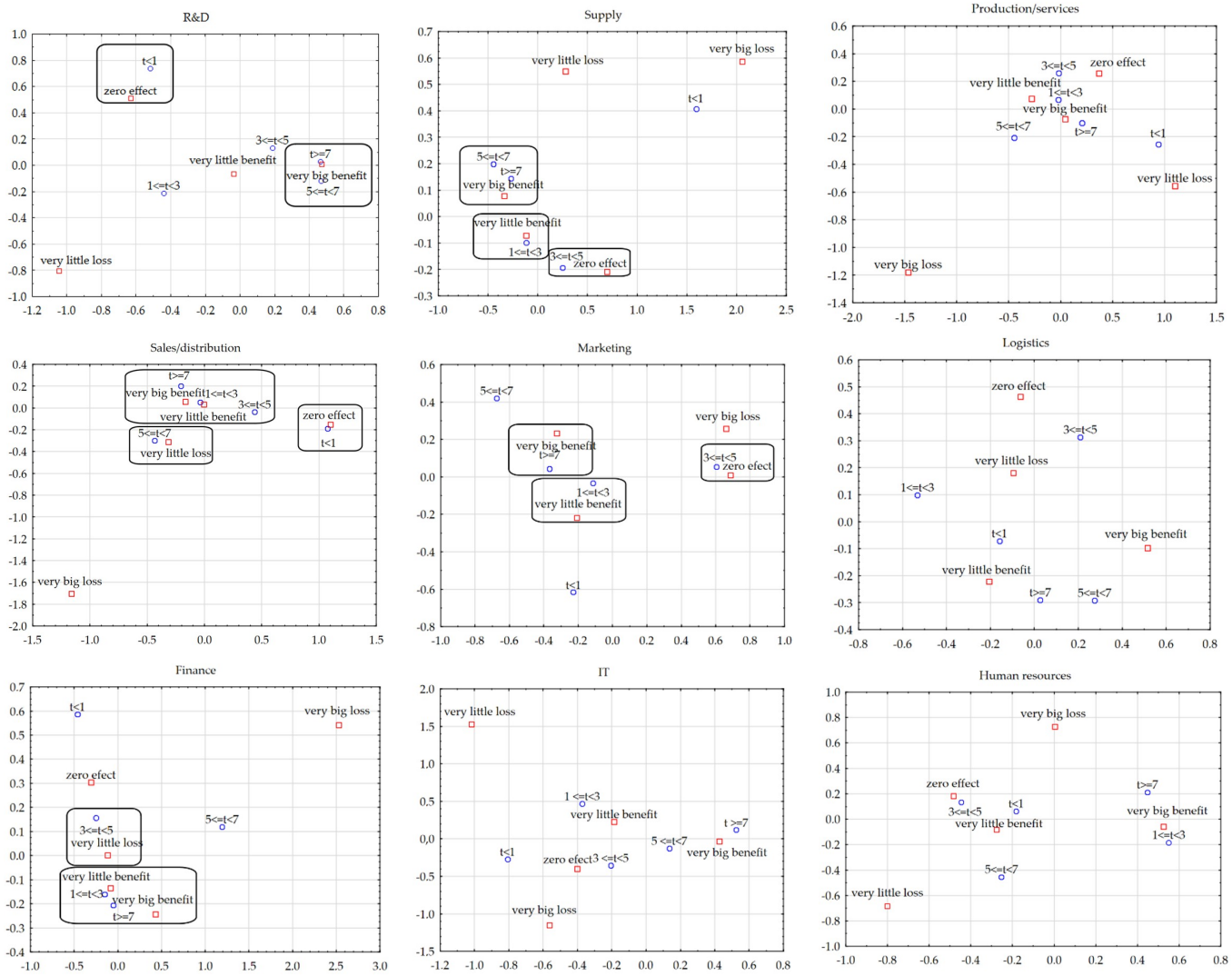


Figure 5. Correspondence maps showing the relationships between duration of coopetition and the assessment of coopetition effects in individual areas.

Furthermore, we recognized association rules linking the duration of coopetition and the associated benefit or loss. The low number of indicated losses made it impossible to identify many association rules between the duration of cooperation and the loss indicated. More frequently, the association rules identified related to the duration and benefits of cooperation. Association rules with confidence indicators of greater than 30% are reported (Table 2).

Table 2. Association rules in particular areas of coopetition.

