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# New Metropolitan Perspectives

Knowledge Dynamics, Innovation-driven  
Policies Towards the Territories'  
Attractiveness Volume 1



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Lucia Della Spina  
Editors

# New Metropolitan Perspectives

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# Preface

This volume contains the proceedings for the fourth International “*NEW METROPOLITAN PERSPECTIVES. Knowledge Dynamics and Innovation-driven Policies Towards Urban and Regional Transition*”, scheduled from 26 to 28 May 2020, in Reggio Calabria, Italy.

The Symposium was jointly promoted by LaborEst (Evaluation and Economic Appraisal Lab) and CLUDs (Commercial Local Urban Districts Lab), Laboratories of the PAU Department, *Mediterranea* University of Reggio Calabria, Italy, in partnership with a qualified international network of the academic institution and scientific societies.

The fourth edition of “*NEW METROPOLITAN PERSPECTIVES*”, like the previous ones, aimed to deepen those factors which contribute to increase cities and territories attractiveness, both with theoretical studies and tangible applications.

When the call for papers of New Metropolitan Perspectives was launched in September 2019, no one could imagine that in a few months we would find ourselves suddenly catapulted into a totally unknown future. And the papers sent in January 2020, of course, could not in any way reflect the dynamics caused by the spread of COVID-19, the outlines of which will all be discovered and deepened in the coming years: it is still too early to fully understand the extent of these changes.

Today, we are still dealing with what appears to be a cataclysm of planetary proportions; it will take time to “historicize” events and interpret their profound meaning and long-term impact, through the multilevel observation—through the interpretation of macro-data and the in-depth investigation of the different realities involved—that the scientific community will be able to develop when the health emergency is over. At that point, the scenarios can begin to be configured with scientific rigour, which are beginning to be intuitively delineated in constant events. It will be possible to appreciate the permanent (real and perceived) effects on the daily life of communities, on the organisation of work and logistics chains and in the system of social relations.

At present, we can only hypothesise scenarios, more or less well founded.

The common thread, that linked the different themes from the Symposium in its original conception, was technology, in particular the effects produced on the settlement systems by the relationship between man and technology, in two different aspects: the progressive replacement of man with machines in practically all production processes and the spread of ICT.

The pandemic and the policies and practices put in place to contain the infection have brought this issue to the fore with arrogance. The replacement of physical interactions with “virtual” contacts has used consolidated technologies but has accentuated their pervasiveness, generating impacts of different nature. The next few months will tell us how much of this acceleration will persist in our daily lives and how much it will be a transitory phenomenon.

Permanent changes are conceivable, for example, in the organisation of work, with the adoption of smart working as an ordinary way of carrying out various tasks, also in areas where until a few months ago it seemed a distant future, such as in teaching.

And these changes will probably also affect other areas, just think of the use of culture, in a broad sense, as the many virtual opening initiatives of museums and sites of cultural interest have shown us in this period.

As well as central issues for democratic systems will be those related to the use of big data and their impact on individual freedoms: the ongoing debate on tracking movements and personal preferences is extremely topical.

However, the data that seems to emerge with greater force from the phase we are experiencing is the progressive loss of relevance of the location factor: the pandemic has made even more evident the fall of many barriers to the global dimension of relationships and exchanges. This change brings with it, as a consequence, a change also on the plane of centre–periphery dualism: what is centre and what is periphery, when the two terms no longer refer to accessibility to physical places but, for example, accessibility to goods and services and, ultimately, to knowledge? And how do you measure accessibility if you can no longer measure in metres or hours?

The other phenomenon on which it will be increasingly necessary to reflect in the future is the speed of changes. As already underlined on the occasion of the past edition of the symposium, while society evolves with accelerations impressed by endogenous and exogenous factors (such as the pandemic COVID-19), the physical dimension of space adapts with extended times.

At the dawn of the studies on the impacts of ICT on the city, the “wired city” studied by the research group of Corrado Beguinot was divided into a system of three cities: stone, relationships and experience. To harmonise the development times of the physical city with the “liquid” city of human relations is, after thirty years, still a priority.

So how will our cities and, more generally, the settlement systems on a planetary level record these changes? Will the trend towards population concentration persist in hyper-equipped and congested metropolitan areas or will we see reflux? New perspectives open up towards what are now considered peripheral areas (such as the Inner Areas so dear to our Master Edoardo Mollica), in which perhaps some

organisational processes are more easily managed and there are still values that could be appreciated by future generations.

The ethics of research, in the disciplinary sectors that the Symposium crosses, invites us to feed, with scientific rigour, policies and practices that make the territory more resilient and able to react effectively to events such as the pandemic that we are suffering in recent months: we hope to know the outcomes of these courses in the next editions of the New Metropolitan Perspectives Symposium.

