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Pathologies and Paradoxes of Co-Creation: A Contribution to the Discussion about Corporate Social Responsibility in Building a Competitive Advantage in the Age of Industry 4.0

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Abstract: **Research problem:** Revolution Industry 4.0. forces companies to face specific competence-related, technological, organizational and even ethical challenges. The use of innovative “tools” associated with that revolution not only brings new technological challenges, opportunities to build new competitive advantages, new areas of activity, and new types of business benefits but also doubts, questions, or even pathologies and paradoxes. Sometimes, entities that do not fully understand the essence of the new concepts, methods, or techniques use them incorrectly or abuse them for private goals and expose themselves to criticism—sometimes even social condemnation. These are examples of the lack of Corporate Social Responsibility (CSR) of these organizations. This situation also has reached co-creation. In theory, it is a very positive concept, aimed at building competitiveness, or various types of competitive advantages of companies by creating value for clients with their participation. In economic practice, unfortunately, it is not always successful. **Purpose:** The main purpose of this paper is to identify and characterize the key paradoxes and areas of potential pathologies of creating competitive advantage based on co-creation without CSR in the case of companies operating in the age of Industry 4.0. **Originality/value of the paper:** A theoretical study based on the extensive literature review describing paradoxes, ethical and CSR problems of co-creation in organizations creating competitive advantage in the age of the Fourth Industrial Revolution and a qualitative methodology of research. This study attempts to systematize paradoxes of co-creation and the areas and industries in which the related pathologies of co-creation occur particularly often and distinctively in economic practice. The empirical studies were conducted as a review of case studies of companies that use the concept of co-creation in an irregular way (paradoxical or with pathologies). This study identified and characterized the key 31 paradoxes and pathologies of creating competitive advantage based on co-creation in the case of 14 companies operating in the age of Industry 4.0. **Implications:** The identification of main dilemmas, paradoxes and pathologies of co-creation; signaling the role of governance and CSR in processes of the valuable use of co-creation in the age of Industry 4.0. Based on the observations described in the paper, it is worth recommending that when becoming involved in co-creation, one should observe ethical standards and assumptions of CSR, and require the same from partners and other parties involved. Otherwise, the risk is that instead of co-creation, the result achieved will be exactly the opposite to that intended, which is co-destruction, and condemnation instead of glory. This is why it is worth considering the paradoxes that are key to co-creation and approaching solutions in a conscious way.

Keywords: pathologies; paradoxes; co-creation; CSR; Industry 4.0; competitive advantage

1. Introduction

Contemporary organizations operate in very difficult, unprecedented conditions. Such conditions are due to Industry 4.0, IR 4.0, which has been developing for some time now. The Fourth Industrial Revolution is based on the use of cyber physical systems, smart factories, and service innovations [1–4]. The IR 4.0 concept still has an irregular title and even inconsistent characteristics [5,6]. It results in enterprises being pressurized to implement not only the latest technologies, or IT and ICT solutions (Information Technology / Information and Communication Technologies) [7–10], but also to operate based on broad cooperation networks, both in the real, and virtual domain, both with partners that are located closely and remotely as well as competitors [11–19]. Therefore, in their acting environment, two realities intermingle, the real one (Physical Reality (PR)) and the virtual one (cyberspace, Virtual Reality (VR)), including new technologies based on computerization, digitizing, robotics (Cyber-Physical Systems (CPS)), the dynamic processing of large quantities of data in real time (Big Data Analytics (BDA)), internet connections - Internet of Things (IoT), Internet of Services (IoS)), close, partner-like interpersonal relationships (Cooperation, Partnering, Team Working), inter-organizational (Strategic Partnering (SP), Knowledge Partnering (KP), Network Cooperation, Coopetition), and also communication between machines (Machine to Machine (M2M) Communications, Artificial Intelligence, Neural Networks). Increasingly, in economic practice, activities based on co-creation are also observed.

Co-creation is the process of involving interested stakeholders from outside a given company, such as customers, business partners, etc., in the process of developing new products and services in order to use their experience in the course of discussions and exchange of ideas. Co-creation is about the joint creation of value by the company, suppliers and the customer. It is not the company trying to please the customer. It is about experiencing the business as consumers do in real time. It is a continuous dialogue about the possibility of co-constructing new, innovative, personalized co-creation experiences and its environments (see [20–22]). The popularity of co-creation has been growing along with the increasing dynamics of changes and the volatility of the environment, which forces companies to take more numerous and more organizationally difficult adjustment measures that are implemented over an increasingly shorter period of time (see [23–28]).

Unfortunately, diverse, and often extremely opposite in their expectations, the socio-economic pressures (tensions) on those delivering co-creation, e.g., with regard to deciding what is more important—the interest of the company, suppliers, or clients, or social interest—bring the need to make decisions that are difficult, controversial, or even bring dilemmas.

In literature, tension is conceptualized as the discomfort generated by ambiguity that can have various sources, such as contradictory and unclear communication, lack of communication, lack of sufficient planning, and incongruity between actors' aims. The problem with tension is that rising discomfort and pressure can disrupt or negatively influence the dialog concerning knowledge sharing and resource integration between network actors [29] in the value co-creation process [30].

This creates specific paradoxes of co-creation [31,32]. Although in their essence, paradoxes are not negative—as by illustrating conflicting requirements, or differing points of view of the parties, or by explaining complex phenomena, this can lead to discussion, break stereotypes and show new opportunities for acting [33–39]—the problem more often consists of the methods of solving them and their effects [34,40–43].

As the variability and complexity of the conditions of business environments and the organizations themselves increase on an unprecedented scale, in the age of Industry 4.0, tensions created as a result of those changes and the related requirements translate to unparalleled effects, or to broadly admired achievements in science, technology, economy, or society (e.g., innovative, breakthrough, novel solutions) [44,45], or, conversely, they come down to extremely sad, undesired, and infamous pathologies (malpractices, frauds, scandals, or “scams”). Unfortunately, as a result of the latter, the importance of the former decreases, tends to be marginalized, or even negated [46,47]. This phenomenon also affects co-creation [48–51].

Noticing this fact brought the authors' interest as to the causes for such a situation. The literature analyses conducted led to identifying the special role of understanding and practicing the principles and tools of Corporate Social Responsibility (CSR) by business entities [52–55]. Competitive firms usually tend to make their CSR activities transparent to demonstrate commitment and build a good reputation [56,57], but the existing Corporate Social Responsibility literature emphasizes that in order to improve value creation, there is a need for companies to apply a more holistic approach through the integration of various functional areas into the CSR interface of responsible management [58–62].

In this study, we take Carroll's view that "the social responsibility of business encompasses the economic, legal, ethical, and discretionary expectations that society has of organizations at a given point in time" [63–66]. The business benefits of CSR adoption are well known [67–71]. However, incorrect adoption of CSR may reduce a firm's ability to maximize profits and shareholder value and reduce operational excellence [72] and competitiveness [55]. As a result, such obstacles make some entrepreneurs and managers avoid uncomfortable and sometimes unprofitable CSR activities, at the cost of limiting or sometimes ignoring the benefit to the consumer, employee, or social good. Such decisions cause the pathologies which were mentioned earlier [46,47].

Because of the above, the goal assumed for this paper is to participate in the discussion on identifying and understanding the reasons for failures of seemingly spectacular projects, products, strategies, solutions, or other types of achievements delivered according to the requirements of the age of Industry 4.0., using the concept of co-creation but without proper implementation of CSR. The goal also seems to be even more important as there is still not much attention devoted in the literature to the issue of paradoxes and pathologies in inter-organizational cooperation and its effects [73–76]. The limited literature concentrates mostly on the creation of network connections and multilateral strategic alliances [77–81]. Therefore, a certain gap in research was created.

In order to fill this gap, this paper adopts the following analysis structure. The study starts with the extensive theoretical background, in which, based on a review of the literature on the subject, we attempted to signal the specific structure of competitive advantage in the conditions of the requirements in the age of Industry 4.0 based on co-creation, as well as the paradoxes and pathologies accompanying those actions with regard to the processes of managing organizations. Additionally, an attempt was made to ascertain why co-creation elicits such diverse behaviors and opinions, and why CSR seems to be such an important support and indicator of the valuable utilization of co-creation.

The collected theoretical material allowed us to propose the conceptual model. To verify the model in the methodological part, a special qualitative research methodology was prepared. The analyses and conclusions used the expert research methodology, which ordered and structured the collected empirical material. The categorization applied allowed us to select the industries that are particularly pathogenic with regard to the effects of co-creation in the age of Industry 4.0. In-depth research in these areas allowed us to show their specific character in analyses of particularly publicized cases of fraud related to co-creation and an attempt to identify their causes (inference). Those actions allowed us to verify the correctness of the conceptual model. Finally, the paper concludes with a discussion of the results and their implications for academics and practitioners, limitations of the study, and directions for future research.

2. Literature Review—Theoretical Background

2.1. *The Age of Industry 4.0 as a Context of Building a Competitive Advantage Based on Co-Creation*

The process of building competitive advantages of companies (the competitive advantage of an enterprise is its ability to consciously identify, implement, develop, protect, and benefit from such unique resources and skills, which while desired and valued in the market, are not available in the same degree to other competitors) has been the object of interest for years, not only for academicians, but practitioners also. The sources and concepts of building competitive advantages are analyzed and discussed broadly, and further new strategies of utilization are proposed [82–84]. Some of them

are less and some of them are more accurate [85–87], which causes disorientation as to where an organization's strategic actions should be directed [88]. The decision is not made easier due to the increasing dynamics of changes and requirements from the market environment, e.g., the age of Industry 4.0 that has been in place for some time now [89]. The revolution that accompanies it strengthens the unparalleled, “unprecedented fusion” between digital, physical, and biological entities, which is the aim for social, economic, and environmental progress [90,91]. This results in pressure from innovators to increasingly equip traditional machines and industrial products universally with sensors, microprocessors, ports, antennae, and various types of software [92,93]. This brings “new paradigms” both in management and production [94], which strengthen the need of “increasingly quicker and more precise decision-making” [95], using new technologies, materials, and tools [87] and implementing, in various areas, various forms of cooperation—both internal and inter-organizational [82,96,97]. Such an approach leads to creating industrial value, which is not only digitized and automated (e.g., as part of individual production plants) but also connected (through links and relationships between things, products, and people, e.g., based on the concept of network cooperation, or using the Internet) [98].

This situation uses co-creation in an interesting way [99]. According to its philosophy, to achieve effects of their actions, organizations operating in the age of Industry 4.0 should model the standards of their conduct in a way that departs from focusing on the independent (unilateral) creation of value for the customer and aims at intensifying the degree of involvement in creating added value that is unique for the customer [100]. This means that instead of using a strategy that consists only in imposing strictly defined solutions on the market, they should aim to diversify entities interested in collaboration/cooperation (e.g., customers, counterparties, final buyers, etc.) in the processes of designing, creating and developing new products and services, so as to use their experiences from the discussion and exchange of ideas. This method of co-creation is an indication of a specific way of acting, which gives the enterprise an opportunity of not only achieving competitive advantage over the current market rivals, but also a chance to continuously stimulate and maintain this advantage.

