

Biodiversity management approaches in small and innovative businesses: insights from a *systems thinking* perspective

Riccardo Torelli and Federica Balluchi

Abstract

Purpose – Amid the current global crisis, biodiversity remains a topic that is often relegated to a few disciplines. Many issues related to the relationship between organizations and the ecosystem remain unexplored. This study aims to fill this gap by examining the characteristics of the interrelationship between these two complex and dynamic systems.

Design/methodology/approach – This research is conducted using a constructivist approach, with an interpretivist perspective and a case study methodology. Through this research perspective and an exploratory multiple case study (holistic), the authors assess the implications related to the concept of biodiversity and the impacts that organizational choices could have on the consideration and management of this complex concept.

Findings – The desire of these entrepreneurs to change their ways of doing things and try to produce in a way that respects the ecosystem and enhances natural genetic diversity, while simultaneously drawing value from it in a healthy and sustainable manner, is evident. The orientation toward a sustainable and ecologically innovative business brings the concept of profit into the background on several occasions, leading these bakery entrepreneurs to be visionary green entrepreneurs (or ecopreneurs). The desire to be sustainable and to change the ways of “business as usual” makes these companies and their entrepreneurs an example of “sustainability-as-flourishing.”

Originality/value – By adopting the systems thinking approach and multiple case studies, this study examines the interrelation between some innovative small companies (bakeries) and biodiversity, their motivations to actively engage in biodiversity protection and their roles in protecting agrobiodiversity as well as the natural wealth of the ecosystem.

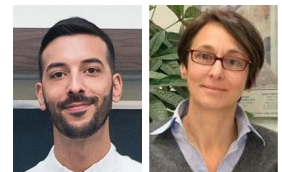
Keywords Systems thinking, Ecosystem, Biodiversity, Agrobiodiversity, Case study

Paper type Research paper

Responsibility is the care for another being when it is recognized as a duty, becoming “apprehension” if the vulnerability of that being is threatened. But fear is already potentially encapsulated in the original question from which it can be imagined that any active responsibility arises: what will happen to that being if I do not take care of it? The darker the answer, the sharper the responsibility (Jonas, 1979).

Introduction

Biodiversity is defined as “all the different kinds of life you will find in one area—the variety of animals, plants, fungi, and even microorganisms like bacteria that make up our natural world” (World Wildlife Fund, 2020) or “the variability among living organisms from all sources including, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part” (United Nation, 1992, art. 2). The importance of biodiversity depends on the ethical approach that underlies its definition. From an



Riccardo Torelli is based at the Department of Economic and Social Sciences, Università Cattolica del Sacro Cuore, Piacenza, Italy. Federica Balluchi is based at the Department of Economics and Management, University of Parma, Parma, Italy.

Received 4 March 2022
Revised 25 July 2022
Accepted 5 September 2022

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anthropocentric perspective, biodiversity protection should be undertaken only if it is useful to humans (Kant, 1963; Brian, 1984; Grey, 1993; Hayward, 1997; Kopnina *et al.*, 2018). According to the biocentrism standpoint, there are no hierarchical differences between beings in the universe and humans are only one type of being (Schweitzer, 1923). Based on this viewpoint, all beings have an intrinsic value and humans are admonished to respect all other forms of life, including nonhumans and the natural world. According to the ecocentrism approach, humans must preserve ecosystems and living species through sustainable development, and the ecosphere and biosphere play a central role in this regard (Leopold, 1949). From a deep ecology perspective, human work should not threaten diversity, except for reasons related to vital needs (Naess, 1973; Devall, 1980; Devall and Sessions, 1985; Tobias, 1985). A final ethical approach to biodiversity is cosmocentrism – the value system of which is centered on the cosmos as a whole, and the planet has supreme value (Lupisella, 2009; McLaughlin, 2013).

Regardless of the ethical approach adopted in analyzing the concept of biodiversity, there is now awareness of the imperative need to respect the natural boundaries of the planet and to change our conception of the natural world and the human–nature relationship before the situation becomes irredeemable (Jones and Solomon, 2013). Notwithstanding the abundance of sustainability policies and virtuous behaviors, humanity continues to have a negative impact on the planet. To minimize these impacts, the United Nations developed 17 Sustainable Development Goals (SDGs), and biodiversity affects at least 14 of these SDGs [1]. Goal 15 (Life on Land) focuses on the biodiversity theme, while Goal 9 emphasizes the protection of ecosystems and their biodiversity [2]. One of the main effects of the loss of biodiversity is the decline in the number of animal and plant species (Cuckston, 2013), and the repercussions are plentiful because biodiversity is fundamental for primary resources, such as food production, drugs and clothes, as well as for maintaining the balance of natural habitats and “ecosystems” (Jones, 2003; Jones and Solomon, 2013).

An ecosystem is “a natural unit consisting of all the plants, animals and microorganisms (biotic) factors [...] interacting with all of the nonliving physical and chemical (abiotic) factors of this environment” (Levin, 2009, p. 779). Rockström *et al.* (2009, p. 474) introduce the concept of planetary boundaries related to ecosystem limits as follows: “climate change; rate of biodiversity loss (terrestrial and marine); interference with the nitrogen and phosphorus cycles; stratospheric ozone depletion; ocean acidification; global freshwater use; change in land use; chemical pollution; and atmospheric aerosol loading.” Biodiversity loss is one of the three Earth processes in which boundaries have already been transgressed. In addition, the interdependence between boundaries facilitates the transgression to other boundaries if one of them (in our case, the biodiversity loss rate) is exceeded. Rockström *et al.* (2009, p. 474) regard planetary boundaries as “biophysical preconditions for human development,” indicating that these ecosystem limits are indispensable *vis-à-vis* sustainable development. Biodiversity loss, a natural and unavoidable process, is an urgent problem (and challenge) for humanity, and it is currently occurring at an alarming rate. Rockström *et al.* (2009) state that “the rate of extinction of species is estimated to be 100 to 1,000 times more than what could be considered natural,” thus underlying the impact (among others) of the conversion of natural land into farmland as well as the introduction of new species to land environments. Biodiversity loss also affects the “operativeness” and resilience of ecosystems “since it reduces the capacity of ecosystems to regenerate or reorganize after a perturbation, while a high level of biodiversity can buffer and help revitalize the system without irreversibly tipping it into an undesirable state” (Jacob *et al.*, 2021; Winn and Pogutz, 2013, p. 215).

Within the broad concept of biodiversity, agrobiodiversity [3] is crucial and has several direct implications for environmental health, food production, soil poisoning, human health and nutrition. Industrial and chemical farming methods (including the related food production incentives of monocultures and cash crops) contribute to the loss of agrobiodiversity (Lanka *et al.*, 2017).