For this edition, meanwhile, approximately 230 papers published allowed us to develop six macro-topics about “*Knowledge Dynamics and Innovation-driven Policies Towards Urban and Regional Transition*” as follows:

- 1 - Inner and marginalized areas local development to re-balance territorial inequalities
- 2 - Knowledge and innovation ecosystem for urban regeneration and resilience
- 3 - Metropolitan cities and territorial dynamics. Rules, governance, economy, society
- 4 - Green buildings, post-carbon city and ecosystem services
- 5 - Infrastructures and spatial information systems
- 6 - Cultural heritage: conservation, enhancement and management

And a Special Section, *Rhegion United Nations 2020–2030*, chaired by our colleague Stefano Aragona.

We are pleased that the International Symposium NMP, thanks to its interdisciplinary character, stimulated growing interests and approvals from the scientific community, at the national and international levels.

We would like to take this opportunity to thank all who have contributed to the success of the third International Symposium “NEW METROPOLITAN PERSPECTIVES. *Knowledge Dynamics and Innovation-driven Policies Towards Urban and Regional Transition*”: authors, keynote speakers, session chairs, referees, the scientific committee and the scientific partners, participants, student volunteers and those ones that with different roles have contributed to the dissemination and the success of the Symposium; a special thank goes to the “Associazione ASTRI”, particularly to Giuseppina Cassalia and Angela Viglianisi, together with Immacolata Lorè, Tiziana Meduri and Alessandro Rugolo, for technical and organisational support activities: without them the Symposium could not have taken place; and, obviously, we would like to thank the academic representatives of the University of Reggio Calabria too: the Rector Prof. Marcello Zimbone, the responsible of internationalisation Prof. Francesco Morabito, the chief of PAU Department Prof. Tommaso Manfredi.

Thank you very much for your support.

Last but not least, we would like to thank Springer for the support in the conference proceedings publication.

Francesco Calabrò  
Lucia Della Spina



# Cities and Regions Towards Transition

The fourth edition of the New Metropolitan Perspective Symposium took place in a period of global uncertainty that is calling into question the essence of the economic prosperity pursued in the last decades. It is recognised that what is urgently required is a policy shift from a primary push towards ever-increasing productivity and competitiveness goals to one that pursues a “renewed” concept of competitiveness—socially just and environmentally responsible—employing a reformed pan-economic approach. **The continuing and progressive changes due to the systemic impact of shocks and stresses at the global level need a convergence of efforts by all countries.** This is critical to balance the need to maintain economic prosperity generated by globalisation and to mitigate global crisis like climate change and the ongoing COVID-19 pandemic. The scenario that is emerging these days is similar to a post-war reconstruction economy, alongside climate change and the risks associated with it, the emergency of the pandemic has seriously questioned social stability at the urban level and the confluence of institutions in multilevel governance processes. Concurrently, the main question to be addressed can no longer be confined to how cities and regions can compete in a global context, but rather how they can survive in a world that must face the effects of continuous shocks by ensuring socially acceptable living conditions for everyone.

At European level, this need has been stimulating the debate for the revision of policies designed to build a better Europe for its citizens and a “restructuring process” of EU institutions in the light of anti-European, populist and sovereign political movements. These movements together with far-reaching global crises and shocks are threatening the future of EU and the Cohesion Policy grounded on the virtuous principle to reduce disparities by promoting social, economic and territorial cohesion. In response, the European Commission has recently introduced the European Green Deal, a set of policy initiatives to strive for a green transition based on solidarity and fairness. This marks a novel growth strategy that is comprehensive, ambitious and bold, integrating climate, environmental and social protection goals with economic ones. Such a transformative pathway helps set the stage for policy actions in the upcoming post-2020 programming period of the Cohesion

Policy. Arguably, these days the perspective of the EU mission will be redesigned, through new priorities and new tools launched for shaping the Conference on the Future of Europe.

In this context, the debate on how to prepare EU territories and cities to address the challenges of regional and global implications cannot be more relevant. The current development approaches need to be adjusted to formulate a new development pattern. Such a pattern is characterised by a more flexible approach in allocating investment, a more integrated approach to reach the goal of transition development and a more tailored, place-sensitive approach to regional development. It should facilitate a sustainable transition process towards transforming regional and urban socio-economic and technological systems. This process will be driven with an evolutionary approach in which knowledge and innovation dynamics can break path dependency and promote an effective regional diversification. This pattern should be underpinned by an integrated, multiscale and multidimensional approach aimed to enhance the resilience capacity of territories to respond to the various crises and shocks they are exposed to.

