Innovating the Agricultural Sector: A Digital Framework of Circular Economy for Southern Italy

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Abstract

Nowadays agriculture has to deal with many challenges, including the implementation of new production models for the transition from Linear Economy (LE) towards Circular Economy (CE). In order to develop a more efficient model of production and consumption, it is fundamental mapping the use of natural resources, as water and soil, and the relationship between positive and negative externalities, as climate condition, that influence the sector. In this particular phase of quantification, the process elaborates a large amount of data that must necessarily be recorded and digitized. The paper addresses the objectives of the main topic of Basiq2022 Conference based on *"Regional innovation for sustainable development"*. The objective of this study is to design an interactive framework for the implementation in agriculture and based on the collection of data and subsequent sharing among the private and public stakeholders involved. Through this model it is possible towards the best model of Circular Economy in agriculture. The analysis is based on the stakeholder engagement guidelines (AccountAbility, 2018) which includes the use of the survey to build a model with sustainability indicators that can be replicated in other applications. In order to conduct the survey, it was involved the Regional Department of Public Administration with expertise on agriculture and supply chains. The results obtained are useful for establishing priorities in regional funding programs and establishing intervention areas.

Keywords

Agricultural sector, Southern Italy, Innovation, Digital Framework, Circular Economy.

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Introduction

The concept of Linear Economy (LE) explains a conventional model based on the *"take-produce-consume-waste"* approach characterizes the Circular Economy (CE) and consists of the sharing, rental, reuse, repair and recycling of materials and products that have already had a life cycle (European Parliament, 2021).

Therefore, Circular Economy focuses on the circular approach to the energy and materials use, providing environmental, economic and social benefits for the stakeholders involved in production, distribution and consumption chains.

The fundamental transition from a Linear Economy to a Circular Economy, especially in agricultural sector, requires an updated database with information on the waste of natural resources, on the production of waste, and on the climatic conditions, which have influenced this sector.

Among the economic sectors, agricultural sector strongly contributes to the consumption of resources (e.g. water, soil and energy), to the greenhouse gas emissions and waste (e.g. wastewater) generation. For this reason, is need to switch from Linear Economy to a Circular Economy in agricultural sector.

The data required to implement and optimize the transition to Circular Economy are often disaggregated, difficult to find, out of date, expired and complex to consult by some agricultural stakeholders, for example farmers and ranchers.

Analysing the scientific literature associated with this new topic, it emerged a shortage of papers (Klerkx, Jakku and Labarthe, 2019). Then, in order to address this gap, we presented this analysis regarding the sixty topics group named *"Regional innovation for sustainable development"*.

The aim of this paper is to identify a data-set model in order to enable all private and public stakeholders along the chain of agricultural activities to apply the most suitable sustainability indicators for the Circular Economy model.

We used a large quantity of digital sources, including bibliographic platforms, international and digital tools, regulations and standards.

The methodological path includes the following phases:

- questionnaire administration to a sample of stakeholders for mapping the potential lack of data concerns the planning the Circular Economy in the agriculture
- manipulation and analysis of data derived from this ad-hoc survey
- building of a matrix composed of reusable sustainability indicators
- modelling a digital virtuous framework towards a Circular Economy in agricultural sector.

The results obtained thought the survey will be used for planning activities and development interventions inserted in the future funds programme.

This new framework supports the stakeholders' decision-making process (Wolfert et al., 2017), achieve a Circular Economy approach and lead to a better collaboration in the agricultural sector.

Furthermore, the application of this Circular Economy knowledge model enables to overcome obstacles in data procurement (Newton, Nettle and Pryce, 2020).

Hence, digital transformation is a fundamental aspect in economic sectors, within the design phases of Circular Economy models, especially in primary and agriculture sector (Lajoie-O'Malley et al., 2020).

For this reason, starting from the theory of Chehri et al. (2020), the data collection activity must be organized and be functional to the stakeholders in order to move easily to the Circular Economy.

Additionally, the building of a replicable framework allows to widespread a digital learning and soft culture among stakeholders, create an effective and adoptable model in the Mediterranean regions, especially in agricultural sector.

Scholars, stakeholders, public administration and private business owners can use this framework to design a common language of data collection, identify the information gaps to be filled and plan Circular Economy strategies in agriculture.

1. Review of the scientific literature

We have analyzed the interest of scientific research on the topics of sustainable agriculture, Circular Economy and suitable tools through the Web of Science (WoS) platform. The scientific interest is quite recent and has highlighted only two certain results concerning the fundamental digital transformation to implement the Circular Economy.

For this reason, Klerkx, Jakku and Labarthe (2019) proposed a study with a twofold objective: to increase scientific production and to propose a new model for the implementation of the Circular Economy in agriculture.