2.2. Co-Creation as an Example of the Paradox of Management in the Age of Industry 4.0

In its essence, inter-organizational cooperation (including that which aims at co-creation) represents a relationship, beneficial to all parties and well defined, of two or more organizations, serving the goal of achieving common goals of those organizations. It is based on various structural contexts (coalitions, alliances, partnerships, networks), and on eliminating tensions and disagreements in delivery of common actions, and in the case of conflicts—aiming to achieve compromise. Among the reasons for starting inter-organizational cooperation are most often the high level of co-dependence between partners, common experience in cooperation, reducing the risk of failure, improving the effectiveness and flexibility of actions, the synergy of resources and skills, transfer of knowledge, or increased innovativeness of actions. Unfortunately, its complexity, dynamism, and ambiguity make starting and maintaining it a task that is complex and full of challenges. This is mostly driven by organizational culture and the priorities of the cooperating organizations, as well as operating in different hierarchical structures. Besides, the cooperation is related to the individual character of the relationships perceived from a network perspective. As a consequence, this may bring contradictions, disagreements, and conflicts, causing inter-organizational cooperation to become inert and have a paradoxical nature [43].

The above issues intensify the requirements set by the age of Industry 4.0 and the selection of partners for a cooperative relationship. Innovation in the age of Industry 4.0, especially in business-to-business (B2B) markets increasingly entails co-development processes involving suppliers and their customers in the development of products and services (e.g., co-creation). Firms engage customers at various stages of the innovation process, such as defining the requirements and desired outcomes for the development of products and services. This increasing collaboration during development reflects a shift to more complex product systems and customized solutions [46,101]. Such relationships are not simple or straightforward, and the literature suggests that co-development with customers is a double-edged sword that has positive and negative effects [102]. The negative

effects of co-development include possible delays in the development process as well as decreased innovativeness and the possibility of “me-too” products [103,104]. There is also a risk that ideas from close customers will lead only to incremental innovation. In addition to these potential negative effects, co-development may complicate the development process itself, because of the challenges of establishing trusted partnerships, agreeing on common goals and engaging customers [105]. Methods of coping with these challenges remain poorly understood [106] and cause various tensions. They are mainly caused by the co-existence of alternatives to partners’ actions that occupy opposite poles, e.g., cooperate or compete, individually or in a team, ensuring organizational flexibility or productiveness of processes, co-responsibility or autonomy, stabilization or change, trust or control, homogeneity or differentiation, participative or authoritarian style of managers’ behaviors, being rooted or new relationships, specialization or accumulation, anticipation or delaying, discovering or exploiting, and profit or social responsibility? [31,73,107]. The above list is obviously open, as the dynamic character of inter-organizational cooperation creates a potential for new tensions and contradictions to occur. The efficient operation of an organization in praxeological terms depends on the suitable “balancing” of those contradictory directives, especially in the face of the increasing complexity, dynamism, and unpredictability of the environment in the age of Industry 4.0.

Managing these tensions is critical for successful co-development, and there is evidence that goal congruence, complementary capabilities and the coordination of development activities can improve the quality of the co-development process [108,109]. Managing it is not easy. As co-development relationships (e.g., co-creation) involve suppliers and customers in an intensive relational exchange [109], these relationships might be expected to involve very diverse elements that commonly exist simultaneously and must therefore be managed as paradoxes.

Paradoxes as a cognitive category are one of the basic determinants of human thinking and acting. The basis for a paradox is the cognitive tension related to the cognitive and social constructs, in which various types of discrepancies are perceived. In general, paradoxes refer to “contradictory yet interrelated elements that exist simultaneously and persist over time” [110]. A paradox is a certain “object” constructed by people, when contradictory tendencies become closer as a result of their reflection or interaction [111]. Related to a paradox are notions such as antinomy, aporia, dilemma, and oxymoron. The negative effects of the related tensions can be avoided through [111]:

- Acceptance—e.g., of the views of a strong leader by the rest of the team
- Confrontation—creative criticism and discussion to understand the positions
- Transcendence—looking for non-standard, complementary solutions

Managing paradoxes does not mean completely eliminating the tension between such contradictory elements but rather means finding creative ways of dealing with different elements at the same time [33,112,113]. A closer examination of paradox allows us to move from a generic understanding of “challenges” (e.g., [105]) toward a more focused analysis of the contradictory elements inherent in these relationships. The theory of paradox has more recently been used to construct theoretical frameworks to explain how firms manage contradictory elements in various settings. A paradox differs from a dilemma; in the latter, alternative elements offer distinct advantages and disadvantages, allowing for choice between them. In a paradox, however, the contradictory elements are simultaneously present and persist over time, requiring more careful and subtle addressing of alternatives [110,111].

Paradoxes of co-creation arise from tensions and specific features of, e.g., supplier–customer interaction and the innovation-related goals of co-development, at worst undermining the relationship itself. Examples of paradoxes in this context include striking a balance between collaboration and competition [19,114], exploring innovations and exploiting existing approaches [34,112], and balancing control and flexibility [111]. This is problematic, as in co-creation, goals of buyers and suppliers are not usually identical, and contradictions may arise. In particular, the co-development goals of customers and suppliers may be quite different, resulting in potentially conflicting goals and collaborative tensions [108]. In one common scenario, both actors are engaged in co-development, but the supplier

seeks a new product that it can sell to multiple customers while the customer is trying to innovate a specific solution. This creates a contradiction between serving the customer's unique needs (so building the customer relationship) and satisfying a wider market to improve profitability [115]. Besides, co-development partners have partially divergent goal structures, and there are likely to be concerns about potential opportunism. Traditionally, opportunism in buyer–supplier relationships has been discussed in terms of transaction cost analysis, where opportunism means that a partner acts in its own self-interest against joint value creation, which negatively impacts performance in exchange relationships [46]. The shortest definition of opportunism by O. E. Williamson describes opportunism as deceptively looking after one's own interest [116]. Opportunistic behavior in the theory of alliances includes breaking promises, sharing resources in the agreed way, misleading, or information asymmetry.

An increasing number of studies have suggested that pursuing competing demands simultaneously is advantageous for organizations in dynamic environments (e.g., [33,106,110]). This is possible in particular when activities of partners are based on a relationship of exchange, which involves partner-like relationships that create unique value, are ethical, long-lasting, and trusted, rather than a rational cost calculation [12].

Unfortunately, not all organizations correctly deliver those processes. The results of their joint actions do not impress customers with valuable technological, product-related, economic, or social solutions. On the contrary, they evoke outrage, objections, and social condemnation. As much as the former are much publicized and discussed, the latter occur in a specific way, which is still not fully understood and recognized. New explanations and justifications for them keep emerging. In order to at least reduce the knowledge gap in this respect, Table A2 shows a certain base of co-creation paradoxes and dilemmas, and the discussion in the section attempts to explain the specificity and the causes of wrongly solved paradoxes of co-creation, i.e., “co-creation pathologies”.

2.3. The Essence and Specificity of Pathologies of Co-Creation in the Age of Industry 4.0

The literature on the subject contains many different definitions of the term “pathology”, which is driven by the fact that pathologies as a phenomena have intrinsically accompanied human activity since ancient times and are closely related to the development of societies (they occur in various human groups and may occur in any area of life—in politics, economy, medicine, law, philosophy, engineering, etc.). Pathological behaviors, which accompany every area of life have varying degrees and strength of negative impact on the social, economic, and individual life of a human—the participant of an organization.

Semantically, the term “pathology” comes from Greek and means a condition or science on diseases while, in the vernacular language, it means a prolonged significant irregularity—a dysfunction. Such perception of the term was also used in management studies. In this paper, the term “pathology” will be equivalent to a prolonged significant irregularity in the functioning of an organization. Evidence for the correctness of such an approach can be found in the review of the literature, e.g., Kieżun, Stocki, or Pasieczny argue that a pathology can be understood as a prolonged occurrence in an organization (institution), including:

- A situation causing waste in the economic and/or moral sense at a social scale that exceeds the boundaries of acceptable tolerance [117];
- A dysfunction that disallows achieving goals that are realistic, determined for a given organization and consistent with the social interest within the assumed period of time, i.e., with a set deadline and using specified means, i.e., the resources held [118];
- A (or simultaneously many) dysfunction causing some changes that are unfavorable and moving in the wrong direction, affecting a given group and/or social system—here, an organization [119].

Based on observations of Walsh, J.P., Lee. Y-N., Tang, L. [120], it can be stated that in the international literature:

- The researchers studying problems of pathology in the life of an organization often refer to a diversified set of terms similar in meaning, describing attitudes and behaviors, such as misconduct, error, fraud, deviance, malpractice, selective reporting, almost wrongs, etc. [121,122].
- Organizational pathologies result from prolonged actions conducted by the organization or behaviors occurring in it, which may be perceived by the stakeholders, especially by the so-called “social-control agent”, to be those that transgress the acceptable boundary between good and evil or the separation line between legal, ethical, and socially responsible behaviors and their polar opposites/antitheses [123].
- Pathology is organizational conduct, conditioned by high complexity and numerous co-dependencies causing conflict, discontent, decreased value, and therefore bringing negative results, despite involving a sufficient number of suitable people with relevant qualifications, and no bad intentions, who completely fulfil their roles and duties, e.g., [124,125].
- In the psychopathology of leadership, the combination of a dysfunctional personality (i.e., aggrandizement and entitlement, thrives on narcissism, self, deceit, greed, distrust, and the abuse of power) and personal power can, and almost inevitably does, create social and business disasters [126]—the results of pathologies.
- For an organization (perceived as a system), every state in which one or more variables of the system remain outside of their stability range (acceptable deviation from the norm) for a significant period of time represents a pathological situation, as it results from absence or a corrupt functioning of self-regulation systems, which as a consequence causes a dramatic increase in the cost of the operation, making it necessary to restore and then maintain the stability of actions and recovery/adjustment processes [127].

Given the above, it seems to be justified to conclude that the sources and areas where organizational pathologies are created, and their symptoms—consequences of occurrence—are diverse. This poses a significant problem, especially taking account of the specificity of the conditions of Industry 4.0.

The area that is significantly sensitive and susceptible to the influence of both positive and negative pathogenic factors seems to be the area of co-creating value with the customer—in literature, it is called “co-creation”.