To substantiate these arguments, the Symposium was also part of the TREN-D (Transition with Resilience for Evolutionary Economic Development) research project funded by the European Union's Horizon 2020 Research and Innovation Programme under the Marie Skłodowska-Curie Actions—RISE 2018. Considering the above-mentioned unparalleled yet controversial complexity while responding to the European call for the green transition, TREN-D proposes a new approach in the design process of place-sensitive, innovation-oriented development policies that can facilitate the regional and urban transition to sustainability while reinforcing resilience to shocks induced by transition economies (e.g. post-carbon economy). TREN-D's approach is focused on how to strengthen the regional capabilities to trigger, implement and manage transition strategies towards driving "resilience-building" processes. The scope is to combine Transition with Resilience for Evolutionary Development in different territorial contexts towards a reforming process of Cohesion Policy for the next programming period 2021–2027. The TREN-D, therefore, seeks to: 1) identify and examine the factors enabling or hindering the transition strategies at a governance standpoint; 2) assess the territorial characteristics critical to enable a resilient-building process; 3) unveil the unexploited potentials for "re-shaping trajectories" disclosed through the windows of local opportunities due to the external shocks cities and regions are continuously exposed to.

TREN-D highlights regional diversification seen more as a process of co-creation of solutions and concepts to solve development problems through the enhancement of the resilience capacity of regions, which can be achieved by implementing tailored place-based innovation policies with a transitional approach. Stemming from the current debates on regional diversification together with the emerging role of the city in pursuing local innovation ecosystem, the aim is to explore new development policy configuration within the evolutionary framework to help different territories effectively respond to continuous shocks. It is expected to gain a sound understanding of the triggering mechanisms conducive to frame a more

inclusive S3 process for the post-2020 Cohesion Policy. This new framework, thanks to resilience-based process and transition management, will help define tailored S3 processes more sensitive to different regional contexts and needs. In so doing, it will reinforce innovation diffusion, facilitate diversification and tighten the linkages between advanced and peripheral areas (at regional and sub-regional levels) through more inclusive approaches.

Considering this vision, the Symposium tried to offer possible solutions to sustainable development as defined by the UN Agenda 2030, focusing on the complex and dynamic relationships between human society and technological development, and the latter's socio-economic, political, institutional and environmental impacts on territorial and urban systems. Indeed, investigating the nexus between the ever-changing societal needs and rapid technological development represents a valuable opportunity to achieve this ambitious goal. The desired shift towards a more sustainable knowledge-based economy and society since the beginning of the 2000s, especially in developed countries, is impeded by several challenges. In Europe, the Smart Specialisation Strategy (S3) represents the strong push to boost economic development through knowledge, research and innovation. The current academic and policymakers' debate are questioning its capacity to break down path dependencies and facilitate economic diversification. The difficulties in implementing and doubts about the effectiveness of this ambitious innovation-oriented policy—especially at regional level—suggest the need to revise the post-2020 Cohesion Policy and the approach beyond Regional Smart Specialisation Strategy (RIS3). Among the rising concerns, the controversial effect of innovation concentration on peripheral areas due to the new geography of knowledge is coming to the fore. The surging discontent shows how policymakers are struggling with continuous mutating scenarios characterised by more complex territorial dynamics. The pillar on which the current policy action seems to rest is represented by the potentials underlying knowledge complexity and innovation in reversing negative trends. However, recent studies have pointed out how such complexity is giving rise to inequalities in both core and lagging regions, making peripheral areas a common issue to tackle. More efforts are needed to address different aspects of inequalities connected with the new geography of knowledge. Therefore, a more inclusive and integrated approach is desirable to advance technological innovation while addressing social issues of health, environment, education and social exclusion.

Accordingly, the Symposium stimulated multidisciplinary discussions on the key elements of the debate on a shift in policy design and implementation, including transition management, resilience, diversification and quality of governance to leverage the potentials of peripheral areas and reshape the trajectory of economic growth for more equitable development. It aims to identify a new and balanced developed pattern, casting light on the multiscale and multidimensional analysis of different perspectives, strategies, tools, objectives and impacts of local economic development and innovation processes. Such a pattern needs to be framed within the United Nations 2030 Agenda (TS25) and to reach the Sustainable Development Goals (SDGs).

The sessions have been organised around key elements affecting vertically (multilevel) and horizontally (cross-sectoral and multidisciplinary) the social, economic, institutional, organisational and physical/environmental dimensions of local economic development. The themes of sessions followed the key elements of the debate on a shift in policy design and implementation to drive transition-oriented structural change of regions. This echoes the EU's desirable smart transition that requires an economically prosperous and socially inclusive transition process to promote regional convergence. Sessions TS04T1, TS04T2, TS04T3 and TS04T4 altogether build up the overall theoretical framework of sustainable transitional development, offering insight into knowledge complexity, transition management, resilience, diversification and quality of governance to leverage the potentials of peripheral areas and reshape the trajectory of economic growth for more equitable development.