A data collection model on agricultural activity would have ensured complete monitoring of sustainable practices and the design of implementable development plans as Della Chiesa et al. (2019) stated.

Chehri et al. (2020) also stated that coordination between information technology tools and agriculture can improve the management of farms and their practices, especially sustainable and circular ones.

2. Research methodology

The methodological path used is based on the AccountAbility guidelines (2018) which adopts an approach on the involvement of stakeholders, as contained in the AA1000 SES regulation.

Particularly, the main phases of this methodology are three:

- basing the first part of the analysis on the involvement of actors and stakeholders with the aim of understanding their expectations on aspects of governance, policies, strategies and practices,
- reporting the questions asked and the answers received with transparency and clarity,
- Create an innovative data collection and dissemination model to implement sustainable and circular practices.

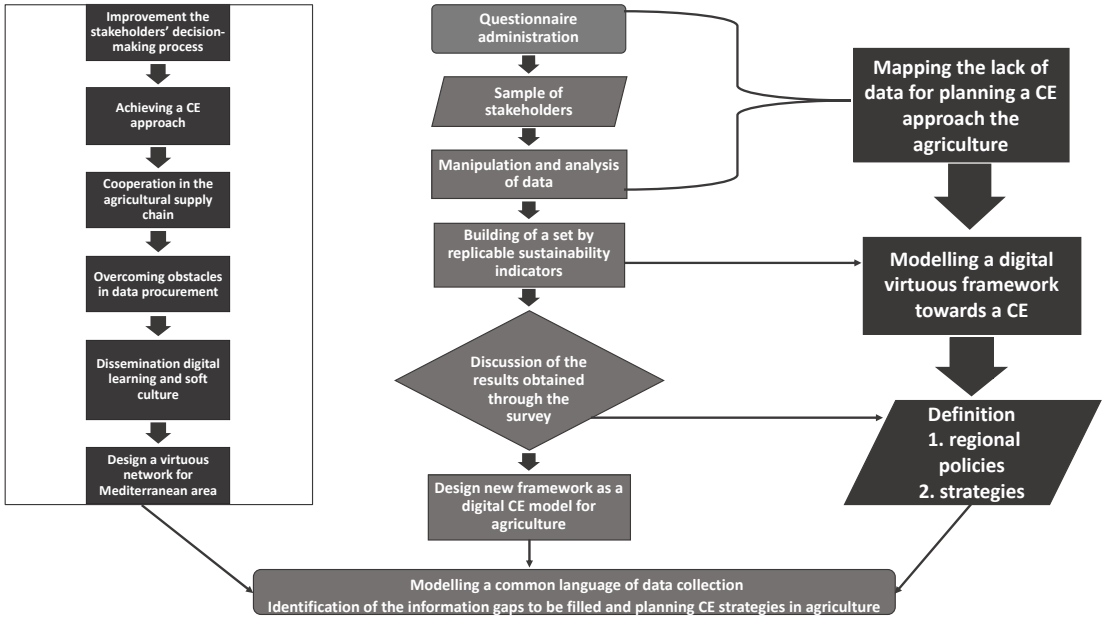

Figure no. 1. The methodological path
Source: Authors' elaboration.

Figure no. 1 explains the methodological path adopted in order to:

- elaborate a model, based on a common language, of data collection in agricultural sector
- identify the information gap reveled after the survey process.

The stakeholder engagement methodology (AccountAbility, 2018) is focused on the administration of questionnaires to analyze the needs of actors and stakeholders with the aim of effectively planning projects on sustainability and Circular Economy. The questionnaire was developed jointly with the public administration.

Therefore, the data gathered, processed and transformed through a statistics tool were inserted into a shareable and replicable framework.

Figure no. 2 shows the topic contained in the questionnaire administered and organized in four areas of investigation:

- General Information of stakeholders interviewed,
- Information about the relationship with Circular Economy practices implemented,
- Information about use/consumption and reuse of water resource,
- Interest in planning and funds activities.