Co-creation is about the joint creation of value by the company and the customer. It is not the company trying to please the customer. It is about experiencing the business as consumers do in real time—it is a continuous dialogue about the possibility of co-constructing new, innovative, personalized co-creation experiences and its environments (see [13,14,128,129]). The advocates of this concept argue that co-creation processes are characterized by interdisciplinarity, interactivity, iteration, and looking through the prism of value creation for the environment. These actions are not based on the genius of an individual, but on the strength of cooperation and relationships. As a result, co-creation provides a company an opportunity to not only gain a competitive advantage over its current market rivals but also a chance for the continuous dynamization and sustainability of this competitive advantage over an increasingly shorter period of time (see [23–26]). The meaning of the concept of co-creation became noticeably stronger with the development of service logic in marketing (Service-Dominant Logic), one of the main assumptions of which is cooperation between entities, leading to the exchange of services that carry value [130]. The co-creation of value “is then a process in which diverse entities (market, public, and private) voluntarily participate in indirect and direct interactions leading to the parties involved achieving certain benefits (values) based on the use and exchange of resources. Co-creation of value may occur both in the process of making a purchasing decision, during consumption, and after finishing it” [131].

Co-creation is usually discussed in a positive context, by quoting numerous benefits of applying it. It is definitely less often that the cost incurred by the involved entities is mentioned, and even less common are the mentions of negative effects of co-creation [132]—finally, this is a process that involves entities with different goals, who aim at optimizing their benefits, which naturally makes a conflict of interests, or even intentionally detrimental actions, unavoidable. Such situations are usually referred to

in the literature as undesired consumer behaviors, behaviors that are: deviant [133], problematic [134], aberrative [135] or dysfunctional [136]. Publications from the recent years increasingly show that the concept of co-creation also has its dark side and quite important disadvantages. Those allegations, or rather observations are not unfounded—this is confirmed by numerous case descriptions [137–140] & (N1, N2).

The above conclude that the “dark side” of co-creation usually:

- Results from poor preparation (no rules or principles specified), poor management (absence or poorly specified goal and expectations, absence or poorly specified required and/or available resources, errors in communication, lack of supervision and/or control, poorly balanced empowerment), or simply ill will from the parties involved;
- Is shown in the form of various pathologies (which are discussed in this article);
- Brings the risk of exposing the brand (party offering the product/service/result) to financial loss and/or reputational damage (ridicule), and sometimes this results in the necessity of suspending work on a project, and sometimes even the inability to commercialize (wasting an idea, time, resources, etc.).

To sum up, it seems to be justified to state that customer participation is always combined with potential risks and there is no guarantee for collaborative behavior [141,142]. Thus, co-creation, on the one hand, can lead to the creation of value for the brand but, on the other hand, it can also result in destruction (co-destruction).

2.4. CSR as a Determinant of Co-Creation Quality: Value or Pathology?

In order to protect oneself from the negative aspects of co-creation, companies should use specific governance mechanisms to protect themselves against the opportunistic behavior of partners. The literature has identified contradictory elements in the governance of such relationships. Thus, governance is critical for co-development, as appropriate governance processes reduce the transaction costs related to co-development [143]. This involves formal and contractual governance that relies on control and legal enforcement, as well as relational governance that relies on trusting relationships. It has been suggested that these types of governance include a set of mechanisms that operate on partially contradictory principles but still exist simultaneously; for instance, explicit contracts versus reliance on relational aspects (e.g., [144,145]). An important goal of such an approach seems to be Corporate Social Responsibility, including the degree of understanding its concept and implementing the accompanying principles and tools [55,72].

Corporate Social Responsibility (CSR) is an important concept of modern management, as the increasing pressure from various environments forces enterprises to take actions that are not only economic and legal, in their character, but also social and ecological, taking account of various groups of stakeholders. CSR does not apply to large enterprises only (as the “corporate” might suggest), but also small- and medium-sized ones, as well as NGOs (non-government organizations) or government agendas. This is driven by the fact that a responsible business looks for synergy between economic, environmental, and social areas of an enterprise’s activity, which is described by the “3P” principle, meaning People-Planet-Profit.

CSR is increasingly considered a strategic and long-term approach, as delivering on the rules of social dialogue, transparent relationships, and solutions beneficial to all stakeholders (employees, customers, suppliers, stockholders, competitors, and local communities) leads to achieving a permanent profit. Moreover, promoting conducting business in a way that takes account of ethical values, laws, respect for employees, the society, and the natural environment contributes to sustainable growth by initiating such cooperative relationships between partners that from its essence improve the quality of life of all citizens (e.g., improve people’s health, general safety, and wealth). The characteristic feature of managing the organization in the age of Industry 4.0 should therefore be the creation of a social responsibility system (SRS) as a part of the system of managing the enterprise used to develop

and implement its social strategy and managing the activities of an enterprise significant from the perspective of its key stakeholders" [64,66,67,146].

In economic practice, this may be delivered via various forms of operationalizing concepts, e.g., Total Responsibility Management (TRM), which is a comprehensive management of responsibility, Triple Bottom Line (3BL), or economy, ecology, ethics (3xE), understood as a process of looking for such solutions for economic activity that are socially responsible, environmentally-friendly, and economically valuable at the same time [45,54,55,67,69,147]. However, the foundation for all of them must be a human manager or owner, as it is often said by many authors that "we must have moral people if we want moral business—those in turn must be supported by relevant tools so that the institutional solutions support moral conduct, rather than make it difficult" (see [64,65,67,148]). This is of crucial importance, as a well-constructed social responsibility system in business (SRS) plays a double role in the time of globalization and the age of Industry 4.0. On the one hand, SRS is a tool to protect society and the environment against the negative effects of the operation of enterprises in the age of Industry 4.0, in particular various types of corporations, inter-organizational networks, and given the goals of this paper, also of organizations that build their advantage on the basis of co-development, or co-creation. In this respect, CSR is an instrument that protects them against the threats from these processes. On the other hand, globalization has made contemporary enterprises operate in the conditions of strong competition and growing consumer pressure on acting in accordance with the principles of CSR. Having an effective SRS in place and applying CSR has become for many organizations a way to distinguish themselves in the market, and therefore a source of competitive advantage. Nowadays, only companies who operate in a socially responsible way can count on a long-term success [67,68,70,71,149].

As a result, the social responsibility of a business is not only a desired value, but also a necessary one. It is becoming an indicator of the quality of market actions taken by enterprises. Unfortunately, behaviors consistent with the rules of CSR are still not spontaneous and autonomous but must be stimulated and enforced. Business responsibility that is fair must consist of renouncing all practices that are detrimental to others and avoid giving the impression that the company takes care of the surroundings and all stakeholder, while in reality only pursuing dividends for shareholders and bonuses for the management board. If there is no such approach, CSR becomes yet another marketing technique or way of making money by some and spending company funds by others [66,68,70,71,150].

Effective CSR action should be an iterative, sequential and multi-stage process. Organizational CSR capability evolves over time, reflecting an iterative process as firms learn to alter business activities to support social and environmental concerns. Along with the increased involvement of an enterprise in CSR, usually its power of social influence increases and its actions are legitimized. "The power of CSR" represents a formidable force that can effectively exclude suppliers from the marketplace if they appear socially irresponsible. From a CSR perspective, how positive and negative forms of power, specifically expert, reward, and coercive power, impact the relationship between a dominant firm and their trading partners is unclear. Both expert and reward power are based on giving positive reinforcements to the party that is subject to the use of power, whereas coercive power is essentially negative and is based on some form of threats and the withholding of some resource from the other party [151].

In the age of Industry 4.0, without embedding co-creation processes and utilizing modern technologies of behaviors and tools for directing and monitoring corporate social responsibility, one cannot expect a full and long-term effective technology, nor the accompanying innovation [57,103,152–154]. This is because technology is not a pure application of scientific discoveries, rather it is subject to the influence of social, cultural, economic, and technical relationships which precede and shape it [11,58,60,61,155,156]. In those conditions, CSR is an indispensable and obligatory element of the contemporary technologies, especially highly advanced technologies. From the organization's perspective, one needs to invest in it on many levels and continuously develop and effectively utilize the resulting market chances and opportunities (e.g., building the image of a company that is socially

responsible, creating pioneering, innovative, socially responsible, or ecological products, services, and technical solutions). From the stakeholders' perspective, CSR should be demanded from enterprises and their partners, firmly exercising its practice and monitoring the degree of involvement on an on-going basis. The above activities can be supported by tracking the social reporting done by them and professional assessments of their activity with regard to CSR.

The literature on the subject describes a number of tools for tracking “the power of CSR”, and therefore monitoring the reliability and social responsibility of the partners selected for co-creation. Monitoring them may make it easier for managers to make many decisions, through solving their decision-making dilemmas more efficiently. It seems that it may also limit the trouble resulting from the paradoxes of co-creation and the number of situations and solutions that are pathological in their essence. Determining the level of companies' involvement in CSR requires a measurement of effects in comparison with inputs. Measures of CSR activities may be created by a company or based on a range of ratios defined in the Global Reporting Initiative guidelines (GRIs) [157–161]. As GRI standards are still not mandatory and the content of CSR reports is usually not audited, corporations can feel free to understand and use CSR measures. In order to systematize the knowledge on CSR and provide additional details on the values that should drive organizations (not only businesses) in their operations, the ISO 26000 standard was created. According to that standard, CSR should be considered in areas such as organizational governance, human rights, employment relationships, natural environment preservation, consumer relations, and social involvement.

There are many detailed indicators (measuring tools) illustrating the application of CSR and they are divided into various categories. The following indicators can be distinguished: economic (e.g., investment indicators and capital expenditures, their percentage share in revenues, innovativeness: new products versus total products, R&D expenditures versus future revenues), environmental (e.g., waste management, number of environmental protection standards breached, value of investments reducing the environmental impact versus the total value of investments), ecoproductivity indices (e.g., quantity of materials manufactured to the quantity of raw materials used, ecoefficiency indices, e.g., CO₂ emissions to revenues), employee-related (e.g., average salary of women to average salary, salary brackets, number of employees participating in trainings to the overall number of employees, number of newly hired employees to the overall number of employees, etc.), work safety (e.g., accidents with hospitalization to the overall number of employees, hours of sick leaves to hours worked, etc.), social involvement (e.g., funds assigned to social investments such as science, health, sports; number of hours volunteered, level of taxes and local fees to the overall revenues of the municipality, charitable subsidies, etc.), and concerning relationships with business partners (e.g., Average payment term for suppliers' invoices, number of complaints received, etc.). In practice, there are various CSR measurement tools applied, which can be divided into seven main categories [162]:

- Benchmarking of achievements and ranking tools,
- Certification and accreditation,
- Guidelines regarding reporting,
- Networks based on voluntary participation,
- Analysis of the content of corporate publications,
- Evaluation scales, and
- Creating partial indicators as part of BSC.

CSR also measures the “world of finance”. All-important world stock exchanges introduced instruments supporting investors in assessing the social and environmental aspects, called Environmental, Social, Governance (ESG) [163]. One of the oldest stock exchange indices relating to socially responsible actions is the Domini 400 Social Index, created in 1990. Among popular indices are the RESPECT Index, Dow Jones Sustainability Index series (DJSI), Calvert Social Index (CSI), FTSE4GOOD series, FTSE Johannesburg Stock Exchange Socially Responsible Index (JSE SRI), Sao Paulo Stock Exchange Corporate Sustainability Index (ISE), and the KLD Global Sustainability Index Series

(GSI). Market participants also have other, increasingly more specialized tools, e.g., environmental indices such as the FTSE CDP Carbon Strategy Index Series or religious indices such as the Dow Jones Islamic Market IndexSM [153].