Irrespective of the global warnings and relative interest in biodiversity by scientific disciplines, management scholars have not systematically or consistently focused on its study, particularly regarding the impact of business practices on the protection and promotion of biodiversity (Cuckston, 2018a; Feger and Mermet, 2022; Schaefer *et al.*, 2015; Whiteman, 2013; Williams *et al.*, 2017; Winn and Pogutz, 2013). Thus, this study aims to fill this gap in the management literature (Cuckston, 2018a; Williams *et al.*, 2017; Winn and Pogutz, 2013) by focusing on the dynamics between organizations and ecosystems based on a systems thinking approach. This holistic study on biodiversity can also provide further insights into our understanding and management of the interrelationships between two dynamic systems, such as economic organizations and the natural ecosystem (Davila *et al.*, 2021).

We conduct multiple case studies on four innovative and sustainable small businesses operating in the bakery industry. Bakeries represent an intermediate step in the specific supply chain of bread and its derivatives, and they can provide insights into the choices of and impacts on farmers and consumers, as they play a key role in agrobiodiversity.

This study analyzes the main motivations behind organization owners' commitment to the protection of biodiversity and respect for the ecosystem. We believe that such behavior can be analyzed via the systems thinking approach. The results show the important role that small companies play in effectively promoting a sustainable relationship with the environment with a view toward realizing sustainable development.

The remainder of this paper is organized as follows: the first section offers a literature review on corporate biodiversity management. The second section introduces and analyzes the systems thinking approach and its strengths. The third section presents the three research questions, and the fourth section discusses the methodology. The fifth section briefly describes the reference context and analyzes the main characteristics of the business cases. The sixth section presents and discusses the results, and the seventh section concludes by outlining the contributions, future research directions and limitations of the study.

Literature review

Over the past two decades, the subject of biodiversity has become particularly relevant to companies, and the broad concept of sustainability and environmental friendliness or consciousness now forms a part of many businesses in different industries and countries (Overbeek *et al.*, 2013; Winn and Pogutz, 2013; Boiral and Heras-Saizarbitoria, 2017; Smith, *et al.*, 2020). Many organizations integrate these concepts into their visions, missions and strategies (Marcus and Fremeth, 2009; Nidumolu *et al.*, 2009) for various reasons. These rationales can include the recognition of their strategic dependencies on the quantity and quality of the goods and services provided by ecosystems, consideration of reputational risks, a desire to be different and gain a competitive advantage and an attempt to reach a specific category of customers and/or stakeholders (Delmas and Toffel, 2008; Ramus and Montiel, 2005; Schaltegger and Beständig, 2010; Winn and Pogutz, 2013). Nevertheless, the ethical vision of the entrepreneur with respect to nature plays a fundamental role in companies that are particularly attentive to biodiversity (Kearins *et al.*, 2010) and the concept of entrepreneurship as an indispensable source for the creation of social and environmental value (Schaefer *et al.*, 2015).

Corporate awareness of the presently pressing need to protect the environment and its biodiversity has been accompanied by the progressive and systematic development of management studies on this subject over the past two decades. The perspectives of analysis against which these contributions can be grouped are mainly two: one concerns the issues related to reporting/measuring biodiversity and the other perspective of study relates to the issue of biodiversity management [4].

With reference to the accounting perspective, there are now many published scientific contributions, which particularly focuses on the problem of biodiversity assessment and its subsequent reporting. Jones's works in 1996 (Jones, 1996) and later in 2003 (Jones, 2003) represent the first approach to uncovering the accounting–biodiversity relationship in an attempt to operationalize the reporting of corporate natural assets (flora and fauna) through a natural inventory model. Ten years later, the problem of biodiversity assessment and its subsequent reporting emerged in several studies (Cuckston, 2013; Groom and Freeman, 2013; Jones and Solomon, 2013; Rimmel and Jonäll, 2013; Siddiqui, 2013; Tregidga, 2013; van Liempd and Busch, 2013; Samkin *et al.*, 2014). Overall, they represent the first major attempt to assess biodiversity and incorporate it into the current accounting and reporting models. Other studies on biodiversity in the field of business economics and accounting were conducted in 2017, proposing new forms of ecology-centered accounting and reporting practices for biodiversity conservation and promotion (Adler *et al.*, 2017; Cuckston, 2017; Feger and Mermet, 2017; Ferreira, 2017; Gaia and Jones, 2017; Lanka *et al.*, 2017; Russell *et al.*, 2017), and in 2018, when there was an attempt to provide new forms of extinction accounting and accountability frameworks and to investigate the current experiences of extinction disclosure (Adler *et al.*, 2018; Atkins and Maroun, 2018; Cuckston, 2018b; Gray and Milne, 2018). Overall, there has been a succession of more or less in-depth attempts to integrate the concept of biodiversity with all its aspects into existing mechanisms and frameworks for socioenvironmental assessment and reporting, thereby indicating the importance of this concept. Hence, it must be considered in economic and financial assessments. However, the concept inevitably clashes with many problems owing to its intrinsic characteristics, which are difficult to determine, different to assess and rather challenging to identify in the operational reality, ethical–philosophical assessments and strong interrelationships with other socioenvironmental aspects. In this sense, some studies critically examine the concept of biodiversity and its link with accounting and invite researchers to focus less on the current attempts to include biodiversity in existing accounting schemes but more on the potential of accounting in ongoing efforts to preserve biodiversity (Gray and Milne, 2018; Cuckston, 2018a, Addison *et al.*, 2020). Finally, recent studies have analyzed the tools available to companies to monitor and assess the biodiversity performance of their products and found shortcomings in the criteria for biodiversity or that the criteria are weak in certification and standards as well as corporate accounting and reporting systems (Beck-O'Brien and Bringezu, 2021). These studies have also revealed a significant gap in the corporate responsibility reporting on biodiversity impacts and environmental restoration, thereby highlighting the need to restructure and incentivize the reporting on environmental risks and biodiversity (Bohnett *et al.*, 2022). Furthermore, these recent studies investigate the extent to which organizations account for responsibility for biodiversity; thus, highlighting responsibility with respect to species extinction is essential in postCOVID-19 reporting, as the lack of valorization, promotion and investment in biodiversity is considered to be one of the main causes of the COVID-19 crisis (Hassan *et al.*, 2022).