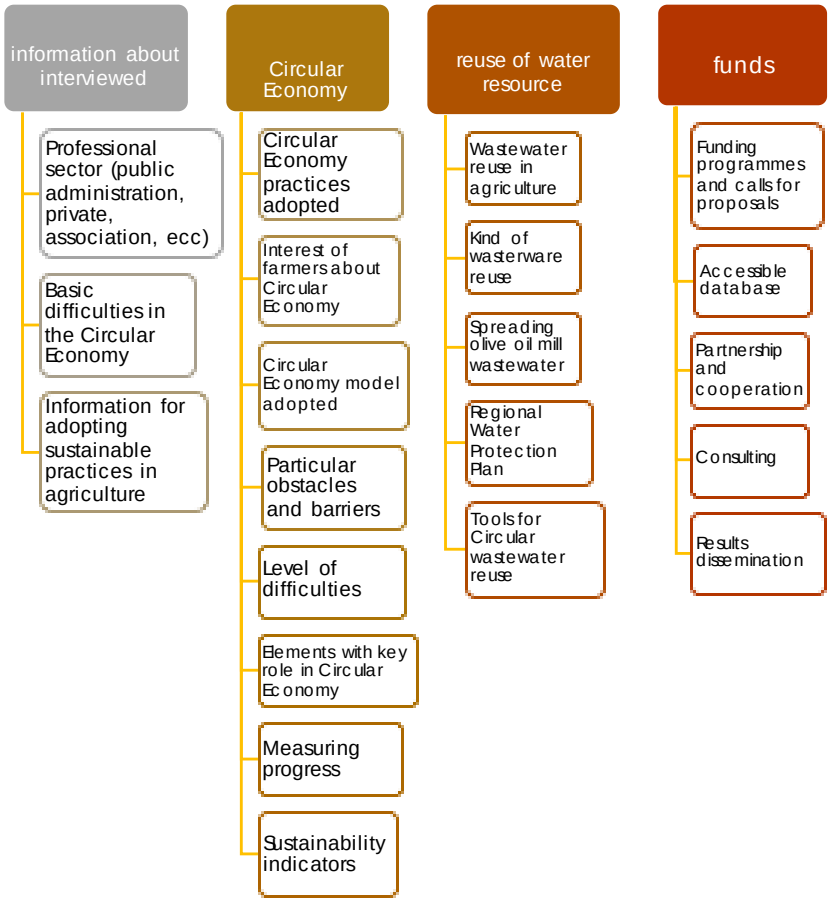

Figure no. 2. The structure of the topics and questions
Source: Authors' elaboration

Jointly with the regional body that deals with agriculture and supply chains, we have organized a list of public and private actors to be involved in the analysis.

The sample consisted of 60 public and private sector stakeholders working for the agricultural industry. Furthermore, the questionnaire was administered via email through a link that can be quickly shared and also reachable from a smartphone o personal computer.

3. Results and discussion

Compared to the initial sample, 52% of the interviewees answered.

Concerning question no. 2, 50% of the stakeholders highlighted the absence of direct tools to collect information on the implementation of the Circular Economy in agriculture; moreover, 40% noted the lack of technical training.

The 67% of the answers for question no. 3 stated that farmers often ask for information in order to implement the Circular Economy and Sustainable practices.

Furthermore, according to 3/4 of our sample investigated, some CE models have been activated in the agricultural sector and, although few, some industries have experimented with this innovation.

1/3 of the stakeholders interviewed stated that have been contacted in the past regarding wastewater reuse practices.

The sample stated that farmers encounter some difficulties in implementing the adequate production model of Circular Economy. Two thirds of the stakeholders highlight that the is the difficulty in finding specific information and receiving adequate training.

Furthermore, the sustainable use of water plays a key role in achieving the objectives of the Circular Economy, starting with the reuse of wastewater and agricultural waste.

Notwithstanding the purposes associated with Circular Economy practices, it is necessary to adopt participatory processes between actors and stakeholders, bottom up or top down, to facilitate the achievement of results.

2/3 of the sample is informed of the existence of sustainability indicators, while just over 1/6 adopt the reuse of waste water based on the storage of rainwater.

1/3 sample collaborated with farmers who also practice an agronomic use of vegetation waters.

On the contrary, however, no farmer knows the regional water protection plan drawn up by the regions. Almost 60% of the sample reiterated the need for coordination between the various bodies involved in the implementation of the Circular Economy and sustainable practices.

Furthermore, to better manage planning and financing activities, it is essential to digitize information and use a connected network even in agricultural spaces.

Currently, according to almost all of the sample, farmers encounter some difficulties in finding information, including digital, in the short term and easy to understand.

Nevertheless, 2/3 of the sample is ready to collaborate to design a participatory model of information collection for the implementation of the Circular Economy.

It should be emphasized that all the stakeholders interviewed in this first phase agree to share the results of this survey as they consider them useful and fundamental for the improvement of planning and project activities.

Finally, with the last part of this study, there were developed some indicators to be included in a useful framework for all actors and stakeholders in order to facilitate the implementation of an effective Circular Economy model.

Figure no. 3 displays the most important topics, such as data set, monitoring activities, implementation instruments, sustainable indicators, design framework, incentives and financing, planning activities, training and dissemination. These elements compose the innovative framework fundamental to meet the needs highlighted by our sample.