The decrease in trust to great supranational corporations suspected of using unfair business practices, related among others to human rights or environmental standards, forces managers to launch CSR activities in at least several basic areas [153,164]. These are explicitly signaled by: the Respect Index, which assesses the following parameters:

- Environmental: environmental management, reducing environmental impact, biodiversity, and environmental aspects of products/services;
- Social: OHS (Occupational Safety and Health), human resources management, relationships with suppliers, dialogue with stakeholders, and social reporting;
- Governance: strategic management, code of procedure risk management, managing the risk of fraud, internal audit and control system, customer relations.

It seems that based on such multi-stage analyses and the broad scope of the organizational activities being assessed, companies with a high Respect Index may enjoy a high level of social trust. It is therefore worth the effort to obtain high rankings in the above areas, especially if the organization's operations are to be supported with resources of external partners. In the age of Industry 4.0, this should even become a standard. Observing and analyzing, taking account of the tools for monitoring CSR represents significant support in the processes of assessment and taking various kinds of decisions, especially those related to investment, consolidation, and cooperation. This also acts as a sort of a warning system, indicating unintended, indirect, and delayed factors occurring around technology that may stop or accelerate their development or utilization. The results of research available in the literature show that the higher Respect Index result, the more attractive enterprises are for investors, and the introduced innovations and actions aimed at implementing high technologies become increasingly more expected (both by the investors and the managers) [59,66,68,70,165–167].

Although CSR activities are difficult to capture due to their dispersion and multi-dimensional character, and the benefits of their application occur usually in the future, the results of the assessments of CSR activities of enterprises seem to prove the reliability of their actions, responsibility and credibility, making them act as a certificate of integrity. It may be concluded that if the competitive advantage is built on the basis of co-creating, they may act as an indicator of the quality of the solutions generated jointly by the partners. Businesses that are active and involved in CSR, in order to build their positive potential, will surely look for partners with similar parameters. Additionally, due to the essence of the promoted concept, they will take care of the quality of their actions and their social interactions. They will have similar requirements to the co-creators. As part of their joint actions, there are chances of creating solutions that are positively assessed by the society, and therefore generate co-creation value. It may be assumed that a cooperation of partners with low levels of CSR involvement indicators may much more often bring actions that are criticized, unethical, socially unacceptable, or even pathological (co-destruction).

A breakdown of the information, collected as part of the literature analyses of requirements, dilemmas, paradoxes and pathologies related to building competitive advantage based on co-creation in the age of Industry 4.0, as well as the special role of “the power of CRS” of the partners, allowed us to formulate the following research hypotheses shown in Figure 1 and then verified in the empirical part of the paper:

- **Hypothesis 1 (H1).** *In the realities of the Fourth Industrial Revolution, organizations which take actions based on co-creation are subjected to socio-economic pressures, stronger than ever, which brings numerous management dilemmas and the need to make controversial decision.*
- **Hypothesis 2 (H2).** *The need to make controversial decisions strengthens the role of conscious utilization of governance policies and CSR strategy (SRS) in companies.*

- **Hypothesis 3 (H3).** *Conscious and holistic/comprehensive use of governance and CSR allows companies (suppliers) to effectively achieve a high co-creation value.*
- **Hypothesis 4 (H4).** *The lack of activity or errors in the area of CSR leads companies (suppliers) to pathology in delivering co-creation and, in extreme cases, causes a change of its character to co-destruction.*

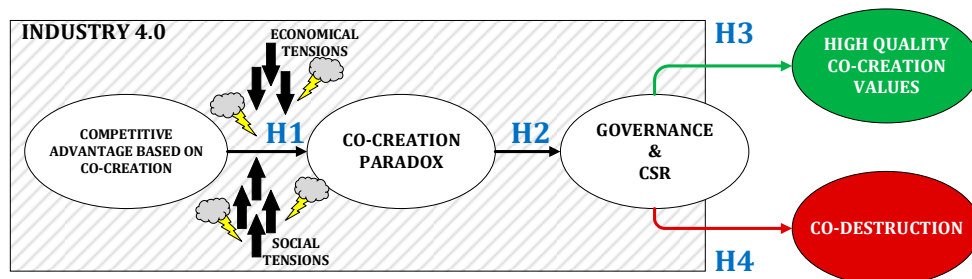


Figure 1. The conceptual model. Source: Authors' own elaboration.

3. Methodology

3.1. Research Approach

Paradoxes and pathologies of co-creation are socially complex phenomena, inseparable from their organizational context, and are represented by scarce theoretical knowledge. Wilson [168] suggests that qualitative research is most beneficial for the investigation of complexities and processes, little known ways of management, and unstructured and informal linkages in firms. According to these criteria, qualitative research is a good fit for investigating co-creation paradoxes and pathologies. To this end, we adopt an exploratory, nonlinear, qualitative research design to generate a theoretical framework that offers rich explanations and insights. Our research involves data collected from a multi-area review of the results of world research, reports, news, and other data on abuses and pathologies resulting from the activities of enterprises in various industries who in their practice affect cooperation based on co-creation. The data was collected from years 2015–2019. The core premise of this approach is the systematic combining of inductive and deductive approaches in seeking knowledge via a nonlinear process of combining observations, empirical insights, and constantly consulting relevant literature [169]. We juxtaposed the existing theory with the phenomenon we observed over the course of empirical research with data analyses ensuing the differences between the evidence and descriptions in the literature. This allowed the simultaneous and interactive evolvement of data and theory as well as the achievement of a relevant and rigorously validated framework for theory elaboration. Because of the above, the article is both a conceptual work and review the current state of knowledge, and the study makes an original contribution to the discussion of the issue of pathology in co-creation. The qualitative research presented in this article is an introduction (pilot study) for the planned so-called appropriate quantitative research, which is why hypotheses dedicated to the entire research process were included in the model. Despite the fact that the hypotheses may be seen as “disputable”, they have been deliberately planned, and thus the attempt to verify them should allow for better orientation of further parts of the research process.

3.2. Collection of Empirical Material

When collecting the research material, qualitative analysis was performed on approximately 200 purposefully selected sources, varying in terms of their genre. The analyses were performed based on a rich review of scientific literature (see the references (e.g., [74–76,117–145,170–189]); netography: (N1–N56)), reports from consultancies (including Ernst and Young LLP; KPMG; BCG; Accenture), industry press and websites of world media broadcasters (including cnbc.com;

bbc.com; theguardian.com; reuters.com; cbsnews.com; fortune.com; newsweek.com) and public blogs (including networkworld.com; calvertjournal.com; digitaltrends.com; gobankingrates.com; yannigroth.com; medium.com; theverge.com), popular science literature, as well as breakdowns and online rankings (gizmodo.com; kotaku.com; thrillist.com; businessinsider.com; wired.co.uk; wired.com; worldfinance.com; bitcoincasinopro.com; planetcompliance.com) (see (N1–N56)). Also, taken into account was a review of opinions from industry specialists, members of social organizations monitoring the abuses of the business in relation to the society or the environment in which the co-creation/co-development activities are conducted.

During the analysis of world literature, issues related to co-creation (cooperation supplier-customer) and cases described as misconduct, error, fraud, deviance, malpractice, offense, crime, pathology, weaknesses, threats (keywords) were sought. Among the journals, the most useful issues in this regard were Research Policy, Annual Review of Sociology, Systems Research and Behavioral Science, Journal of Services Marketing, Journal of Business Research, Journal of Service Research, The Journal of Medical Internet Research, Business Ethics: A European Review, Clinical Chemistry and Laboratory Medicine, Ethics and Information Technology, Journal of International Management.

3.3. Analysis of Empirical Material

The empirical analyses in this paper are conducted in four stages. This paper started with the idea of co-creation as an example of a particular bundle of decision paradoxes related to managing organizations in the age of Industry 4.0. According to the authors, its elements are related to the structural elements of the business model of enterprises, which strongly determines the quality of the delivered activities related to building competitive advantage. Therefore, dilemmas characteristic for co-creation were analyzed for the typical 10 elements of the business model (in two base areas: key and peripheral) (Appendix B—Table A2 column 1). Such a structure was adopted based on the concept of business dimensions proposed by Wirtz [190]. Each of them was assigned co-creation paradoxes identified on the basis of a literature review (Appendix B—Table A2 column 2). The first stage of the analyses helped define 31 paradoxes of co-creation related to how enterprises solve 31 A versus B type of dilemmas (see Appendix B—Table A2 column 3). According to the research assumptions, solving them with no social responsibility taken into account signaled the potential occurrence of co-creation pathologies (see Appendix B—Table A2 column 4). It was decided that examples of such behaviors would be looked for in practice in the second stage of the research. Because of the above, a broad review of archival materials with reports of pathological cases related to co-creation was performed. After analyzing almost 100 cases, industries were identified that, according to the authors, concentrate the most scandalizing pathologies/abuses of the business in relation to society or the environment in which the co-creation/co-development activities are conducted. The particularly pathogenic industry sectors included the investment, IT/electronic entertainment, automotive, new technologies, and financial sectors. In the third stage of the analyses, to establish the character and source of such negative social perceptions of these sectors, a deepened literature research was performed. It allowed us to finally select, from among several dozen identified cases for each of the industries, the most publicized (resounding, discussed, and outrageous) cases of pathological effects of co-creation. Finally, 14 case studies were described and assessed. For each of the cases, it was attempted to ascertain the method of solving the approach to 31 paradoxes of co-creation (see Appendix B—Table A2 column 3) and identify the lacks/gaps of the described cases with regard to governance and CSR activities (see Appendix C—Table A3). In the fourth stage, based on the case analyses performed, an attempt was made to draw conclusions regarding the sources of pathologies observed. We also tried to verify whether the hypotheses formulated were right.

4. Findings: When and Why Co-Creation Results in Co-Destruction

In presenting our findings, we first start from showing the paradoxes, dilemmas, and the areas of potential pathologies related to building competitive edge based on co-creation. This breakdown was

based on the structure of a business model that identified the areas of business activity conducted in a modern way. This was done in an attempt to systematize the paradoxes of co-creation and link them with the logic and architecture of the way of making money by an enterprise in the age of Industry 4.0. Such a structure was to support the strategists in organizations when making decisions related to the organization and effective utilization of co-creation. In particular, it was supposed to reveal the specificity of the dilemmas that must be solved and their possible critical consequences, if they avoid social responsibility in solving it. This breakdown is presented in Table A2 (see Appendix B). In the three key elements of the business model (i.e., configuring business relationships, configuring competencies, and configuring resources), 10 leading paradoxes of co-creation were isolated. For seven peripheral elements of the model (i.e., concept of communication, concept of cooperation, concept of coordination, concept of growth, configuring competencies, storing values, system of value creation), 21 potential paradoxes of co-creation were found, which provide the sources of dilemmas, and therefore the sources of potential pathologies of co-creation. In the situation of the lack of support from CSR, each of them is a significant threat to the co-creation value provided by the partners (see Appendix B).