To achieve a smart transition, it is critical to reinforce the resilience of regions at different territorial scales, especially those expected to be more affected, to respond to the shocks that green and digital transitions are likely to trigger. In this regard, the Symposium undertook a multifaceted and multidimensional conceptualisation of resilience, for which sessions TS01, TS25 and TS26 investigated territorial systems resilience, urban resilience and sustainability. Session TS07 looked into smart and resilient infrastructures, and sessions TS09 and TS23 investigated urban and built environment with sustainability and resilience. Sessions TS02, TS06, TS10 and TS21 pay close attention to territorial and urban regeneration. Urban and territorial regeneration are considered as a useful tool to facilitate territorial and urban resilience-building processes by promoting positive physical transformations and thereby increasing cities' preparedness and response capacity to crises and shocks. Sustainable urban and territorial regeneration need to define new economic and territorial strategies within a period of financial constraints. Therefore, session TS21 casts light on the issue of circular regeneration, while session TS03 conducts a critical review of territorial dynamics and urban growth models.

The value-adding of local assets from the urban–rural perspective offers a chance to define alternative development patterns. In this respect, cultural heritage, as potential local assets, needs to be properly leveraged to drive sustainable local development. The Symposium, therefore, highlighted innovative approaches to heritage management. Session TS19 casted light on the enhancement of cultural heritage in fragile areas; session TS20 presents new management strategies for the value-adding of heritage in inner areas; and session TS22 relates heritage management to climate change, exploring integrated conservation strategies based on traditional and innovative technologies able to help mitigate the negative effects of climate change. The Symposium equally gives insight into the urban transition towards a post-carbon society, a key element useful for the discussions on the new objectives of the post-2020 Cohesion Policy and new strategies and tools. Accordingly, session TS23 investigated an ecosystem services approach to the evaluation of settlement transformations; session TS12 was focused on green building related to post-carbon transition, and session TS30 furthers session TS12 and proposed eco-design-based strategies and approaches.

As in the past editions, this year's Symposium has received generous support from and will see the participation of a high-quality international network of higher academic institutions and scientific societies. Therefore, it will undoubtedly serve as an important occasion for exchanging and disseminating research findings and stimulating a fruitful debate on global challenges among academics and policy-makers. All in all, the Symposium and the contributions to its different sessions contributed to deepening the discussions on a transition-oriented approach—on which the TRENd project is grounded—while offering insights into how to fill the existing gaps.

Carmelina Bevilacqua

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# Toward Nature-Based Solutions (NBS) Approach in Integrated Segment Reporting of Place-Based Organizations

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**Abstract.** This paper aims to focus on the contribution of the approach by segments of place-based organizations to planning and reporting social and environmental performance along with economic and financial dimensions. The literature review is about Nature-Based Solutions (NBS) and segment reporting. In the context of scientific contributions regarding the NBS approach, an important issue is to evaluate the impact of NBS about different social and environmental challenges. Raymond et al. (2017) propose a framework to identify how NBS can produce both synergies through ecosystem services and co-benefits in a NBS view. Moreover, the paper analyses the logic underlying the technique of segmentation in the “space”, the social performance of the operating segments over “time” and the synergies between segments. In the case examined (a Farm), we will demonstrate how the case manages to achieve significant economy with the production of electric energy deriving from the biogas obtained by fermentation of manure, therefore it does not incur the cost of purchasing electricity and it doesn’t incur in the disposal costs of the manure, but to translate them into raw material to produce electricity and also to sell the energy in excess to its needs. Besides, the Farm generates benefits for the environment inside and outside of it.

**Keywords:** Nature based solutions · Segment reporting · Environmental impact · Farm analysis · Value added

## 1 Introduction

In the past, the debate had developed with fierce criticisms over the behavior of transnational companies, which have given rise to and continue to perpetrate greenwashing behaviors without highlighting an effective change in production systems. Systems that are not yet able to guarantee respect for the environment and its improvement. In practice, instead, a marketing process oriented towards greenwashing is developed, which is also accompanied by a “discreet” intervention strategy at the

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political level and also by international organizations to make it possible, however, to make a greater profit for each company with the illusion that they implement them in environmentally friendly projects [1].

Since some classic business economics authors analyzed farms, including Giannessi [2] and Besta [3], the situation in which they operate has completely changed and requires reflection on the company-environment relationship. For this reason, we try to interpret NBS within a territorial context as well as it relating to farms, despite being a theory applied to urban areas through the correlation with the NBS. In this context, the role of accountability [4–9] is very important, because it is a process that allows all companies to acquire legitimacy from the stakeholders who employ certain tools, including segment reporting, which are outlined in this work.

Moreover, this paper has the objective of answering the research question: How to write segment reporting by NBS perspective?

The research design involves the deductive [10] and inductive approach [11]. The deductive approach is analyzing the literature review in two ways. The first step is the presentation of Nature Based Solutions (NBS) to create a wider framework to construct further analysis. The second step is considering the presentation of the theory of segment reporting. The inductive approach regards implementation of segment reporting using the research case of Fattoria della Piana (Italy).