	Predecessor (Duration of Relationship)	**==>**	**Consequence (Benefit/Loss)**	**Support (%)**	**Confidence (%)**
			R&D		
1	$5 \leq t < 7$	==>	Increase in innovativeness	10.8434	69.2308
2	$t \geq 7$	==>	Cost reduction	12.0482	58.8235
3	$t \geq 7$	==>	Acquiring unique knowledge	12.0482	58.8235
4	$t \geq 7$	==>	Increase in innovativeness	10.8434	52.9412
			Supply		
1	$1 \leq t < 3$	==>	Access to resources	13.9130	53.3333
2	$3 \leq t < 5$	==>	Reduction of transaction costs	11.3044	37.1429
3	$t \geq 7$	==>	Cost reduction	13.9130	59.2593
			Production/services		
1	$1 \leq t < 3$	==>	Access to resources	13.5135	51.2821
2	$3 \leq t < 5$	==>	Strengthening the position against other competitors	11.4865	48.5714
3	$3 \leq t < 5$	==>	Extending the scale of operations	10.8108	45.7143
4	$t \geq 7$	==>	Cost reduction	12.8378	50.0000
			Sales/distribution		
1	$3 \leq t < 5$	==>	Increase in company value	11.6279	46.8750
2	$3 \leq t < 5$	==>	Extending the scale of operations	10.0775	40.6250
3	$t \geq 7$	==>	Cost reduction	10.0775	34.2105
			Marketing		
1	$1 \leq t < 3$	==>	Access to resources	10.8911	35.4839
2	$3 \leq t < 5$	==>	Loss of independence	10.8911	35.4839
			Logistics		
1	$1 \leq t < 3$	==>	Acquiring unique knowledge	7.14286	37.5000
2	$5 \leq t < 7$	==>	Reduction of transaction costs	5.95238	45.4546
3	$5 \leq t < 7$	==>	Extending the scale of operations	5.95238	45.4546
4	$t \geq 7$	==>	Cost reduction	9.5238	34.7826
			Finance		
1	$3 \leq t < 5$	==>	Cost reduction	14.2857	52.3810
			IT		
1	$3 \leq t < 5$	==>	Access to resources	11.7647	40.0000
2	$3 \leq t < 5$	==>	Increase in innovativeness	11.7647	40.0000
3	$5 \leq t < 7$	==>	Cost reduction	10.5882	52.9412
4	$t \geq 7$	==>	Acquiring unique knowledge	10.5882	40.9091
			Human resources		
1	$1 \leq t < 3$	==>	Access to resources	10.7692	58.3333
2	$3 \leq t < 5$	==>	Increase in company value	12.3077	33.3333
3	$3 \leq t < 5$	==>	Reduction of the transaction costs	12.3077	33.3333
4	$3 \leq t < 5$	==>	Access to new markets	12.3077	33.3333

In the R&D area, one can see that coopetition lasting up to five to seven years (or longer) more frequently brought about the occurrence of benefits in the form of increased innovation. Coopetition lasting more than seven years implied lower costs or the acquisition of unique knowledge. In turn, associative rules in the supply area indicated that access to resources was a more frequently indicated benefit if coopetition lasted from one to three years. In the case of longer coopetition (three to five years), the main benefit was the reduction of transaction costs, and, when coopetition lasted more than seven years, the main benefit was cost reduction. This finding is also in line with expectations and previous research [129]. The R&D sphere is characterized by a long-term nature, delays, unpredictability of the new product development cycle, and other factors [130].

The probability that access to resources will be an advantage in coopetitive relationships lasting between one and three years is over 50% in the area of production/services. If the duration of the relationship is between three and five years, one can expect the strengthening of a firm's position against competitors and the expansion of the scale of its operations. In turn, the reduction of costs may occur during coopetition lasting over seven years. In sales/distribution, coopetition lasting from three to five years leads to an over 40% chance that there will be an advantage in the form of an increase in the company's value or the expansion of the scale of its operations. If coopetition in this area lasts more than seven years, a reduction of costs may be expected.

In the area of marketing, two association rules were distinguished, for which the level of trust was 35%. If cooperation lasts for one to three years, we have a 35% degree of certainty that there will be an advantage in the form of access to the markets, whereas coopetition from three to five years may generate a loss in the form of the loss of the company's independence.

Four association rules were identified in the area of logistics. Cooperation lasting from one to three years gives an opportunity to acquire unique knowledge. If cooperation lasts longer (five to seven years), advantages in the form of a reduction of transaction costs and extending the scale of operations may arise. In terms of the longest-lasting coopetition in the logistics sphere, a benefit in the form of cost reduction was observed.