When browsing the archival materials with reports of pathological situations related to the above issues, special attention was paid to fourteen particularly interesting cases, which were found to be representative of the selected industries. The first one among them is the investment industry.

4.1. Investment Industry: Unethical Usage of Venture Capital, Crowdfunding or Crowdsourcing

Crowdsourcing is a term used to describe the involvement of a virtual crowd in a task. Typically, the task is posted online as an open call and members of the crowd self-select a task to be undertaken [170,171]. Therefore, it is a mechanism used by organizations, public institutions, non-profit organizations, and increasingly private individuals, to obtain external support. The support is obtained by outsourcing the tasks which before were performed by employees, to an unidentified, usually very broad group of people in the form of an open query/call. In other words, crowdsourcing allows any Internet user to participate in the tasks that used to be reserved to a narrow group of specialists. What is important for crowdsourcing, is that it is acceptable to “obtain information or services by soliciting input from a large number of people, typically via the internet and often without offering compensation”. This very fact makes this mechanism susceptible to pathologies in many situations. Crowdfunding is a method of financing various types of projects by the community, which is or will be organized around those projects. The project, in such cases, is financed by a large number of small, one-off payments made by people interested in a given project. This may be any project: in business, culture, science, or society (introducing a new product or service to the market, scientific research, creating computer software or websites, organizing mass events, building public utility facilities, cinema and musical productions, or even election campaigns).

Although both crowdsourcing and crowdfunding are legally regulated and usually conducted using online platforms created for this purpose (less often using social media or blogs), those mechanisms generate a very broad field for abuses, which is confirmed in the publications [172–175]. Among the most common threats are the risk of financial excesses of the creators and permissiveness to waste. The history of public fundraisers organized by crowdfunding platforms unfortunately too often shows projects which either turned out to be a total failure, as they were simply wrong, or because they were poorly managed, or, what is particularly outraging, because their proponents—beneficiaries of the public fundraiser—used the collected funds inconsistently with their purpose, usually by spending them to satisfy their private needs. Representative examples include: Ant Simulator [N3], Zano, Ouya, Star Citizen [N4] (due to editorial purposes, more detailed description is included in the Appendix A—Additional information about presented examples of “When and why co-creation ends with joint destruction”). Another pathology which needs to be mentioned is the risk of breaching and/or stealing intellectual property and the resulting right to obtain financial gain in a situation, when some of the people involved intellectually or financially in the process of co-creation once the product/service/solution is created and made available (introduced) to the market are not included

among the co-creators. Unfortunately, similarly frequent are the cases of attempted frauds and extortions—attempts of obtaining funds and different types of support by way of intentionally misleading and exploiting the community. The scandal that received some significant coverage was that by Elizabeth Holmes—the founder and former CEO of Theranos (see Appendix A) [176–180] & (N5). A case at a smaller scale, but also outraging is Jennifer Cataldo’s Cancer Scam (see Appendix A) (N4,N6). Next, the IT area was investigated.

4.2. IT Industry—Products Digitized and the Issue of Incompatible Add-Ons Damaging the Original Product

The above situation is one of the most common, as in the realities of Industry 4.0, many products and/or services are available in digital, or digitized form. There are many very fitting examples showing why free and unlimited digitization with no principles or rules implemented from CSR may have serious negative consequences and lead to pathology, which is described in the article by Lambèr Royakkers, L., Timmer, J., Kool, L., van Est, R., [181]. However, to relate to a specific example, consumers increasingly expect to be able to freely modify purchased digital products, and this possibility is increasingly a sort of indicator of quality/value/attractiveness of a given product or service [182]. Sometimes a part of the offered modifications/extensions/add-ons are incompatible with the original product, or limit its performance, or change its functionality completely. There are also situations when, after introducing the modifications, the digitized product loses its function—it no longer operates and/or operates to the detriment of the user, in a situation when, according to the intent of the creator of the modification, the user unknowingly installs spyware, malware, adware, etc. [183]. Such pathologies especially threaten initiatives related to the distribution of software under an open license GNU, Freeware, BSD (Berkeley Software Distribution), X11—e.g., Linux operating systems (there are over 100 “main” distributions, i.e., versions of the operating system, serving various purposes/goals [Mens, Claes, Grosjean, Serebrenik 2014; <http://futurist.se/gldt>, online access 12 January 2019]), or programs and applications from the sector of electronic entertainment, especially computer games, e.g., those that can be downloaded from Steam platform (see Appendix A)—usually, each one has many “additional content” and modifications created by the fans). An equally “interesting” (although “scandalous” seems to be a better word here) case was recorded in the automotive industry.

4.3. Automotive Industry: Dieselgate Scandal (Unethical Usage of AI)

Using artificial intelligence (AI) is a “daily bread” in the context of implementing innovative solutions in the age of Industry 4.0. Unfortunately, the case of the car manufacturer Volkswagen showed explicitly irresponsible (in the context of CSR), and at the same time “resourceful”, a person can be when wanting to make money. The pressure from market rivals combined with the requirements and strict environmental standards cause a situation where “economic” and “environmentally-friendly” cars sell better—those with engines meeting Euro-5 and Euro-6 standard requirements, which are restrictive standards setting the acceptable exhaust emission levels. (see more (N7)). As this is very difficult in practice, and in consequence very costly, engineers from VW developed a specialized software installed in cars with Diesel engines. (After the international scandal erupted, an investigation found that similar practices were used also by other car manufacturers—including Volvo, Renault, Jeep, Hyundai, Citroen, and Fiat.) Its task was to detect “when it is being tested” and temporarily limit the engine’s parameters, so as to show lower levels of emissions—lower emissions of nitrogen oxides (NOx), hydrocarbons (HC), carbon monoxide (CO) and solid particles (PM10). More coverage on the “Dieselgate” and its consequences was written by Spapens, [184], Hachenberg, Kiesel, Schiereck, [185], Bowen, Freidank, Wannow, Cavallone, [186], Held, et. al, [187]. How does the quoted example represent the issues discussed in the article and deal with the subjects of Industry 4.0, co-creation, and CSR? Firstly, it describes a purposeful and unethical use of artificial intelligence in order to mislead the surroundings. Secondly, in a way, it condemns lack of awareness and/or silent acquiescence of the surrounding for such practices, depending on which scenario we are discussing. Next, our attention was attracted by the pathologies related to the use of modern technologies.

4.4. Modern Technologies—VR and AR

Virtual reality (VR) is a three-dimensional image created by computers—an image of artificial reality created using IT technology. VR may show various things, objects, or even entire events—it allows/consists of a multimedia creation of a computer vision of objects, spaces, and events. Depending on the concept, virtual reality is based both on elements of the real world, and the world that is completely fictitious. VR is used to evoke natural and real sensations. One of the most popular, widely recognized applications using the discussed technologies is the game called Pokémon Go. Due to the subject matter of this article, the application will be presented as an example illustrating the society's lack of readiness to ethical and safe use of such programs—and therefore the leitmotif—"Pokémon Go: case about lack of respect for privacy and sometimes even shocking stupidity that threatens life".

Pokémon Go (N8) is an urban game in the genre of computer role playing games, using the augmented reality (AR) technology, created by Niantic and released in July 2016. Thanks to the use of augmented reality technology, a gamer with a smartphone with a gyroscope and camera can "catch" pokémons, which are displayed on his/her screen. (After the first launch of the game, a player may create his/her virtual avatar: they can choose the color of their hair, skin, eyes, and clothes. After creating the character, the player is located in the map of the world using GPS (Global Positioning System) technology, and the map generates objects, such as Pokémon battle rooms, Pokéstops, and the pokémons, as the player moves closer to them. The avatar changes its location in the map as the player moves in the real world.) The application uses GPS technology to find the gamer's location, and camera to generate the world of augmented reality. Sounds innocent, does it not? Unfortunately, as it turns out, the co-creators—gamers/users of the application—proved multiple times that it is unfortunately not. This may be proved by the following cases (calvertjournal.com; networkworld.com; cbsnews.com; fortune.com) (see Appendix A):

- Youtuber arrested for playing in church,
- Soldiers caught playing in a war zone, and
- A minefield of Pokémon.

4.5. Cybersecurity—Spyware and Espionage Scandal

The continuation of the theme of Pokémon Go, this time as a spying application. Before Ruslan Sokolovsky ever set foot inside a church with a smartphone, Pokémon GO was accused of all manners of evil in Russia and has had officials fearful of a potential Western conspiracy. Some critics voiced concerns that the game may be a thinly veiled surveillance operation orchestrated by the CIA (Central Intelligence Agency): "Pokémon GO might turn out to be a spy game", readers were warned by the Moscow newspaper Moskovsky Komsomolets. "Players walk around not only streets but also indoor. For example, offices with some important papers". The St Petersburg Cossacks also called for a ban on the app after agreeing that American spies could be behind it. "Where were the applications developed? In the USA. That's why you cannot rule out the presence of the CIA", said representative Andrey Polyakov. If you dig deeper into this matter things go interesting. Further back in 2001, Keyhole, Inc. was founded by John Hanke (who previously worked in a "foreign affairs" position within the U.S. government). The company was named after the old "eye-in-the-sky" military satellites. One of the key early backers of Keyhole was a firm called In-Q-Tel. In-Q-Tel is the venture capital firm of the CIA. Yes, the Central Intelligence Agency. Much of the funding purportedly came from the National Geospatial Intelligence Agency (NGA). The NGA handles combat support for the U.S. Department of Defense and provides intelligence to the NSA (National Security Agency) and CIA, among others. In 2010, Niantic Labs was founded (inside Google) by Keyhole's founder, John Hanke (see more (N9,N10)).

Another case is even more shocking. The year 2017 saw the eruption of the scandal related to Kaspersky Anti-Virus software. It seems that people who installed this program became a part of a huge botnet of 400 million computers, and their computers could be used to steal their files. The suspicion of

this fact reached the public opinion in quite an interesting way. It happened with the participation of Israeli special services, who decided to break into the internal network of Kaspersky. After breaking in, the Israelis noticed that Kaspersky's servers are used by "someone" to search millions of computers on which this antivirus is installed, not only for samples of malware but also hacking tools created by the NSA. The antivirus also searched for (and automatically downloaded, if found such) documents that were bearing very specific markings—ones used to mark the strictly confidential reports of American services. Speaking in simple terms, the Israelis, who hacked Kaspersky noticed that Kaspersky had already been hacked by the Russians, who use it to hack Americans (see Appendix A). As a consequence, the US government has banned federal agencies from using cybersecurity software made by the Russian company Kaspersky Lab over fears that the firm has ties to state-sponsored spying programs (N11–N13). Also, the supermarket chains popular in USA, BestBuy and Office Depot, withdrew Kaspersky from their shelves. In order to understand how serious the situation is, one has to add that most of Kaspersky's revenues were generated from its presence in the U.S. market (N14). The last of the areas analyzed in more detail is the financial sector, and particularly the pathologies related to the operation of pyramid schemes and the so-called currencies of the future—cryptocurrencies.