The research case is very important, because it involves a vast area of the territory and for this reason may be termed: a place-based organisation. The research case, that is a farm, is based on internal and external NBS, as it can simultaneously relate cost savings and the supply of production factors, because it will be demonstrated how bio-gas allows for the direct production of electricity for self-consumption. In the case examined, we will demonstrate how the case manages to achieve significant economy with the production of electric energy deriving from the bio-gas obtained by fermentation from animal excrement, therefore it does not incur the cost of purchasing electricity and it does not incur disposal costs of the excrement of the animals rather to use them as fuel to produce electricity and also to sell the energy in excess relevant to its needs. Similarly, with waste-water that the firm refines by phytodepuration and uses to irrigate the fields that produce animal feed. The circularity of the economy is put on the net, creating differential economic, social and environmental advantages. In addition, the Farm generates benefits for the environment, creating a NBS both inside and outside of it.

The paper is divided into the following sections: the first one concerns the literature review relating to NBS; the second section regards segment reporting analysis; the third section concerns the results of the case analysis and the forth section regards discussion and conclusion.

## **2 Nature Based Solutions (NBS) as Framework to Pass from Greenwashing to Green?**

NBS is primarily designed for nature-based and eco-system solutions at an urban level in order to create improvements in the harmony existing among: environment, space, structures and human beings. It is a very wide framework to place our analysis in and

which involves an interdisciplinary approach and in this paper we are going to use only some areas of the this theory. To introduce NBS the definition framework indicates that: “NBS explicitly address societal challenges. The solutions are not aimed at addressing only environmental challenges or minimizing only environmental impacts, although these may be part of what the NBS is targeting “produces societal benefits in a fair and equitable way, in a manner that promotes transparency and broad participation” [12].

Among the different themes and guidelines, that are proposed by Raymond et al. 2017, we focus our attention mainly on two areas. The first area concerns: “benefits and co-benefits for human health and well-being” and the second area regards: “integrated environmental performances; costs, trade-offs, benefits and co-benefits for biodiversity, economy and community” [13]. The meaning of the first area is to create improvement in the quality of life using relationships and co-creation opportunities to create an emancipatory change. The meaning of the second area is that of developing the emancipatory change that is necessary to activate the process in order to measure, record and monitor the performances of project implementation. Especially for companies this process is very important to avoid green-washing and to move to real environmentally friendly change. These areas are divided into other more specific ones, because the objective is to create projects that implement this general theory and to develop indicators that will be able to monitor the level of application of the theory. The first area involves deeper specific sub-areas, which allow for a better articulation and possible, subsequent control of the qualitative and quantitative information that may derive from them. Among the specific areas, we can highlight that one relating to water management, which represents a fundamental resource for agricultural companies both as regards food and also regarding irrigation. The second specific area, of special interest for this paper, is also attention to human health and quality of life which, in the case of farms, extends to that of animals. The third specific area relates to the management of the impact on the climate, which requires cutting-edge technologies for the recycling of materials, the reuse of the same as also suggested by the integrated and NBS. Moreover, NBS is primarily designed for nature-based and eco-system solutions on the urban level. In this paper, on the other hand, we want to extend the reflection that derives from NBS to the level of even rural territories. Actually, as regards measurement and monitoring of the first NBS area, it is necessary to underline the importance of organic production and breeding that respect both the size of the spaces for animals and the rhythm and natural seasons that we will find in the research case. This means that the criteria for using natural fertilizers and cultures are respected in the production chain, even those used as food for animals follow the logic of the biological circuit. The second area, which is related to integrated environmental performances, requires the structuring of an information system [14], that is described in the case analysed, to be able to quickly and reliably measure the external and internal impact of the aspects related to cultures and breeding considering the costs and benefits deriving from respect of the environment. Within this, the management of the agricultural territory is particularly relevant, which is in close connection with the company and therefore the protection of the same is important to make it usable with the same effectiveness for future generations too. To reach this objective some more specific drivers and models are required. We will involve the following drivers: reduce, reuse,

recycle and recover [15, 16] and the segment reporting model that we are going to analyze in the following paragraph.

### **3 Segment Reporting: An Integrated Perspective of Analysis in “Space” and in “Time” of Financial and Social Performance of the Companies**

The operating segments are companies’ subsystems resulting from a process of segmentation in “space” in correspondence with the different products, markets, groups of customers, geographical areas, with similar characteristics. Segmentation in “space” leads to the definition of the “map of the segments” and can be carried out according to one of the abovementioned criteria or even a combination of them. The choice of the segmentation criterion (or criteria) depends on the information needs of the management which uses information on the performance of the segments to take decisions and to evaluate the results of the segments and the company as a whole.

Segmentation in “space”, by geographical areas and/or by lines of business (LOB), highlights if there are not good performing segments, or even that produce losses. Good performance of the company may hide a bad competitive and/or economic performance of one or more segments. Segmentation in “time”, moreover, allows the management of companies to promptly perceive if some segments have an unfavorable financial and/or economic trend, highlighting the need to improve the current trend through targeted choices [17].