With reference to the strand of studies on biodiversity dedicated to management issues, the main aspects analyzed concern the role of companies in biodiversity conservation and how this can influence the behavior of companies and their strategic and operational decisions. In particular, some authors have demonstrated the importance of biodiversity conservation by using companies of various sizes in different industries (Schaltegger and Beständig, 2010). Others stress the need to find the right balance between biodiversity protection and economic interests. The balance they claim is conditioned by an indispensable process of stakeholder engagement by companies, government agencies, scholars, nongovernmental organizations, experts and universities and other stakeholders, and these demonstrate that intensive stakeholder engagement is the basis for biodiversity management initiatives (Reade *et al.*, 2014; Boiral and Heras-Saizarbitoria, 2017; Boiral *et al.*, 2019; de Silva *et al.*, 2019; Thompson, 2019; Krause *et al.*, 2021). Some scholars have proposed a link between

the concepts of biodiversity, ecosystems and ecosystem services and ecological resilience and the management of companies, thus deepening the implications for management theory and practice and offering food for thought for future research (Winn and Pogutz, 2013). Finally, other studies focus on the characteristics and nature of the corporate governance body, trying to verify whether and how gender diversity in board composition influences biodiversity management initiatives (Carvajal *et al.*, 2022) and how the different roles of business within the economic system (“change makers” as government agencies, nonprofit organizations and businesses) can influence the approach to the biodiversity problem (Quarshie, 2021).

An interesting perspective on the managerial issues of biodiversity is based on a systemic approach to social, ecological and economic issues. Some authors argue that a systemic and multidisciplinary study perspective can facilitate the understanding of the interconnectivity between economic, political, social and ecological issues from a spatial and temporal perspective (Williams *et al.*, 2017), whereas others argue that a necessary condition for biodiversity management is a general systematic view in which humans situate themselves in relation to their environment (Perey and Benn, 2015).

The main objective is to improve and preserve nature through an understanding of its relations and links with businesses and organizations. Winn and Pogutz (2013) document key questions, including:

- Q1. To what degree has our discipline been able to provide useful lenses to analyze the transformations in our society?
- Q2. Are we providing the interpretative frameworks capable of favoring or supporting the conservation of our fragile ecosystems?

These key issues encourage scholars and organizations’ managers to consider natural challenges as part of the problems and responsibilities of stakeholders in the future. Gray (2010) suggests that sustainability in socioecological systems is the result of an organization’s actions and outcomes (as well as institutions, society and individuals), but the focus of this study does not consider the role of feedback in systemic interdependency (Williams *et al.*, 2017). Considering that the transformation of the natural ecosystem affects organizations and other socioeconomic factors, scholars should focus on both the environmental system and socioeconomic factors (Winn and Pogutz, 2013). Biodiversity is a part of the broad socioecological system; therefore, it is worth exploring further (Whiteman *et al.*, 2013).

Systems thinking approach

Systems thinking is increasingly being used to understand sustainability issues in management (even if peripherally so in mainstream organizational journals), yet merely a few studies focus on the relevant “interconnections across multi-level, nested social-ecological systems” (Williams *et al.*, 2017, p. 34). Williams *et al.* argue that a systemic and multidisciplinary study perspective can help understand the interconnectivity between economic, political, social and ecological issues from a spatial and temporal perspective. Their argument is based on an analysis of the literature on *systems thinking* and sustainability management from 1990 to 2015 (96 articles). The authors also identify several interesting research opportunities in the field of management that are based on a systemic study approach to social, ecological and economic issues, regarding them as interdependent. We believe that the systems thinking approach can contribute to the understanding of corporate biodiversity management issues.

The concept of system has been outlined by the German philosopher Hans Jonas (1903–1993), who considers human beings and their actions or thinking from a philosophical perspective; this system is a precursor of the concept of sustainable development and sustainability. In his 1979 work “Das Prinzip Verantwortung” (The Principle of Responsibility), he calls upon each human

being to act, “[. . .]so that the consequences of your action are compatible with the permanence of authentic human life on Earth,” contemplating the fact that human beings are only a part of a wider system that is not limited to their actions toward others (human, natural or otherwise). In his work, which reformulates the concept of ethics (and bioethics), [Jonas \(1979\)](#) recognizes the fundamental necessity of the existence of a natural environment capable of allowing not only the biological continuity of people in the world but also an ecological quality capable of preserving the genetic heritage inherited from millions of years of life on our planet. It is precisely in this logic that the importance of the concept of responsibility – and of not acting as an “irresistibly unleashed Prometheus” ([Jonas, 1979](#)) – is born. Following this logic, people should not consider nature as a trivial fund of resources from which to draw and exploit, as described by Heidegger ([Zimmerman, 1990](#)), but instead should be respectful of their impact on nature without undermining existing limits and current natural wealth ([Rockström et al., 2009](#)).

In the analysis of a dynamic and complex set of relations, such as that between businesses (as a company activity) and the natural ecosystem, the choice of a useful and suitable theoretical framework is crucial. In this context, to study and understand a transforming concept, such as sustainability and the related macroissue of biodiversity preservation, a system perspective appears to be a good choice. The systems thinking approach ([Williams et al., 2017](#) for a systematic review) allows us to highlight and correctly consider the core concepts surrounding this type of dynamic state. In particular, the socioecological system perspective guides us in recognizing the interconnection and relationships between business and nature, considering them as embedded in a wider (but defined and limited) natural system ([Davila et al., 2021](#); [Marcus et al., 2010](#); [Whiteman et al., 2013](#)). Business stakeholders and socioecological systems are dynamically and strongly interconnected and linked by a complex set of reciprocal feedback ([Folke et al., 2002](#); [Winn and Pogutz, 2013](#)).

[Williams et al. \(2017\)](#) highlights five main theoretical concepts related to systems thinking as applied in the sustainability field: interconnection, feedback loop, adaptive capacity, emergence and self-organization. Understanding the actual and potential interconnections between the actors and the entire network leads not only to a better organization and improved company management (in particular, regarding strategy, resource use and allocation and decision-making) but also to greater sustainability, especially in a medium-/long-time horizon ([Kunz et al., 2013b](#); [Metcalf and Benn, 2013](#); [Valente, 2012](#)). These positive effects could be reached only if the actors (in particular, the company and its managers) pay the right attention and are willing to note the feedback provided by the ecosystem network. The external environment can communicate and react to stimuli created by active system actors, and it is necessary to listen to these communications to manage system behavior and correctly choose the next decisions and actions ([Allenby, 2009](#); [Starik and Kanashiro, 2013](#); [Serman, 2001](#); [Winn et al., 2011](#)). Directly connected with the system feedback between the ecosystem network actors is their adaptive capacity, characterized by the ability to change, innovate, adapt and improve in response to the evolution of the dynamic macrosystem ([Beermann, 2011](#); [Ferreira et al., 2006](#); [Serman, 2001](#); [Valente, 2010](#)). Thus, the emergence of new and sustainability-oriented patterns can lead to a better problem-solving and decision-making approaches ([Dougherty and Dunne, 2011](#); [Kunz et al., 2013a](#); [Rotmans and Loorbach, 2009](#)) when there is self-organization ability ([Batten, 2009](#)). This is probably the last step in a chronological and logical order: if a business actor pays attention to the interconnections in the network, it can listen to and consider the feedback flow, reach a dynamic adaptive capacity and permit the emergence of new patterns. It is then possible for self-organization to increase ([Ashton, 2009](#); [Rotmans and Loorbach, 2009](#)). The internal structure of the actor is pushed by external energy, owing to a loss of equilibrium in the system, to adapt and change ([Batten, 2009](#); [Dougherty and Dunne, 2011](#); [Rotmans and Loorbach, 2009](#)). This ability to self-organize is a cornerstone in the relationship between a business and an ecosystem. Through this capability, the company can

decide what stays outside its walls and redefine its priorities in accordance with a new equilibrium goal.