4.6. Financial Pyramid Schemes, Block Chain and Cryptocurrency

The mechanism of operating financial pyramid schemes is relatively simple. The system works, making an impression of being financially attractive, as long as there is a regular inflow of new investors, and its participants make payments. Historically, the first pyramid scheme was conceived by Charles Ponzi (N15–N17). However, he has many followers—Enron, Worldcom, Bernard Madoff, and the Lehman Brothers. Sound familiar?

Some similarities can be also noticed in the case of the systems leading in the age of Industry 4.0, Blockchain and Cryptocurrency. Experts also note that apart from undoubted advantages, there are numerous pathologies and threats in this case [168]. Firstly, it is noted that cryptocurrencies may be a perfect way of money laundering, i.e., be used by organized crime to legalize their revenues (N19–N25). Secondly, the analyses indicate the increase in human activity that is harmful to the natural environment. According to reports from Digiconomist, Bitcoin and Ethereum networks together consume more electricity than countries such as Jordan, Iceland, and Syria. Those calculations were published on 7 July 2017. At the time, the production of Ethereum consumed 4.69 TWh, while the production of bitcoins was at 14.54 TWh. Those figures have increased since then [N26]. The calculations by PowerCompare.co.uk show that in 2017, Ireland consumed 25 terawatt hours of electricity while, at the same time, bitcoin mining consumed as much as 30.15 terawatt hours of electricity. It turns out that as many as 159 countries of the world use less electricity than all bitcoin mines altogether (N27). The speculation that the most popular cryptocurrencies may prove to be speculative bubbles (speculative bubble—a self-perpetuating process of unbalanced growth or drop in market prices for goods. Often related to "market overactivity", which is temporary. After a period of relatively rapid increase in the price of goods, there is a sudden drop, often called "burst" (crash), which usually brings a radical drop in the value of resources of many investors) are quite widespread (N28–N32)—in the great Bitcoin bubble of late 2017, the honor goes to John McAfee, founder of computer security company McAfee LLC, and passionate cryptocurrency evangelist. On 7 December 2017, he wrote: "Bitcoin now at \$16,600.00. Those of you in the old school who believe this is a bubble simply have not understood the new mathematics of the Blockchain, or you did not care enough to try. Bubbles are mathematically impossible in this new paradigm. So are corrections and all else." A few days later, Bitcoin's price briefly peaked at \$19,511 before it began an epic plunge that would see the original cryptocurrency lose approximately 82 percent of that value.

4.7. When and Why Co-Creation Ends with Joint Destruction—A Quick Summary of the Presented Examples

The analyses shown above of 14 so-called pathological effects of co-creation show that the participants of co-creation in the age of Industry 4.0 are subjected to exceptionally strong

economic and social pressures. Those pressures cause the need to make paradoxical choices in the decision/management process delivered by them (solving difficult dilemmas), whether to use the tried, effective, safe, yet not unique line of action, or dare to take risky challenges in the age of Industry 4.0. When analyzing the cost and profit, the results of those choices tend to differ, just like their consequences described above (which confirms the validity of hypothesis H1). The research showed that in the analyzed “pathological” cases, when solving co-creation dilemmas, the path directed to meet and utilize the challenges of the age of Industry 4.0 was chosen more often—22 out of 31 dilemmas were solved as a result (and this should be praised—the advantage of cases with B indicated when solving dilemmas; see Appendix B—Table A2, Column 3). This was related especially to peripheral elements of the business model, related to the concept of cooperation, coordination, and growth. In the key elements of the business model, there is a higher balance of the choices between classical and modern forms of solving co-creation dilemmas. Choosing modern solutions predominates in the sphere of configuring resources, and the classical solutions with regard to configuring business relationships. Unfortunately, in the analyzed cases, due to the orientation to own profit, social responsibility was definitely lacking, as well as understanding and acting for the benefit of society, or observing elementary rules of, e.g., management, ethics, security, timeliness, or reliability (which confirms the validity of hypothesis H2). When analyzing the approach to CSR from those delivering co-creation solutions that are infamous, unethical, often useless, uneconomical, or even harmful, it can be clearly seen (see Appendix C—Table A3) that there is a lack of awareness of the meaning, and as a result, observing of the basic standards of the ethics of business, good governance, and conscious, responsible CSR (which would allow us to infer the validity of hypothesis H3). Unfortunately, the described cases of co-creation are definitely focused on achieving unilateral economic benefits (for the company that initiates co-creation), and generate little significant values for the consumers, society, or the natural environment that co-create the solutions. The co-creation value offered to them is illusive, has little functionality, is often combined with unethical addiction, the risk of losing some resources, reduced security, or even ordinary fraud. In the actions delivered jointly, there is often no risk analysis, market analysis, environmental analysis, or reliable economic analysis. To maximize the profit of the party initiating co-creation, which often dominates the relationship, there are all possible tricks, strategies, and techniques utilized, including those using trust, naivety, credulity, ignorance, flexibility, or openness to cooperation and changes signaled by the customers. The co-creation path without CSR is therefore definitely an expensive way to co-destruction, which is a slow destruction of the value that was initiated when starting the relationship of cooperation between the partners—cooperation, which in its pure form and due to its essence, should be a “positive sum game”, in which all parties benefit (which confirms the validity of hypothesis H4).

5. Discussion and Conclusions

The results of the research presented in this paper, both in the literature and archival materials, case studies, and empirical desk research with regard to dilemmas and paradoxes related to the competitive advantage of enterprises built on the basis of co-creation in the age of Industry 4.0, show that contemporary enterprises must cope with numerous pressures—both social, and economic. When starting co-creation relationships, due to the specificity of co-development, the importance of solving the related decision-making dilemmas responsibly is critical. Experience and the involvement of co-creation partners in utilizing and developing CSR tools and exercising similar behaviors in business partners currently represents the indicator of the quality of their joint efforts. Information on a permanent lack in at least one of the partners should act as a warning of the potential issues, conflicts, and even pathologies. Therefore, partners in co-creation should be increasingly required to produce reports on their CSR, or other tools identifying their “power of CSR”. In the age of Industry 4.0, when the level of requirements and the pace of accompanying changes, both technological and social, generate and discover new possibilities, often of quick, spectacular profit, it is easy to fall victim to the paradoxical mindset pitfall, which is oriented to short-term, risky, often unethical and socially

irresponsible solutions. In order not to lose customers and profit, and reputation and social trust, which takes years of hard work to develop, it is worth considering the paradoxes that are key to co-creation and approaching their solutions in a conscious way, which can be fostered by reading this paper (see Appendix B—Table A2).

The conducted analyses showed that the research of the above problems is generally quite universal and well known. However, the fact that they are usually conducted without mutual coincidence taken into account should be noted, i.e., the importance of CSR is investigated separately (i.e., [54,55,60,62,137,169]), the problems of cooperation and networking separately (i.e., [13,15,16,18]), aspects of co-creation separately (i.e., [13,27,28,47,137]), paradoxes and/or pathologies separately (i.e., [35,37,39,73,112]), or separately the problems of the importance, requirements, positive sides and threats of Industry 4.0 (i.e., [9,63,89,91,183]). Therefore, the base, developed for the needs of this article, aggregating “the paradoxes and areas of potential pathologies of co-creation in the age of Industry 4.0”, may be considered a certain novelty, contributing to management studies.

When analyzing the individual cases, some common patterns were also observed. It seems that the described pathological cases of co-creation are driven in principle by greed, vanity and herd mentality, understood as “jumping on a bandwagon” of the idea (here, possibilities of IT/ICT, new technologies in the age of Industry 4.0, the uniqueness of the solution, a possibility of a quick, easy profit). Based on the above observations, it is worth recommending that when becoming involved in co-creation, one should observe ethical standards and assumptions of CSR, and require that from the partners and other parties involved. Otherwise, instead of co-creation, the result achieved will be exactly the opposite to that intended, which is co-destruction and condemnation instead of glory.

Despite the interesting results of the pilot studies described above, the authors are aware of their imperfections and limitations.

When analyzing the limitations encountered during the conducted research and analyses, it is worth noting the low number of publicly available breakdowns and institutional reports regarding pathological phenomena related to managing organizations, inter-organizational cooperation networks, or co-development and co-creation processes. As far as good practices, results, and spectacular successes in these areas are much discussed, the sources of pathologies are rarely stigmatized or analyzed. The research conducted here cannot be representative but can only act as a voice in the public discussion and a signal regarding the observed trends.

Besides, drawing conclusions developed from a multiple case study, such as this one, can be problematic. The in-depth analyses used only a few sectors with unique specificities of co-creation relationships. Thus, while the nature of the tensions might differ, the paradoxical mindset, paradoxical practices, and the organizational arrangements discussed within the notion of a “base of paradoxes and areas of potential pathologies” could apply to other contexts (for example, to other branches). Hence, it is fair to claim that the notion of “a base of paradoxes and areas of potential pathologies” presented here may be transferable. The fact that it is based on the structure of the business model allows us to refer it to most organizations in the age of Industry 4.0.

The described cases of pathologies are related to selected, much-publicized projects and solutions that are pathological in their essence. It seems that further research should aim at a more complex research of behaviors of selected companies that are assessed in all areas of their co-creation activities, also in the form of longitudinal studies (extended in time over several years). Research based on longitudinal data from projects would allow for the identification of patterns of decisions over time rather than those just pertaining to single issues.

A significant value, and at the same time a difficult and important research challenge also seems to consist of the quantitative research of the subject scope on a significant research sample, e.g., representative for a given industry or enterprises in a given country.

Considering the above limitations of the conducted study and at the same time treating them as a pilot study for broader quantitative studies, representative studies are planned in the particularly

pathogenic industry sectors identified here, namely, the investment, IT/electronic entertainment, automotive, new technologies, and financial sectors in selected European countries.

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Appendix A When and Why Co-Creation Ends with Joint Destruction

Table A1. When and why co-creation ends with joint destruction. Source: Authors’ own elaboration.