Reporting by segment is a source of analytical financial information very useful both for strategic management and external financial disclosure of the companies. Originally to satisfy the information needs of top management, interested in measuring with high frequency (quarterly, monthly) the performance of the segments [18–23], segment reporting has also become a very important part of external financial disclosure [17, 24–27].

Since the international accounting standards (SFAS: 14 and 131; IAS 14 and 14-R; IFRS 8) introduced segment reporting as a mandatory external financial disclosure tool for listed companies, a rich research area has developed on this subject.

The IFRS 8 (Operating segment) has introduced the management approach according to which external reporting by segment for the stakeholders must be based on the same segmentation criteria used for the internal segment reporting addressed to the top management. The underlying idea of this principle is: if a segmentation criterion delivers significant information for management control, it will also be significant to meet the information needs of stakeholders [17, 24, 28–34].

This paper highlights a very important function that can be performed by segment reporting, not yet examined by the literature: measuring the social performance of each segment of the company is very useful in understanding the drivers of the social performance of the company as a whole. In this way, it is easy to find out if there are segments with sub-optimal performance, not only from an economic perspective but also from a social one. The same can be said for the environmental and social dimension of their performance. Furthermore, disclosing the social performance of the

segments allows stakeholders to know how much value the company produces and distributes, with specific reference to each of their segments as well. Adopting a similar approach, it is also possible to report and manage the company's impact on the environment, with high frequency (monthly, quarterly). In this paper, both from a theoretical point of view and through a case study, these important functions of segment reporting are analysed. The research line suggested by this paper is to combine the social and economic information by segment into an integrated segment reporting [35]. To this end, a segment reporting scheme is proposed. This model is innovative because it integrates two performance dimensions of the segments: both the economic one, highlighted by the operating result of the distinct segments and the social one, expressed by the added value produced by each of them and intended to satisfy the interests of the stakeholders. The value added is assumed as a synthetic indicator of the social performance of the companies and their segments because it shows the wealth distributed to stakeholders (workers, financiers, public administration, shareholders).

The contribution of this paper is to highlight the relevance to measure the contribution of each segment to overall company worth. By measuring the value added created by each segment with high frequency (monthly, quarterly), the management can be informed promptly if some segment does not contribute adequately to the total value added of the company as a whole and set tailored choices to correct any unfavourable trends. For this reason, we propose a reporting by segment scheme which highlights not only the operating result but also the value added created by each segment. This scheme is general and must be tailored by the companies to their specific needs. This model is then applied to a case study in the agri-food sector. In other papers we have presented general reporting schemes for segments that can be adopted by companies operating in other sectors: transport and healthcare [36, 37].

Another contribution of this paper is to propose segment reporting to investigate the synergies between segments and thus highlight the elements of internal synergy (i.e. between segments) and of the ecosystem (between each segment and the environment) that derive from the NBS model adopted in the case-study examined in this paper.

In the case study examined the synergies between the segments are evident: the waste produced by some segments becomes raw material for other segments thus creating a double economic advantage for the company: on the one hand, the costs of waste disposal are eliminated (in both the dairy and the farmhouse) on the other, the costs of purchasing raw materials and consumables of some segments are reduced since they are obtained by recycling, converting and reusing waste materials from other segments. There is also an NBS advantage that is achieved with other companies (farms operating within the same ecosystem) from which the company under examination purchases manure to transform it into electricity through the biogas plant. In addition to minimising their environmental impact, these transactions generate significant reciprocal economic benefits. In particular, those that use manure and wastewater from stables not only generate revenues by selling electric energy but also do not pay waste disposal expenses. The company examined in this paper achieves the advantage of obtaining raw materials at a very low cost, i.e. manure and wastewater from the stables, which is needed to produce electricity using the biogas plant that enters the national electricity grid, achieving substantial revenue flows (on average €2.1 million per year).



Integrated segment reporting allows measurement of the added value of these segments, that is, the wealth they produce, and which may be distributed to meet the interests of stakeholders. Furthermore, when integrated segment reporting is prepared by a company that implements an NBS model, it highlights the benefits that derive from it in terms of costs and revenues for each distinct segment. Following the literature review, in the next section, we will examine the case study.

## 4 The Research Case of Fattoria della Piana: Methodology, Mission and Governance

### *Methodology*

This section presents a research case [38–40], the analysis of which is performed through a qualitative approach [41]. The case was chosen because it is a “critical case” [39]. In fact, it is of significant importance for the positive results that the company has achieved to date in the concrete implementation of an NBS model. These results derive from the transformation of agri-food and zootechnical production waste into resources in an efficient and economical way. This process demonstrates the concrete possibility of combining the reduction of the environmental impact of production activities, good economic, social and environmental results. To this must also be added the satisfaction of the stakeholders through the distribution of a substantial added value and the adoption of NBS.