The recognition of an interconnected system by managers and scholars helps them to understand the link and dynamic interaction between business, society and environment, which assists in management with a sustainability approach (Davila *et al.*, 2021; Roome, 2012; Whiteman *et al.*, 2013; Whiteman *et al.*, 2004). Williams *et al.* (2017, p. 3) emphasize the need for “a more holistic lens to examine the role of corporations within social-ecological systems” and underline the possible contribution of introducing a systems thinking lens to this issue. Socioecological systems are clearly a form of complex dynamic systems, as are organizations.

Research aims

In environmental sustainability studies, the agrifood sector is a highly relevant field related to management/organization issues (Hamann *et al.*, 2017; Perey and Benn, 2015; Potts *et al.*, 2016; Winn and Pogutz, 2013). With specific reference to biodiversity, agrobiodiversity is the subcategory that is most at risk and relevant to the European continent (Negri, 2005), yet it has not been fully explored (Lanka *et al.*, 2017). Regarding the agrifood industry, this study focuses on the bread and bread derivatives sector because it represents basic food products purchased and consumed by almost everyone in industrialized countries. The bakery industry (in its most natural and sustainable form) is also particularly interesting because it is represented by a short supply chain, with only one intermediate step between the producer of the raw material (flour) and the consumer, that is, the baker (Torelli and Balluchi, 2020).

Recent studies have analyzed the relationship between production and the environment with respect to the implications in terms of biodiversity management (Ehrlich and Pringle, 2008; Engels *et al.*, 2011; Feger and Mermet, 2022; Le Coeur *et al.*, 2002; Marshall and Moonen, 2002; Paoletti, 2001; Singh and Abhilash, 2018; Tilman, 1999). Conversely, this study investigates the interconnections between the ecosystem and organizations: the interdependence of two complex and dynamic living systems. Therefore, we define the first research question as follows:

RQ1. How is the interrelation between biodiversity and companies structured? Does the systems thinking approach to biodiversity management lead to a different relation?.

The response and reaction of small- and medium-sized enterprises (SMEs) to environmental issues is another crucial aspect. Regarding large companies, Bansal and Roth (2000) identify three categories of motivations toward ecological responsiveness: competitiveness, legitimation and ecological responsibility. Williams and Schaefer (2013) confirm the presence of all these motivations in SMEs with a particular emphasis on environmental responsibility (Hamann *et al.*, 2017) as “personal values [...] a fit between personal and professional values” (Williams and Schaefer, 2013: 183). In such cases, managers’ personal convictions lead to unpublicized initiatives, philanthropic actions and eco-oriented assessments of processes (Bansal and Roth, 2000; Hamann *et al.*, 2017). Nevertheless, particular attention should be paid to verifying the presence of motivations linked to the legitimization of social norms and private/public regulation. This typology of motivation, which is also related to reputation, often leads to impression management practices and the creation of new networks between firms and associations (Hamann *et al.*, 2017). This has been identified as particularly important in family-owned firms (Berrone *et al.*, 2010). The last motivation, competitiveness, is rather related to cost savings and market advantages through green marketing and the production of green (or pseudogreen) products (Hamann *et al.*, 2017; Williamson *et al.*, 2006). Coherent identity also plays a primary role in family-owned firms in guiding the company’s strategy toward proenvironmental actions (Berrone *et al.*, 2010; Hamann *et al.*, 2017). For Berrone *et al.* (2010), proenvironmental behaviors in SMEs and family-owned firms are facilitated and stimulated by a longer-term

orientation and direct influence (Hamann *et al.*, 2017). Therefore, we define the second research question as follows:

RQ2. What are the main motivations for these SMEs to actively engage in biodiversity protection?

These types of companies play an important role in the economic system (Baumann-Pauly *et al.*, 2013; Raynard and Forstater, 2002; Wennekers *et al.*, 2005), and they are increasingly prompted to respond and take responsibility for the effects of their activities and output/outcome (Spence, 2007; Weissbrodt and Kruger, 2003). The literature highlights how some small enterprises, guided by a new type of entrepreneur, consider their relationship with nature (Kearins *et al.*, 2010). The focus is not only on the organization and entrepreneurs' understanding of nature and its role in their business but also on the role of their business in nature. In this regard, Townsend (2005) discusses a new and desired relationship in which organizations are engaged in the ecosystem, providing benefits to both nature and the firm itself. This relationship could be stronger and more apparent in smaller or recently established firms because of the entrepreneur's higher level of influence (Townsend, 2005). From a holistic systems thinking perspective, entrepreneurship can achieve the sustainability-as-flourishing concept (Laszlo *et al.*, 2014). This concept, coined by Ehrenfeld (2012), argues for change in two beliefs:

1. Human nature is based on caring, not needing.
2. Large systems are best understood from a complexity perspective (Schaefer *et al.*, 2015).

Systems thinking is crucial for this flourishing perspective (Capra, 2002; Ehrenfeld, 2012; Levy and Lichtenstein, 2012; Roome, 2012), especially considering that humans are embedded in the ecosystem (Davidson-Hunt and Berkes, 2003). Therefore, we define the third research question as follows:

RQ3. What is the role of small and sustainable bakeries in the protection of nature and biodiversity?

Methodology

The research is conducted using a constructivist approach, with an interpretivist perspective and a case study methodology (Yin, 2017). Considering that little is known about corporate practices related to biodiversity or the relationships between business processes and the complex concept of biodiversity, a case study can be particularly appropriate, especially in bounded circumstances (Tregidga, 2013; Yin, 2017). Through this research perspective and an exploratory multiple case study (holistic), we assess the implications related to the concept of biodiversity and the impacts that organizational choices could have on the consideration and management of this complex concept. The present study focuses on four sustainability-oriented bakeries located in the famous Italian "Food-valley" (an area located in the north of Italy, in the vicinity of Parma), an interesting, bounded area to study the concept of agrobiodiversity and specifically the bakery sector (Burton and Goldsby, 2009; Schaper, 2005; Walley and Taylor (2005) for the importance of small business entrepreneurs in sustainability/responsibility research). The two cities involved in this study also have unique characteristics in a European context, making them even more attractive for this study. Parma (194,417 inhabitants) is the "City of Gastronomy" (UNESCO), the headquarters of the European Food Safety Authority, and it hosts an international cooking academy (Alma). Reggio Emilia (172,010 inhabitants) is a widely recognized leading town for education and environmentally sustainable food. The number of case studies (four) allows for an easy understanding of the results without creating an unnecessary overlap of information. In the fourth case study, a certain repetition of the

concepts and results was detected; thus, four studies were considered satisfactory, which was in line with Yin (2017) and Stake's (2005) assertions on multiple case studies.