Case of ...	Additional Information
Ant Simulator	Dealing with a fallout among friends is never easy, especially if you are an indie game developer. The rise and fall of Ant Simulator, a 48-h game jam idea that appeared to be blossoming into a full game in 2014, is the perfect example of this. Crowdfunding for Ant Simulator’s development was raised through various channels—one source being the “Ultimate Gamedev Tutorials” Kickstarter that featured the making of the game. However, development would soon come to a close. What happened? According to developer Eric Tereshinski, his business partners were negligent in spending Ant Simulator’s crowdfunded budget. He accused his former business partners and friends of wasting the money on booze and strippers. When Game Informer asked to get their side of the story, they denied the accusations and pointed the blame back to Tereshinski. Regardless of who’s telling the truth, Ant Simulator will never see the light of day.
Zano	Life was good for Zano a few years ago. After blowing past its 2014 Kickstarter funding goal (total amount raised: 3,262,860 USD), the hand-held drone photography device debuted at CES (Consumer Electronics Show) in January 2015. By 2016, a few backers had Zanos in hand, but the undelivered majority were “delayed” as the company claimed to have spent all of its funding and creditors were preparing to liquidate its assets. To add insult to injury, the Zanos that had shipped would become useless, as the gizmo needs to connect to a now-defunct server to operate. The majority of backers might have been left poorer and still drone-less, but Zano quietly reappeared at the CES Drone Rodeo in 2018, where a company called Extreme Fliers announced it had purchased Zano’s assets and IP (Internet Protocol address) during the liquidation and wanted to revive it.
Ouya	Funded by 63,416 Kickstarter backers, this company zoomed well past its \$950,000 goal in 2012 (total amount raised: \$8,596,474). Ouya billed itself as a “new kind of video game console”—a tiny, Android-based console with an open development platform that retailed for only \$99. Despite plenty of hitches along the way—including consoles hitting store shelves before some backers received them—Ouya basically delivered. But a lack of exclusive games, a poorly received controller and an audience devoted to the Xbox 360 and PlayStation 3 meant the Ouya was pretty much dead on arrival. The console’s best-selling game peaked at about 7000 copies and the brand was sold to gaming hardware company Razer for an undisclosed amount in 2015.
Star Citizen	“Star Citizen’s” saga began simply enough. It was to be an epic space adventure video game with a persistent online universe featuring first-person dogfights and an intricate trading ecosystem. The idea was neat enough to raise more than \$2.1 million on a \$500,000 Kickstarter funding goal in 2012, with an estimated delivery date of November 2014 for the final product. Instead of delivering a game, however, developer Chris Roberts continued crowdfunding efforts on the official “Star Citizen” website. Some fans donated \$5, some more than \$15,000. By 2014, Roberts was up to \$35.5 million. Two years later, that figure had fattened to \$104.4 million. As of February 2018, “Star Citizen” has raised more than \$179 million and counting from nearly 2 million donors. Currently in the “Alpha 3.0” stage, Chris Roberts’ game has missed every single release date it has set for itself since 2012. In a way, “Star Citizen” is simultaneously one of the biggest crowdfunding successes and failures of all time.

Table A1. Cont.

Case of ...	Additional Information
Theranos	The promises to develop and patent a modern technology gave the company 724 million dollars. Many fine words were said by Elizabeth Holmes and her associates in all those years when she obtained funds from investors. So, when it turned out that in tests, Theranos's technology worked in only 12 out of 100 cases, many rubbed their eyes in disbelief. The FBI (Federal Bureau of Investigation) wrote that Elizabeth Holmes become involved in a multi-million-dollar project in order to deceive investors, doctors, and patients. What is particularly important is that the public prosecutors investigating the case accused Holmes of encouraged customers to use blood tests from Theranos, although she perfectly realized that they were inaccurate and unreliable, and therefore they threatened their health and life. Could anyone imagine a more unethical and socially irresponsible business idea? This is highly doubtful.
Jennifer Cataldo's Cancer Scam	Some crowdfunding failures get a mark of shame for being predatory scams disguised as genuine philanthropic efforts. This is Jennifer Flynn Cataldo's story. In 2016, this Alabama woman lied about having terminal cancer in an attempt to scam GoFundMe donors out of more than \$38,000. Thankfully, Cataldo's racket was exposed, the money was refunded, and she was charged with two counts of first-degree theft by deception that same year.
Steam Platform	Some examples of how user engagement can extend the lifecycle of a product is the Steam Workshop operating within the Steam (see http://steamcommunity.com/workshop). This application allows the community to prepare custom modifications and extensions to games/programs/applications available on the Steam platform. Unfortunately, there is very limited control on who and what content uploads ... and that is the main reason why some addons may corrupt the original product—on purpose or accidentally. Let us take into account X:COM 2 PC game. From the moment of its launch in 2016, through the platform, each of the game owners can install as add-ons to the original version more than 4800 various modifications changing to varying degrees the gameplay and players' experience. There is no way that after installing even let us say 5% of them the game would be still be functional without the risk of crashes.
Pokemon Go	Ruslan Sokolovsky originally uploaded a video of himself catching Pokémon in the Church of All Saints in Yekaterinburg at the beginning of August, when Pokémon frenzy was in full swing. At least a few of the video's 1 million views likely came from the authorities: Sokolovsky is currently being detained for two months, charged with inciting hatred and offending religious sensibilities, and could be sent to prison for up to five years. There is nothing like taking a Pokémon GO break to kill some time, at least if you are a member of the Ukrainian army on the front lines. A clip of two soldiers using the app on their smartphones while two others kept watch with machine guns went viral after it was filmed near the city of Dokuchaevsk in Eastern Ukraine. Rare Pokémon, including Pikachu, were alleged to be present. Pokémon-related injuries have been piling up worldwide, with players falling off cliffs, crashing cars into schools, and getting shot. Meanwhile, in Bosnia, Pokémon hunters have been wandering into minefields. An estimated 120,000 active mines leftover from conflict in the 1990s are still scattered throughout the nation, and after reports of players proceeding into no-go zones, a demining charity in Bosnia felt it necessary to issue a warning lest some promising Pokémon-catching careers reach an explosive end.
Kaspersky's antivirus program	Everyone should be aware that for each antivirus program with integrated "silent detection" mechanism, the only defense against downloading any file from the user's drive by the antivirus is the ethics of its producer. It all seems that in the case of Kaspersky this ethics was lacking, and someone used the "silent detection" mechanism to search millions of computers on which Kaspersky was installed, not only for samples of malware, but also other files. The founder of Kaspersky, Yevgeny Kaspersky strongly denies cooperation with any government with regard to stealing data from his customers. But many security experts, despite their sympathy and respect, do not believe those assurances. As they say, it is beyond belief that Kaspersky would not have a premonition of what was going on. Because as the boss of the company, who himself worked for the Russian services, could he not know that GRU or FSB (Main Directorate of the General Staff of the Armed Forces of the Russian Federation and Federal Security Service of the Russian Federation) would want to have access to the data that Kaspersky's antivirus program, installed in hundreds of millions of computers, can access? This is doubtful.

Appendix B Co-Creation as an Example of Managerial Paradox of the Age of Industry 4.0

Table A2. Co-creation as an example of a managerial paradox of the age of Industry 4.0. Source: Authors' own elaboration.

Business Model Elements	Paradoxes of co-creation	Dilemmas of co-creation: A <i>versus</i> B {a given orientation was observed in the described cases}				Potential Pathologies
		CLASSIC APPROACH		APPROACH CONSISTENT WITH INDUSTRY 4.0		
KEY ONES	I. Configuring business relationships	1. Paradox of responsibility	Orientation to profit {1,2,3,4,5,6,8,9,10,11,12,13,14}	vs.	Orientation to social responsibility {7}	PARADOXICAL MINDSET: THE LACK OF THE CORPORATE SOCIAL RESPONSIBILITY 1. Destroying the natural environment 2. Exploitation of employees, partners, product quality fails to match the price. Exploitation of partners (customers). Bribing, cronyism, cliques, clans, mafias No responsibility for mistakes made. Multi-national teams with issues in communication and delivery of operating tasks. Unprofitable products, non-functional. Rewarding inefficiency, blocking implementation of changes, diversion, negation, negative campaigning.
		2. Paradox of orientation	Our goals are more important {1,2,3,4,5,6,7,9,11,12,13,14}	vs.	Partner’s (customer’s) goals are more important {8,10}	
		3. Paradox of architecture (structure)	Hard architecture ¹ {1,3,4,5,9,10,11,12,13}	vs.	Soft architecture ² {1,6,7,8,14}	
		4. Paradox of identification	Individual identity {5,7,8,11}	vs.	Collective identity {1,2,3,4,6,9,10,12,13,14}	
		5. Paradox of diversity	Consistency of the team {5,7,9, 11,12,13}	vs.	Diversity (e.g. cultural) of the team {1,2,3,4,6,8,10,14}	
	II. Configuring competencies	1. Paradox of a project team	Experienced, homogeneous teams {5,6,7,9,10,11,12,13}	vs.	Creative teams {1,2,3,4,8,14}	
		2. Young-old paradox	Experience, knowledge, resistance to change {6,9,13}	vs.	Learning, searching, originality, innovation {1,2,3,4,5,7,8,10,11,12,14}	

Table A2. Cont.

Business Model Elements	Paradoxes of co-creation	Dilemmas of co-creation: A versus B {a given orientation was observed in the described cases}			Potential Pathologies
		CLASSIC APPROACH		APPROACH CONSISTENT WITH INDUSTRY 4.0	
III. Configuration of resources	1. Paradox of a product	Functionality {6,8,9,11,12,13}	vs.	Technological innovativeness {1,2,3,4,5,7,10,14}	Duping, cheating customers, lack of functionality and uneconomical character of strongly promoted products.
		Cost of operation {5,6,7,9,11,12,13,14}	vs.	Aesthetic values {1,2,3,4,8,10}	
	2. Paradox of an art sponsor	Low budget and various types of limitations from the customer {3,6,11}	vs.	The customer requires modern, innovative, original solutions {1,2,4,5,7,8,9,10,12,13,14}	Apparent improvements
	3. Paradox of resources in alliances	Eroding distinctive resources (sources of competitive advantage) {1,3,5,9,11}	vs.	Synergy, complementary resources of partners, co-creating value {2,4,6,7,8,10,12,13,14}	Mergers, hostile takeovers
PERIPHERAL IV. Concept of communication	1. Paradox of a customer	Results of marketing research {2,3,4,5,9}	vs.	Taste of an individual customer {1,6,7,8,10,11,12,13,14}	Introducing unnecessary products to the market.
	2. Paradox of communication	Customer expectations expressed clearly {1,2,3,5,7,8,9,13}	vs.	Dreamed, hidden expectations of the customer {4,6,10,11,12,14}	Use of devices for tracking/monitoring customers' purchasing decisions.

Table A2. Cont.