The research was conducted by adopting the participant observation method, a variant of the case method, which leads the researcher to observe the reality by interacting with the key players of the company. The results are also based on documentary analysis, used to collect, classify, measure and interpret information [42]. The examined documents made it possible to give definition to the map of the segments and to allocate costs and revenues to these centres and in this way to measure their gross and net added value and operating result. Accounting and non-accounting information was used, acquired directly from the managers. The latter also assessed the consistency of the results of the segments reached through the allocation of costs and revenues to these result centres. We are fully aware that general theories, valid for all companies, cannot be inferred from cases [42, 43]. In fact, this study does not aim to build a “theoretical case” [38] from which to derive a theory by means of a statistical generalisation or mathematical modelling [39, 44, 45], but it has more limited objectives: establishing a theoretical framework of reference for companies operating in this sector who intend to carry out reporting by segment for management control and also external communication needs and demonstrating the economic convenience of adopting an NBS model in the agri-food and zootechnical fields. In fact, the segment report presented in this paper can also be adopted, with the necessary adjustments, by other companies operating in the same fields of activity. By carrying out a similar activity they face similar management problems, the adaptation of the report schemes by segment presented in this paper to the needs of each company is minimal. For the description of the case we use the mission, governance and accountability scheme proposed by Maticena.

### ***Mission and Governance***

For the description of the case we use the mission, governance and accountability scheme [46]. Fattoria della Piana is a cooperative of agricultural products, established in 1986, with registered offices in Candidoni (RC-Italy). The company's mission is to produce mainly dairy products with the aim of respecting the traditions of the Calabrian territory with the combination of modern technologies to respect the environment, giving life to the NBS aspects related to: Reduce; Reuse; Recycle<sup>1</sup> [16].

It operates in the dairy sectors, collecting the milk produced by the members of the cooperative and transforming it into dairy products that it distributes daily using fresh products, its agritourism activity and energy and heat production chain through a biogas plant and a photovoltaic plant. The cooperative created an efficient NBS model by transforming the problems of the disposal of livestock rubbish and dairy processing residues into resources to produce electricity and heat, through a biogas plant with a power of 998 kW, in water that can be used to irrigate the fields in which food for farm animals is grown, through a phytodepuration plant, in fertilizer to fertilize the fields in which forage for animals grows.

The company has obtained ISO 14001 certification, which is issued to companies that are able to control the effects of their production activities, minimizing the environmental impact and won a lot of awards (fattoriadellapiana.it). The cooperative's governance considers the typical aspects of these companies, namely: mutuality, democracy and solidarity, which are reflected in the active participation of employees at various levels. After the brief analysis of mission and governance, we can consider the different dimensions of NBS and add the segments that will be explained in the following section.

## **5 The Case Study “Fattoria della Piana”: NBS and Integrated Segment Reporting**

In the case study examined, Fattoria della Piana, the segment with the highest turnover in 2017 and 2018, is a “Dairy”, together with the segments of: “Electricity production from biogas plant”, “Electricity production from a photovoltaic plant” and “Farmhouse”.

The biogas plant collects the manure of the livestock farms in the area, especially one located in an area adjacent to the farm examined in this case study, and the discharges of the dairy processing (mostly whey) into two large fermentation tanks that

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<sup>1</sup> “Today ours is the largest farm in the province of Reggio Calabria and one of the largest in Southern Italy. A reality that continues to grow, always respecting the environment and transforming what is normally waste into a resource. Our organic fertilizer returns to the soil all the nutrients necessary to obtain quality productions. We replicate natural cycles by generating more energy than is necessary for the operation of the company, helping to reduce the environmental impact. We have a photovoltaic system that powers the entire farm and allows you to cut costs. We have a biogas production plant powered by different processing residues, which allows you to create biomethane. Finally, there is our phytodepuration plant, the largest in Southern Italy. The electricity produced by biomethane, equal to 998 kW/h, is fed into the national grid, covering the energy needs of 2,680 families.” ([www.fattoriadellapiana.it](http://www.fattoriadellapiana.it)).

transform these waste materials into biogas. The biogas thus obtained is burned to produce electricity which is sold to the national electricity company. The “Dairy” and the “Farmhouse” segments are self-sufficient as regards electrical energy and heat need thanks to the photovoltaic plant, built using solar panels applied onto the roofs of the farm. The fermentation residue of the biogas plant is transformed into fertilizer which is used to grow fodder. Biomasses (basically manure and sewage deriving from cattle breeding and milk processing) pose the ecological and economic problems of their disposal. The NBS model adopted by the company examined allows these problems to be transformed into profit and cost-saving opportunities. On the one hand, there are substantial cost savings since the companies participating in this NBS model do not pay the following costs: disposal and treatment of manure, sewage and discharges from the farm and dairy, since they are used as raw material for the biogas plant; water for irrigation purposes, provided by the phytopurification of waste water and farm and dairy drains; fertilizers, obtained as a residue from the fermentation of biomass in the biogas production plant; electricity and heat of the dairy and the farmhouse, thanks to the photovoltaic plant.