The research was preceded by the timely drafting of a case study protocol with 20 questions, which provided the basis for all the individual case studies. In addition, the preparation of the authors prior to fieldwork focused on the retrieval of general information on the activities involved, the characteristics of the sector under investigation and the type of product concerned; they also ensured that all the privacy policies and authorization procedures necessary for the empirical research were carried out. The actual survey was conducted via the following "data collection plan":

- press review;
- direct observation (approximately 10 h per bakery);
- review of the relevant documents;
- nonstructured interviews (recorded) (approximately 1 hour per person); and
- brief semistructured interviews to customers (approximately 15 min per customer).

To ensure scientific consistency in the case studies, the following aspects were considered: construct validity, internal validity, external validity and reliability (Yin, 2017). Regarding construct validity, we:

- used different sources of evidence;
- talked with industry players to discuss what was collected in the individual case studies;
- respected the data triangulation using primary sources from press reviews and websites, consumers and bakeries (owners and employees);
- followed the chain of evidence through a case study protocol, questions, findings and database; and
- verified that the interview respondents understood what we asked them.

Related to internal validity, we:

- addressed rival explanations;
- used logic models; and
- built a new explanation starting from evidence.

To address external validity, we:

- used a replication design; and
- based our study on important theoretical pillars.

Finally, the use of a case study protocol, case study database and consequent chain of evidence helped us to maintain an adequate level of reliability.

Brief description of the cases

In recent years, the bakery industry has experienced critical pressure and constraints. During the COVID-19 pandemic, restrictions on mobility and at least temporary changes in purchasing and consumption habits created new difficulties for this industry and other agrifood sectors. The resulting economic crisis has also changed the spending possibilities of individuals and households, which still affects their ability to sell even food products. Today, with the ongoing Russian–Ukrainian conflict and the resulting difficulty in finding raw materials (such as wheat) as well as issues concerning the availability and price of energy,

new and unprecedented market scenarios are emerging. These are all combined with an increasingly evident and impactful climate change scenario that is irreparably modifying some agricultural practices. The search for practices that favor and use local varieties of raw materials more suited to the climate in which they are grown, as ancient grains often are, is undoubtedly a possible risk mitigation strategy (Jacob *et al.*, 2021). Difficulties in the use of water, finding genetic varieties created in distant countries and the lack of sufficient quantities of local or national raw materials are increasingly pushing the realities of the agrifood sector to rethink their production models and medium- to long-term strategies (Blicharska *et al.*, 2019).

The four bakeries (B1–B4) use biodiverse raw materials (flour) that promote and protect agrobiodiversity, particularly in the areas where the crops are grown. They mainly use flour derived from grains of Italian origin belonging to landraces. These are nongenetically modified cereal varieties, typical of the area wherein they are cultivated; thus, they are very resistant and less subject to treatment with chemical products. These varieties are in danger of disappearing because they are no longer used in modern, genetically modified or selected and crossed cereals, with specific characteristics that are better suited to intensive farming (Singh and Abhilash, 2018; Thomas and Kevan, 1993). The ancient grains used are soft wheat solina, verna, gentil rosso, san pastore and virgo; durum wheat perciasacchi, saragolla and russello; and einkorn wheat (*Triticum monococcum*). The four case studies are small enterprises, with a maximum of six employees, that have an active and highly influential entrepreneur. All the bakeries have a point-of-sale directly adjacent to and communicating with the production laboratory, which is totally or partially visible to the public. Most of the sales volume is made at the headquarters' point of sale; the remaining part occurs through organic supermarkets, farmers' markets, catering activities and solidarity buying groups. The activities are carried out in fairly central points in the cities (Parma and Reggio Emilia) and are marked by a good or excellent passage of potential customers. In all the bakeries, the type of product sold is clear, while the clarity of the type of raw material used and its specific characteristics vary. Communication and advertising are also highly variable. These activities are contradicted by the production of bakery products using mother dough and local or national raw materials, which are mostly certified organic materials. These products are esthetically different from those sold in traditional bakeries and differ in their selling prices (they have much higher prices). However, they are characterized by higher digestibility, higher presence of fibers, longer shelf life and have a clearer and more intense taste (Antognoni *et al.*, 2017; Arzani and Ashraf, 2017; Dinu *et al.*, 2018). All the locations, apart from one that is now considered historical, are recent with modern and attractive sales methods (furniture, counter positioning, product layout, etc.).

Discussion of the case findings

RQ1. The relationship between business and ecosystem from a holistic perspective

The bakery industry is characterized by a strong and direct relationship between business activities and the ecosystem, particularly for small, innovative and sustainable bakeries. However, this relationship can assume different nuances and be “guided” by different impulses. These are dynamic living systems (Shrivastava *et al.*, 2013; Winn and Pogutz, 2013) in the continuous evolution of different types of exchanges. We have holistically attempted to understand how a systems thinking approach can engender an improvement in practices with respect to the relationship between nature and biodiversity management (Davila *et al.*, 2021).

This approach seems to be linked to a high level of consideration of the characteristics of the ecosystem with which one enters into the relationship through business practices, including the supply chain, production and so on. In Case B1, the desire to consider as many aspects as possible that are inherent in to the natural breadmaking cycle led to the decision to internalize the processes as much as possible, from the cultivation of wheat in

the field to the sale of the finished product. The intent is to obtain a closed cycle that can protect the environment and preserve the biodiversity that characterizes it, while trying to imitate the natural production cycle. The entrepreneur highlights numerous difficulties in pursuing this aspiration; for example, adapting to the dynamism and unpredictability of natural cycles in addition to the consequent economic weight. The manner in which the bakery staff express themselves indicates that the production activity is regarded as one that is entirely incorporated with and dependent on the ecosystem. The production of bread in this case acts on and intervenes in the natural environment with the priority of preserving, protecting and developing it, thereby relegating the economic and personal objectives to the second place:

Nature is all one [...] We see nature expressing itself. (B1)

A holistic and integrated vision of the supply chain is considered fundamental and not negligible, and where this is not possible (e.g. in certain periods or in the case of lack of production because of unforeseen weather conditions), firms rely on synergies and collaborations with other small sustainable businesses.