In turn, coopetition in the area of finance lasting from three to five years gives a more than 50% probability that there will be a reduction of costs.

In the next area of coopetition, namely IT, we had four association rules, the first two of which are related to the time of cooperation lasting from three to five years: access to resources and an increase in innovation were the most frequent benefits indicated. If coopetition lasts from five to seven years, there is an over 50% probability of cost reduction. In turn, coopetition for longer than seven years may bring the benefit of acquiring unique knowledge. This means that knowledge exchange and knowledge building in the IT sphere takes time. On one hand, partners must build trust to share valuable knowledge; on the other hand, tacit knowledge is not easily codified and it takes time (over seven years) before knowledge is transferred to competitors.

In the area of human resources, a shorter time of coopetition (from one to three years) gives a more than 50% chance of access to resources, whereas cooperation in this area lasting from three to five years generates an increase in the company's value, lower transaction costs, and access to new markets. This finding is in line with previous research [130], in that firms cooperate with competitors in terms of filling the gaps in human resources. Such gaps are relatively short-term (1–3 years).

Summarizing the association rules presented, it should be stated that, in many areas of coopetition, the reduction of costs is a frequent benefit during long-term cooperation with a competitor. On the other hand, short-term coopetition makes it possible to achieve various benefits, including access to resources or acquiring unique knowledge. The use of association rules in the analysis of benefits and losses resulting from coopetition allows one to state that the time of cooperation determines the type of benefits and losses indicated, which confirms the fourth research hypothesis.

5. Conclusions

Coopetition is rapidly becoming a key success factor for enterprises operating in the contemporary business world. The importance of the coopetition phenomenon increased with the development of globalization processes, especially at the level of sectors and particular corporations. Coopetitive relationships are characterized mostly in the context of the benefits achieved; however, coopetition is fraught with disadvantages arising mostly from competition between competitors. The time factor also plays an important role in these coopetitive relationships. Given these facts, the goal of the paper was to analyze the benefits and costs of coopetition vs. the scope and time of the durability of cooperation between competitors. The presentation of the unique quantitative research related to this topic may be regarded as evidence of the originality of the paper. Using data gathered through the analysis of 210 companies operating in the high-tech sector in Poland, our findings brought very broadly diversified results, allowing us to test the formulated hypotheses.

Our study contributes to the knowledge base in several ways. Firstly, though this research adopts a single-country approach, analyzing high-tech companies operating in Poland gives us the possibility of comparing the results with other sectors of the economy, e.g., traditional ones. Simultaneously, these enterprises represented a diversified sample due to the different branches of the high-tech sector. In addition, this detailed analysis may become a substantial advantage allowing us to formulate hypotheses to be verified in the context of other industries and countries. Secondly, given the growing role of coopetition in any aspect of a business, as well as non-business activities, one should expect that many decision makers would have to take this growing trend into account if they wish to help achieve sustainable development in business. The results of this study can offer guidance to companies willing to obtain specific benefits from coopetition.

Our study had several limitations, the first of which was the analysis of only one sector existing in one country. Secondly, in this study, we explored the duration of coopetitive arrangements without taking the initial temporal orientation of partners into account. Future studies may cover this gap and explore the influence of the duration of cooperative ventures on the results of coopetitive alliances for partners with both a short-term and long-term orientation. We also did not differentiate whether cooperative ventures were dissolved naturally or due to internal tensions. Researchers dealing with this topic may be interested in addressing these issues and comparing the time factor, as well as the benefits and drawbacks of coopetitive alliances that dissolved naturally and those which were terminated unplanned. In addition, we did not consider the influence of external factors, such as market conditions [99] or industrial cycles [131], that potentially led to the unplanned termination of alliances. Thirdly, our study was quantitative, whereas a qualitative approach might be used in future research to explore the in-depth benefits and drawbacks that coopetitive ventures have, the reasons for their termination, and how the longevity of cooperation influenced the results achieved.

The methods used for data analysis did not allow us to test the influence of control variables (i.e., the firm's age, size, or industrial affiliation). In other words, these limitations need to be addressed in future research. Furthermore, future studies might explore sustainability-related coopetition strategies with respect to the social, economic, and environmental benefits for companies.

Despite the limitations presented, we believe that the results achieved allowed us to obtain a true picture of the situation in the analyzed sector. To the best of our knowledge, such research is relatively rare (due to the sensitive nature of the sectors analyzed), not only in this country, but also on an international scale.

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