By reclassifying the accounting data, the following reporting by segment scheme was developed. It is based on the value-added model, which highlight the gross and net added value and the operating result of the different segments and which make synergies between segments deriving from the adoption of the NBS model evident (Table 1).

**Table 1.** The reporting by segment scheme adopted in the case study

Revenues and costs	Biogas plant		Photovoltaic plant		Dairy factory		Farmhouse		Total	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Sales										
Segment sales/Total sales	26%	27%	2%	1%	70%	70%	3%	2%	100%	100%
Net value added of the segment/Sales of the segment	16%	37%	26%	17%	12%	11%	61%	64%		
Net value added of the segment/Total net value added	29%	50%	3%	1%	58%	41%	10%	7%	100%	100%
Operating result of the segment/Sales of the segment	15%	33%	26%	17%	4%	0%	10%	-2%		

The biogas production plant also generates an annual turnover of more than €2.1 million (26% in 2017 and 27% in 2018 of the total sales of the company) through the transfer of electrical energy to the national electricity grid. In addition, the photovoltaic system also feeds electricity into the national electricity grid, generating a turnover of just over €120,000. While the dairy contributes a very high percentage to the corporate

added value, only a low percentage of the revenues become operating profit. This means that added value is mainly used for employee remuneration.

It is evident the relevance of this integrated segment reporting which highlights for each segment the economic performance, in terms of operating result, and the social performance, in terms value-added, provided for management (internal reporting by segment) and for stakeholders (external reporting by segment).

## 6 Discussion and Conclusion

This paper has the objective of answering the research question: How to implement integrated segment reporting using the NBS perspective? Following the initial implementation of integrated segment reporting in the “Fattoria della Piana” case, we can find that the dimensions underlined regarding NBS find the case very interesting result regarding the surrounding area in which the case is. This is shown by the certifications that represent annual recognition of the activity of this farm. Concerning the different dimensions of NBS: reduce, recycle and reuse, in the case analysed we found a very interesting relationship among them. The implementation of segment reporting is confirming the increase of the value added in each segment and the positive trend of environmental behavior using the value added by segment (Table 2).

**Table 2.** Segment Reporting, NBS initial results from “Fattoria della Piana”

NBS indicators				
Climate mitigation and adaptation	H It produces energy by burning non-polluting biogas	H It produces energy and heat using the sun's rays	M-H Heat and electricity are of photovoltaic origin	N
Integrated environmental performances	H It produces energy by burning non-polluting biogas	H It produces energy and heat using the sun's rays	H Heat and electricity are of photovoltaic origin	H Green building uses energy and heat from photovoltaics
Costs, tradeoffs, benefits and co-benefits for biodiversity, economy and community	H They have already recovered their investment in biogas	H They have already recovered their investment in photovoltaics over a few years	H They have already recovered their investment in photovoltaics over a few years	H They use energy and heat from photovoltaics
Public health and well-being	H It produces energy by burning non-polluting biogas There are no polluting emissions	H It produces energy and heat with the sun's rays There are no polluting emissions	H Km 0 There are no polluting emissions because they are used to produce energy and heat through the biogas plant	H Km 0 They use energy and heat from photovoltaics
Reduce	H It is reducing waste using it as fuel for biogas	H Because it is creating new energy for the other segments	N	H It is using products and energy that are produced by the farm
Reuse	H	N	H For production it is using milk of the farm and energy that is produced by photovoltaic	N

*(continued)*

**Table 2.** (continued)

NBS indicators								
Recycle	H Manure waste water use and whey and other liquids from the dairy		N		H		N	
Recover	H		N		N		N	
SEGMENTS	BIOGAS PLANT		PHOTOVOLTAIC		DAIRY FACTORY		FARMHOUSE	
Net value added of the segment/Sales of the segment	2017	2018	2017	2018	2017	2018	2017	2018
	16%	37%	26%	17%	12%	11%	61%	64%

Source: our elaboration (H: high; M: medium; N: neutral)

The combination of the drivers and dimension of NBS [16, 47] defined the qualitative approach and analysis of the case and we gave some explanations regarding how the management of each area is developing. Moreover, it is interesting to add the quantitative measurements by segment and we consider the added value determined by them, that is important in order to give such information as accountability of the economic implications of NBS behaviour of the farm. Therefore, to consider them in terms of NBS, we can affirm, regarding the answer to the research question, that the company is improving its environmental protection aspects through the segments and therefore of climate mitigation and adaptation.

The first results are limited because more information is needed to deeply analyse the environmental and social impact of “Fattoria della Piana”.

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