A systemic and holistic approach "limited" only to the supply chain, even if sustainable and synergic, inevitably leads to losing sight of some aspects closely (or only indirectly) related to the protection of nature (hence of biodiversity) and the creation of a healthy relationship with the ecosystem of reference. In the B3 case study, this is strongly underlined by the entrepreneur, who notes that having simple vertical relationships between companies as the only supply chain can also lead to nonpositive results, especially without the education of certain stakeholders (primarily consumers) and without the control of external stakeholders on supply chain activities:

In order to protect biodiversity, it would be necessary to take strong action to achieve greater control over the supply chain; it is also necessary to develop and expand the integration of the supply chain. (B3)

If one is unable to communicate and widely disseminates the efforts made by actors in the supply chain to promote and establish a sustainable relationship with the ecosystem while producing a quality product, everything becomes more complicated and often economically unsustainable over time (Beck-O'Brien and Bringezu, 2021; Bohnett *et al.*, 2022):

Other aspects related to biodiversity protection would also be considered, but sometimes this is not possible because we do not have a communication system that allows us to sell products at higher prices with ease. (B3)

The opening of the supply chain to a systemic approach that also looks outside the boundaries of the supply chain itself is considered valid and necessary in the case of B2, where well-structured disclosure processes and the synergistic involvement of even nonhomogeneous groups are attempted. Notwithstanding the difficulties involved in finding fruitful and stable collaborations (as highlighted in Case B4), it is necessary to convey one's vision and ensure that it is shared by external stakeholders, such as associations, environmental groups, universities, researchers, journalists and schools:

We work together with other actors to share the characteristics and price of the product. (B2)

In all the cases analyzed, there is a willingness to approach the ecosystem and the companies' interrelation with it from a holistic perspective: what changes is the degree of intensity with which this will be applied. In this sense, the owners' sensitivity to this issue and the presence of difficulties that can break or block activities that work to protect biodiversity both play a decisive role. These difficulties concern both social and relational aspects between the various actors in the supply chain as well as organizational and communication aspects, but above all, economic aspects.

In conclusion, the four case studies show that an enterprise's vision as an open system with respect to its environment is a necessary condition for biodiversity conservation. Thus, the

transformation of production factors and the sale of the finished product in the market must be carried out while considering the upstream and downstream needs of the value chain, always with complete respect for nature. The “taking into account” process is only possible through special evaluation, recording and measurement systems, created specifically (or adapted) for these specific natural resources (as detailed by [Feger and Mermet, 2017](#) and [Ferreira, 2017](#)). There is a strong need for systematic synergy among businesses, suppliers and consumers. Such synergy may relate to environmental protection but only after verifying its economic sustainability. In fact, the issue of the cost of raw materials and, consequently, the price of the final product, was a prevalent element discussed in the interviews. Only with the important systematic activity of sharing production/selling and communications strategies with the various stakeholders (wheat producers, flour suppliers, consumers, environmental associations, media, etc.) is it possible to consider a level of economic sustainability that can guarantee environmental sustainability or the conservation of biodiversity ([Beck-O'Brien and Bringezu, 2021](#); [Bohnett et al., 2022](#)).

RQ2. Small- and medium-sized enterprises as promoters of biodiversity protection: motivations

Economic motivation is not the prevailing reason why these entrepreneurs undertake their activities ([Hamann et al., 2017](#); [Williamson et al., 2006](#)). Only one of the four companies (B2) argued that the reason for starting the business was to enter a market niche that was unavailable in the geographical area of reference. However, this was subsequently found to be the least relevant reason.

All those interviewed were motivated by the need and awareness of being able to offer customers a product with a high intrinsic value, precisely because it respects biodiversity. Meanwhile, this awareness presumes the acceptance of a modest (or no) economic marginality, which, once again, is not the main motivation behind the choice of this path:

You don't become rich with this work; my work is a small mission. (B3)

A motivation that is not noted in the literature and stated in particular by one of the entrepreneurs interviewed (B2: “The main attention goes to our microbiota;” “You are so happy to sell a product that does not hurt.”) is the desire to offer consumers a product that protects their health. This is implicit in the variety of raw materials used and, in a broader sense, in the protection of biodiversity. Here, the conservation of biodiversity is instrumental in offering people products that protect their health. In this sense, attention to the environment is secondary to human health, but it is instrumental in delivering human health. In fact, it is observed that “Respect for nature is a positive relapse, but it is not the main reason that pushes people to buy our products” (B2). However, the relationship between human health and biodiversity is not only thought of as subordinate to human health but also as consequential to it:

Take care of yourself, with a varied diet, and therefore you will also take care of the environment. (B2)

Mostly transversal is the personal ethic/philanthropic motivation of entrepreneurs to undertake this sometimes risky path from an economic perspective. These are profound personal values that are intertwined with professional values and needs ([Williams and Schaefer, 2013](#)). However, they give priority to the former over the latter so much so that, sometimes, the initiatives that are put in place to protect the environment are not even made public ([Bansal and Roth, 2000](#); [Hamann et al., 2017](#)). From this perspective, the ethical dimension of the entrepreneur represents the foundation for the definition of strategies to protect the environment, typically from a medium- to long-term perspective ([Berrone et al., 2010](#); [Hamann et al., 2017](#)). This is essentially what emerges from some statements made by the entrepreneurs interviewed:

Respecting biodiversity is the only way for things to go well [...]. Protecting biodiversity is a political, economic, environmental, and agricultural act. (B1)

I was born in the biodiverse, so for me, it is essential to live with this logic. (B2)

Biodiversity is of enormous value to me, it makes me sick to think of not protecting it. (B2)

We need to change the way we think about the relationship between man and nature. (B3)

Ultimately, the entrepreneurs have strong ethical motivations. They chose to implement productive activities that considered the protection of nature and, in this sense, the conservation of biodiversity. These motivations assume the environmental and ecological responsibilities of the managers of not only large companies (Bansal and Roth, 2000) but also, and above all, SMEs (Hamann *et al.*, 2017). The motivations found in previous studies can be traced back to four main categories:

1. search for greater competitiveness;
2. supply of a product with its own intrinsic value;
3. protection of human health; and
4. pure respect for nature.

Contrary to extant observations (Bansal and Roth, 2000; Berrone *et al.*, 2010; Williams and Schaefer, 2013; Hamann *et al.*, 2017), none of the entrepreneurs interviewed found their motivation to be linked to a search for legitimacy or a better reputation.