Business Model Elements	Paradoxes of co-creation	Dilemmas of co-creation: A versus B {a given orientation was observed in the described cases}			Potential Pathologies
		CLASSIC APPROACH		APPROACH CONSISTENT WITH INDUSTRY 4.0	
PERIPHERAL	V. Concept of cooperation	1. Paradox of co-creation		Company delivers an order {1,2,3,4,5,9}	PARADOXICAL MINDSET: THE LACK OF THE CORPORATE SOCIAL RESPONSIBILITY Specially favourable treatment of some customer groups, favouring. Conflicts, bullying, stress generation, time pressure, results pressure. Difficulties pursuing business claims. Collusion between industry leaders. Still rules of cooperation, extensive set of duties, penalties, constraints, exclusions, etc.
		2. Paradox of a hangman	vs.	Customer actively delivers project work {6,7,8,10,11,12,13,14}	
		3. Paradox of effectiveness	vs.	Creative freedom {1,4,6,7,8,9,10,11,12,14}	
		4. Paradox of cooperation	vs.	Many small, agile teams {1,2,3,4,5,6,7,8,12,13,14}	
	VI. Concept of coordination	1. Paradox of diversity	vs.	Cooperation {1,2,4,6,7,8,10,13,14}	Failure to keep the quality and deadlines for orders. Bullying, remuneration inadequate to involvement.
		2. Paradox of controlling creativity	vs.	Freedom of acting {1,2,3,4,5,6,7,8,9,10,14}	
		3. Paradox of motivating	vs.	Control (making sure tasks are delivered as planned) {5,7,9,11,12,13,14}	
				Negative motivation (punishment) {13}	

Table A2. Cont.

Business Model Elements	Paradoxes of co-creation	Dilemmas of co-creation: A versus B {a given orientation was observed in the described cases}			Potential Pathologies
		CLASSIC APPROACH		APPROACH CONSISTENT WITH INDUSTRY 4.0	
VII. Concept of growth	1. Paradox of goals	Long-term goals {3,4,5,7,9,10,11,12,13,14}	vs.	Short-term goals {1,2,6,8}	Conflicts between the partners, no effective development strategy, wasting the assets of the company and equity of its shareholders / stockholders.
		Orientation to financial profit {1,3,5,6,9,10,11,13,14}	vs.	Orientation to quality {2,4,7,8,12}	
		Timeliness {6,9,13}	vs.	Product innovativeness {1,2,3,4,5,7,8,10,11,12,14}	
	2. Paradox of flexibility	Reduced operating flexibility {11,12}	vs.	Increased involvement in the cooperation {1,2,3,4,5,6,7,8,9,10,13,14}	Dependency on the partner.
	3. Paradox of standardised management processes	Methodologies, routines, procedures, rules of conduct {1,5,6,13}	vs.	Improving methodologies, routines, procedures, rules of conduct {2,3,4,7,8,9,10,11,12,14}	Constant changes of rules and terms of cooperation
	4. Paradox of globalisation	Local areas of action	vs.	Global areas of action {1,2,3,4,5,6,7,8,9,10,11,12,13,14}	Product too standardised, with limited usability.
	5. Paradox of openness	Limiting the risk of actions (security) {12,13}	vs.	Entering pioneer areas (uniqueness) {1,2,3,4,5,6,7,8,9,10,11,14}	High infiltration of business partners, prohibitively high entry requirements to cooperation network.
	VIII. Configuration of competencies	The customer requires meeting classic, obsolete rules (known motives, routines) {6,9,13}	vs.	The customer expresses expectations of new, original solutions {1,2,3,4,5,7,8,10,11,12,14}	Apparent improvements, bizarre, non-functional, uneconomical products.
					Uncertainty of the quality and deadlines for the deliverable.
	2. Paradox of distance	Routing actions {6,9,13}	vs.	Creative actions {1,2,3,4,5,7,8,10,11,12,14}	

Table A2. Cont.

Business Model Elements	Paradoxes of co-creation	Dilemmas of co-creation: A versus B {a given orientation was observed in the described cases}			Potential Pathologies
		CLASSIC APPROACH		APPROACH CONSISTENT WITH INDUSTRY 4.0	
PERIPHERAL	IX. Storing value	1. Paradox of learning and knowledge management		Work in standing teams (sedimentation of knowledge) {9,11,12,13}	
			vs.	Wok in project teams (after the team is dissolved, the knowledge disperses, dissapears) {1,2,3,4,5,6,7,8,10,14}	No persons responsible for the quality of the order's delivery.
		1. Paradox of organisational ambidexterity		Utilisation of the experience acquired {5,6,7,8,9,10,11,12,13,14}	
			vs.	Exploring new areas {1,2,3,4}	Constant chase of novelties, product innovations, lack of proper after-sales service for the existing product range.
	X. System for providing value	2. Paradox of productiveness and creativity		Economic results {1,3,5,6,9,10,11,13,14}	
			vs.	Constant innovation {2,4,7,8,12}	Short product life.
		3. Paradox of conception and consumption		Professional management {5,9,10,11,12,13,14}	
			vs.	Autonomy, independence of the creators, managing results independently {1,2,3,4,6,7,8}	Exploiting creators, non-observance of copyrights, plagiarism, unpunished copying.
		4. Paradox of consistency		Individual initiatives, passion from the employees {4,6,7,8,11}	
			vs.	Joint vision (e.g. for a product), financial targets for the organisation {1,2,3,5,9,10,12,13,14}	Exploiting creators.

¹ Formal project teams function. ² Informal relationships apply, so-called a community of practitioners.

Appendix C Gaps in CSR as the Source of Co-Creation Pathology in the Analyzed Case Studies

Table A3. Gaps in CSR as the source of co-creation pathology in the analyzed case studies. Source: Authors' own elaboration.

	#	Name	Observed CSR Gaps	
<i>Investment industry</i>	1	Ant Simulator	1.	Inefficiency and wastefulness
			2.	No effective and responsible management
			3.	No feeling of responsibility for the word given and promises made
			4.	No respect to stakeholders
			5.	Dishonesty to partners, customers, and other stakeholders
	2	Zano	1.	No risk analysis
			2.	Inefficiency
			3.	Dishonesty to partners, customers, and other stakeholders
			4.	No feeling of responsibility for the word given and promises made
			5.	Short-sightedness = undeveloped product – useless when the company went bankrupt (turning off the server made controlling drones impossible)
	3	Ouya	1.	No risk analysis
			2.	No respect to partners / investors and their interests
			3.	Short-sightedness = difficulties with achieving the economies of scale (problems with starting the mass production)
			4.	Short-sightedness = undeveloped product – little applications or programs compatible with the product
			5.	Following the fashion and opportunism
			6.	Breaking rules, obligations, principles – no ethics, misleading and irresponsible marketing
			7.	No effective / responsible management.
	4	Star Citizen	1.	Changing goals and rules during the game (endless extension of the concept for the product under development)
			2.	No restraint, irresponsible visionariness
			3.	No feeling of responsibility for the word given and promises made
			4.	Extending the deadlines, untimeliness
			5.	Following the fashion and opportunism
			6.	Making customers dependent
	5	Theranos	1.	Desire to make a profit at all costs (even at the cost of human health and life)
			2.	No ethics, using a lie,
			3.	Dishonesty to partners, customers, and other stakeholders
			4.	Falsifying results, no reliable tests and using unreliable experts
			5.	Intentional and aware misleading – hypocrisy,
			6.	No transparency, camouflaging actions
	6	Cataldo's Cancer Scam	1.	Preying on human emotions, using a lie
			2.	Unethical conduct
			3.	Desire to make a profit at all costs
			4.	No feeling of responsibility for the word given and promises made

Table A3. Cont.

	#	Name	Observed CSR Gaps
<i>IT industry – digitised products</i>	7	Software created using open licenses e.g. Linux	<ol style="list-style-type: none"> 1. Dedicating the product to a specific purpose – high specialisation at the cost of limited functionality 2. Complexity of the product – understood to experts only (product exceedingly specialised) 3. Extreme diversity and incompatibility of the individual version of the program – making chaos
	8	Steam platforms	<ol style="list-style-type: none"> 1. Extreme diversity and incompatibility of add-ons to the original product, 2. Limited transparency of actions and their discretionary character 3. Too much freedom for co-creators, limited control (risk of copyright violations, etc.) 4. Artificial “improving attractiveness / embellishment” of the product, 5. Insistent (sometimes pointless, unjustified) prolonging of the product’s life cycle
<i>Automotive industry</i>	9	Dieselpgate	<ol style="list-style-type: none"> 1. Unethical conduct and lack of responsibility and/or care for the natural environment (negative impact on the environment, breaking environmental standards) 2. Orientation to profit and misleading the stakeholders intentionally 3. Short-sightedness = lack of thinking about the consequences of such conduct, both for the organisation (“what happens when this comes out”), and stakeholders (“how long can we keep this secret / cheat”) 4. Self-apology and no remorse (error in software, error in engine, ... others did that too, this is not so harmful as experts and the media say...)
<i>Modern technologies - VR & AR</i>	10	Pokémon Go	<ol style="list-style-type: none"> 1. No assessment of the social risk and the social harm of the product 2. Unethical, too far-reaching gamification (getting the customer into the habit too strongly) 3. No mechanisms to ensure the product is safe for health and life 4. No limitations in the product’s availability (e.g. Products for 16+ persons) 5. Exploiting the customer’s naivety, unethical shaping of the customer’s needs

Table A3. Cont.

#	Name	Observed CSR Gaps
11	Pokemon Go	<ol style="list-style-type: none"> 1. No assessment of the social risk and the social harm of the product, 2. Unethical, too far-reaching gamification (getting the customer into the habit too strongly) 3. No limitations in the product's availability (e.g. Products for 16+ persons) 4. Exploiting the customer's naivety, unethical shaping of the customer's needs 5. Embedding a mechanism that allows excess control / tracking of the user 6. Embedding a mechanism that allows to take over control over the user's device and a possibility of involving him/her in espionage activities
<i>Cybersecurity</i>		
12	Kaspersky Anti-Virus	<ol style="list-style-type: none"> 1. Embedding a mechanism that allows to use the product inconsistently with the declared purpose and a possibility of involving the user in espionage activities 2. Embedding a mechanism that allows to automatically download private data from the user's devices without his/her knowledge, and sometimes even without his/her consent 3. Exploiting the customer's naivety, unethical shaping of the customer's needs 4. Readiness to unethically use the information obtained from the client 5. Lack of care to provide really strong security features, making it difficult to use the software for purposes other than declared (assuming Kaspersky was really unaware of what was happening...)
13	Financial pyramid schemes	<ol style="list-style-type: none"> 1. Preying on credulity, naivety, lack of knowledge – misleading customers 2. Desire to make a profit at all costs 3. No assessment of the social risk and the social harm 4. No transparency, camouflaging actions, cheating, falseness, irresponsible marketing 5. Readiness to falsify the results, using untruth 6. Readiness to break the law in a conscious way
<i>Finance and the currency of the future</i>		
14	Blockchain & Cryptocurrency	<ol style="list-style-type: none"> 1. Preying on credulity, naivety, lack of knowledge – misleading customers 2. Desire to make a profit at all costs, speculation, excess risk-taking, 3. No assessment of the social risk and the social harm 4. Lack of care for the natural environment (causing an uneconomical use of natural resources) 5. Misleading and irresponsible marketing 6. No transparency, camouflaging actions

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