Then, this framework is useful to implement Circular Economy model in agriculture through the adoption of bottom-up processes for the actors in the agricultural supply chain.

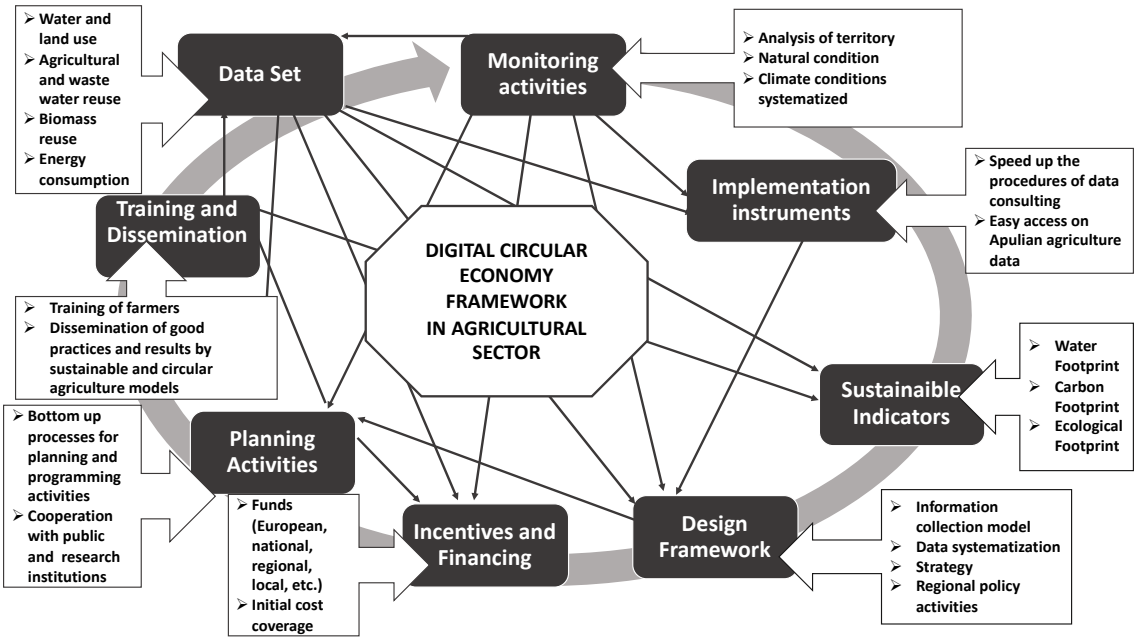

Figure no. 3. The digital circular economy framework
Source: Authors' elaboration

This paper deals with some useful ideas starting from the short scientific literature with the aim of creating a digital framework for the collection and sharing of data in agriculture towards responsible innovation, as Lajoie-O'Malley et al. (2020) proposed.

This investigation was conducted through the use of digital tools (link for the questionnaire and for data manipulation). The questions focused on the consumption of natural resources (such as water resources) and on the knowledge of some sustainability indicators.

This information obtained from the questionnaire is essential for planning activities, creating financing policies and activating suitable tools for sustainable and circular agriculture in Southern Italy.

Therefore, from this first questionnaire administered to this sample made up of public, private and agricultural associations, the urgency emerged to train and disseminate good sustainable practices through both bottom-up and top-down approaches.

The collaboration between actors, farmers and stakeholders, is crucial for implementing Circular Economy practices. Therefore, through a digital model of information, knowledge and skills it is possible to activate this step.

Conclusion and practical implications

We have proposed this dynamic architecture to design a transition model towards a Circular Economy approach.

This digital framework as Newton, Nettle and Pryce (2020) can improve stakeholder decision-making and lead to greater cooperation in the agricultural sector, especially in the southern regions.

It is an operational and knowledge model that allows stakeholders to overcome the obstacles in obtaining data associated with the agricultural supply chain as highlighted by Wolfert et al. (2017). The limitation of this research is the small sample of stakeholders involved, so the next research insights foresee to enlarge the sample.

Furthermore, this replicable model, creating a virtuous network between actors and stakeholders, allows the diffusion of soft culture and digital learning not only in Southern Italy but in the Mediterranean.

Thus, through this study we have strengthened the capacities of public administrations by involving scientific research methodologies and the public interest of the administrative regions, for the purpose of implementing the Circular Economy approach.

Therefore, starting from this new framework, the public administration would find greater stimulus to design strategies and financing programs to allow stakeholders to implement a better Circular Economy model, evaluating the data of the sustainability indicators.

Finally, the digital transformation especially in the agricultural industry will support the various strategies that can be implemented to favor the transition from the Linear Economy to the Circular Economy.

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