RQ3. Small sustainable bakeries toward an active role in biodiversity protection

The approach through which these small bakeries address the problem of protecting biodiversity and the basic motivations that push them to be active players in this chain and in the relationship with the ecosystem make their role unique and impactful. In Case B1, where the holistic perspective is brought to its maximum and the activity of the bakery is considered a small part of the natural system to be respected, the baker is placed in his work as a humble craftsman (Kearins *et al.*, 2010):

Craftsmanship exists; there is a close and intimate relationship between artisan knowledge and nature that guides and teaches us. (B1)

The baker is humble in that he can be guided by the natural ecosystem and adapt to the paths provided by the system. The active and proactive role of the artisan baker lies in his humility; he can shape a natural material without exploiting it. Rather, he enhances it and makes it known to others. In this form of business, the will to remain within an ecosystem and its rules emerges, while trying to do everything possible to enhance its diversity and protect it, even if this may mean not acting for or forgoing profits (Davidson-Hunt and Berkes, 2003).

In this sense, nature is seen as something alive and reactive, capable of reacting to the stimuli provided by people. In Case B3, it is strongly underlined how small artisan bakers can transmit strength and energy to the natural material they handle (flour and dough). Depending on its type, this natural material responds accordingly, giving rise to a unique product (Ehrenfeld, 2012; Laszlo *et al.*, 2014). The bread, based on their feedback, is not considered as an object but as something living, able to transform itself, communicate and use energy. In this sense, the role of the sustainable artisan baker becomes fundamental: his skills and knowledge of the natural world and the biodiverse matter he deals with are necessary to achieve his goals.

I feel like a real artisan. I work with a material that is alive; the work you do on the dough must give strength and not everyone is capable of this. You have to be an artisan. (B3)

The search for a living and biodiverse natural matter is the basis of the choices to supply these bakeries, and this guides the daily work of these bakers. The bakers are aware of being confronted with a complex system that also includes themselves, and they invest in the choice of ancient original and unmodified varieties from which they are able to receive something because they are still intact and alive (Kearins *et al.*, 2010). Notwithstanding the difficulties associated with treating certain types of raw materials and the consequent challenges in selling different products, the bakers' role is neither denied nor neglected – the search for a true, genuine and biodiverse nature and the attempt to protect it as it manifests itself, without tricks, without additions:

We are artisans and not an industrial reality. We don't do the things we can't do. (B2)

Conclusion, implications and limitations

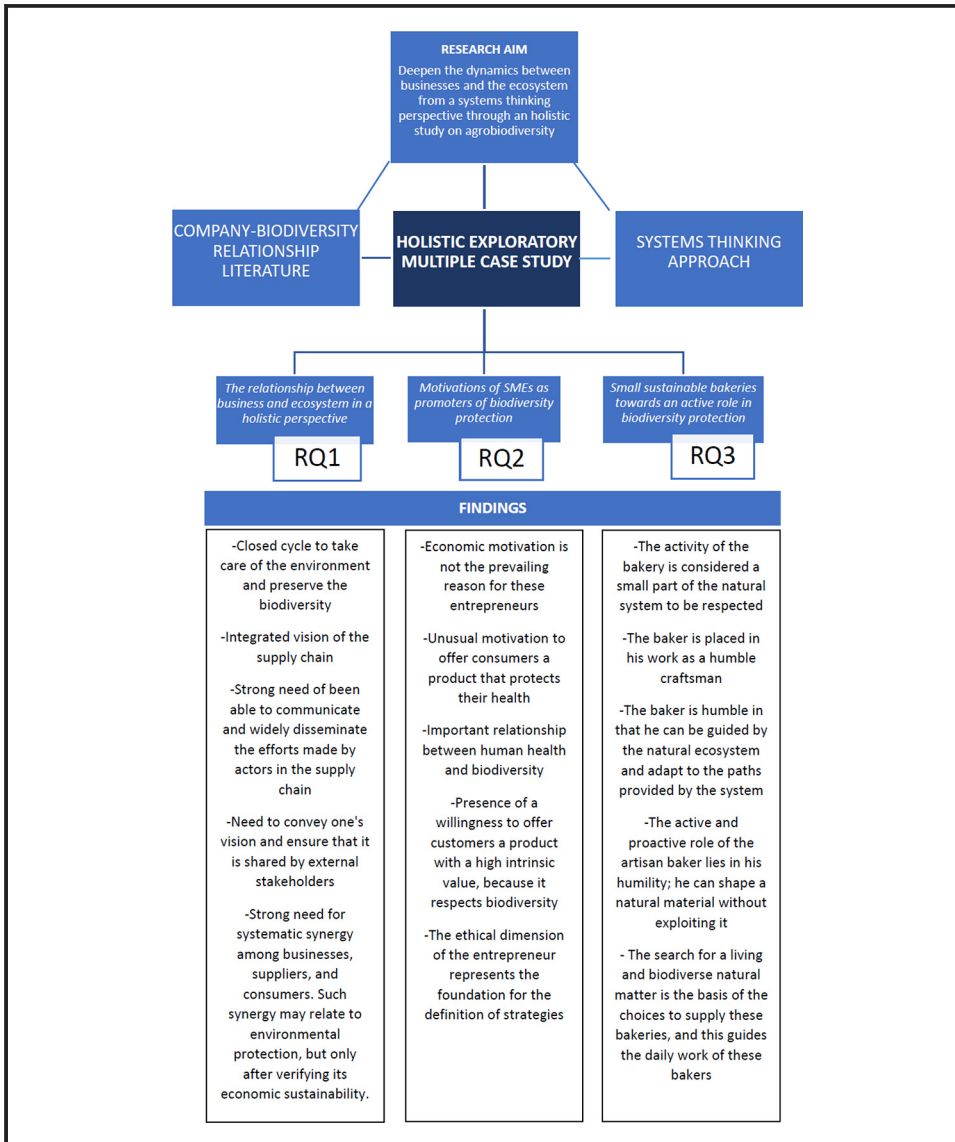
Through the different case studies, a systems thinking perspective and a holistic viewpoint have been used to understand the relationships, roles, motivations and dynamics underlying the close but often not so understandable relationship between business and the ecosystem (Davila *et al.*, 2021). The protection of biodiversity and its management represent a current challenge for any type of business activity, a situation that has been made even more urgent based on the dynamics of today's world and the consequences that the current and more widespread relationship with nature is bringing (Blicharska *et al.*, 2019; Feger and Mermet, 2022; Jacob *et al.*, 2021) (Figure 1).

The desire of these entrepreneurs to change their ways of doing things and try to produce in a way that respects the ecosystem and enhances natural genetic diversity, while simultaneously drawing value from it in a healthy and sustainable manner, is evident (Choi and Gray, 2010). The orientation toward a sustainable and ecologically innovative business brings the concept of profit into the background on several occasions (Schaper, 2005), leading these bakery entrepreneurs to be visionary green entrepreneurs (or ecopreneurs) (Walley and Taylor, 2005). These are virtuous examples capable of plowing new paths toward a new way of relating humans/businesses and the natural ecosystem by adopting a systems thinking perspective and a holistic vision. The motivations and particular role that these stakeholders play in society characterize them as pioneers capable of creating concrete, economic and social value while enhancing nature and its biodiversity (Driver and Porter, 2012; Zahra *et al.*, 2009). The desire to be sustainable and to change the ways of "business as usual" makes these companies and their entrepreneurs an example of "sustainability-as-flourishing" (Ehrenfeld, 2012) – a concept that is far flung from the common practices in the western industrialized world and so close to the vision of active subjects within a wider system capable of protecting natural dynamics by creating new value while preserving the world in which they operate (Schaefer *et al.*, 2015).

This study attempts to provide an answer to the call for new research by Cuckston (2018a), Whiteman (2013), Williams *et al.* (2017) and Winn and Pogutz (2013) by adopting a holistic approach to understanding the mutual relationships between complex and changing dynamic systems, such as the ecosystem and economic organizations. In particular, the focus is on the dynamics of an organization within a natural system with regard to biodiversity practices (Davila *et al.*, 2021). By bridging the literature gap in the study of complex systems through holistic thinking (Schaefer *et al.*, 2015), this study offers useful and interesting insights into the approach of small bakeries toward nature and the concept of agricultural biodiversity.

The concepts and narrative presented in this paper provide a valid theoretical/conceptual basis for companies, associations and institutions interested in the topic of biodiversity,

Figure 1 Research design and main findings



especially regarding how it is considered within rather complex dynamics, such as those that are formed in the relationship between two living and changing systems in relation to each other (organization and ecosystem). We also believe that the reflections made in this study may be useful in raising awareness, particularly among companies operating in the agrifood sector, toward the adoption of practices to protect biodiversity and companies that play a critical role with respect to environmental sustainability. The practices and processes analyzed in this research represent best practices that are potentially applicable to other realities, especially in light of recent market developments and increasingly demanding consumer requirements. Consideration of the relationship between businesses and the ecosystem through a holistic perspective is capable of creating insights for evolution and change that can guarantee not only economic benefits but also social and environmental advantages. The rediscovery of ties with the territory and the raw materials that this territory is capable of producing can support these activities in a progressive detachment from the logic of dependence on foreign markets (increasingly unstable), leading toward the use of

more suitable and resilient plant varieties (Blicharska *et al.*, 2019; Jacob *et al.*, 2021). Currently, in the area where the analyzed bakeries are located (Emilia Romagna), a regional regulation (Law 1 of January 29, 2008) that specifically protects agricultural biodiversity is in force. This regulation has also led to the establishment of the Regional Directory of Agricultural Genetic Resources. However, at the national level, following the issuing of the National Plan on Biodiversity of Agricultural Interest in February 2008, special guidelines were drawn up for The Conservation and Characterization of Plant, Animal and Microbial Biodiversity of Agricultural Interest (July 2012). It was only at the end of 2015 that Italy adopted its own specific law (No. 194) on the protection of agricultural biodiversity. This law also gave rise to the Biodiversity Register, the Standing Committee on Biodiversity, the National Biodiversity Network and a national digital portal, consisting of a database system. Notwithstanding the increased attention given to the issue and the creation of these institutional instruments, these regulations have failed to create a real support and stimulus network capable of fostering the promotion and protection of biodiversity by companies and different businesses that use vegetable and animal resources.

Similar to all scientific works, this study has its limitations. First, we focus on a specific production sector in a specific geographical area and only on small companies. Second, in qualitative research, despite the attention paid to the validity of the internal and external constructs as well as the general reliability, there can be no direct and immediate extensibility or generalization of the results.

Nonetheless, we believe that future research may use this study as a support or stimulus to deepen the theme in different geographical contexts, industrial sectors and companies. Future studies can investigate the possible expansion of the systems thinking approach to more complex and multistakeholder supply chains and markets or examine the potential and effective role of communication in the promotion of biodiverse products. Future studies could also explore the internal company dynamics between entrepreneurs and employees with respect to biodiversity or the role of local and national regulations in encouraging the protection of biodiversity. Finally, it would also be of interest to investigate the problem of determining the economic value of products that offer a high level of environmental protection and the negative/positive role of consumers in business practices that respect the ecosystem.

Acknowledgements

The authors would like to sincerely thank the owners and all the staff of the four bakeries who participated in this research. The authors are absolutely grateful for their full availability and are sincerely impressed by their dedication, knowledge, passion and commitment.

The authors would also like to thank the participants at the 5th French CSEAR – Conference on Social and Environmental Accounting Research (Paris, June 3–4, 2019) and the EBEN – European Business Ethics Network Research Conference 2019 (Roskilde, September 26–28, 2019) for the precious suggestions they gave us to improve our research and the scientific committee of the 23rd EMAN – Environmental and Sustainability Management Accounting Network Conference (Prague, November 7–8, 2019).

Notes

1. Available at: www.cbd.int/development/doc/sdg-jul2016-flyer.pdf
2. By 2020, integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts.
3. FAO defines agrobiodiversity as the result of the interaction between the environment, genetic resources and management systems and practices used by culturally diverse peoples, and therefore, land and water resources are used for production in different ways.

4. Because of the subject topic of this paper, we looked for articles dealing with how companies generally approached the topic of biodiversity (regardless of their industry, country of origin or size). For this reason, the articles discussed in this section were selected following a search on the Google Scholar search engine using keywords such as "accounting," "biodiversity," "business," "corporate" and "management." Further articles were found by consulting the references cited in the analyzed articles.

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About the authors

Riccardo Torelli is Adjunct Professor of corporate social responsibility and sustainable business strategy and research fellow in business sustainability and ethics at the Department of Economic and Social Sciences – Faculty of Business and Law of Università Cattolica del Sacro Cuore (Piacenza – Italy). His research focuses on corporate sustainability and SDGs, corporate social responsibility and business ethics, nonfinancial reporting and greenwashing. He is a member of Center for Social and Environmental Accounting Research, European Business Ethics Network and reviewer of many leading international journals. He has published several international contributions, in particular in *Journal of Business Ethics*, *Business Strategy and the Environment*, *Corporate Social Responsibility and Environmental Management*, *Journal of Cleaner Production* and in some Springer edited books. Riccardo Torelli is the corresponding author and can be contacted at: riccardo.torelli2@unicatt.it

Federica Balluchi is full-time Professor of Business Economics at the Department of Economics and Management, University of Parma, Italy. She is a member of several academic associations (European Accounting Association, European Business Ethics Network, Center of Social and Environmental Accounting Research) and reviewer for Italian and international academic journals. Her research activity focuses on economic and financial communication, voluntary disclosure, management accounting, intangible assets, corporate social responsibility and accounting history. Her work has been published in Italian and international academic journals and presented widely at conferences and workshops.

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