"Smart Farming Innovation Brokers: Fostering the Digital Innovation Hubs approach to Increase modern farming potential"
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Intellectual Output 1

Executive summary

1. Introduction

Technological innovation is transforming agriculture, enabling the rise of smart farming processes to overcome environmental and social future constraints (from the speed in the rise of population to climate change).

Modern agriculture is increasingly based on the introduction of external energy into the system in the form of pesticides, mechanization, fertilizers, genetic engineering, technology, namely intensive agriculture.

The continuous growth of world food needs, the need to keep food prices low, the reduction of the cultivable surface, the need to cultivate even in clearly unfavourable areas (sometimes also due to pollution) and to be able to obtain products of high nutritional quality, pushes farmers to find new solutions that are compatible with the success of the final product (in terms of both economic and quality), but also with low pollution. Such economic, social, and environmental drivers sustain the rise of a new approach to agriculture, rooted in a better control over the processes.

In particular the digital transformation in the agriculture is linked to better production and use of data, where farmers can expand data generation through a larger set of inputs – thanks of sensors and Internet of Things – as well as data elaboration and use.

Smart farming use industry 4.0 technologies in the agricultural sector to deliver a more sustainable and productive agricultural production, based on a more precise and efficient use of resources. Smart farming include different technologies enabling new, more accurate decision processes based on management information systems, the development of precision farming and the use of automation and robotics.

2. Adoption of smart farming technologies: knowledge, barriers and skills

With the aim of exploring the level of knowledge concerning smart farming among farmers in the five countries, their level of adoption as well as the related skills and competences, an international survey has been carried out between **November 2018 and January 2019.**
Two target groups have been identified:

- SMEs in the farming sector located in each of the countries of the project;
- Institutions (i.e. farmer associations) providing services and support to farmers and operating in relation to the farming sector.

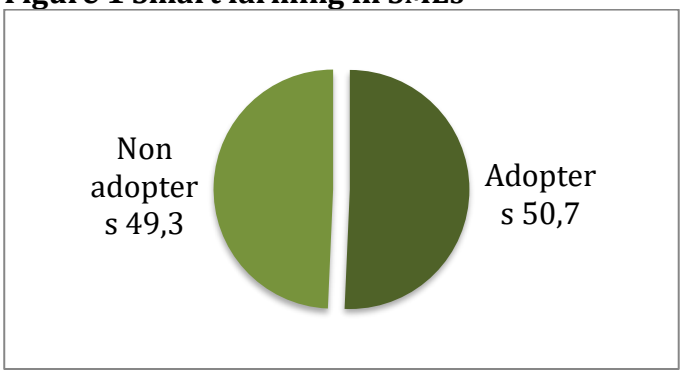
Two different questionnaires covering the following topics:

- SMES: Technologies adopted (industry 4.0 and ICT); degree of investments; motivation of the investments or NOT investments; results achieved; barriers/obstacles; map of internal competences available for innovation/technology implementation and partnership; knowledge on DIH and their role of DIH in supporting innovation
- Institutions: scope of activities and source of funding; motivation for adoption of smart farming; difficulties in adoption; competences and skills required by farmers.

Results refer to **100 questionnaires** collected: 67 SMEs and 33 institutions.
In addition **14 case studies** have been collected into the 5 countries.

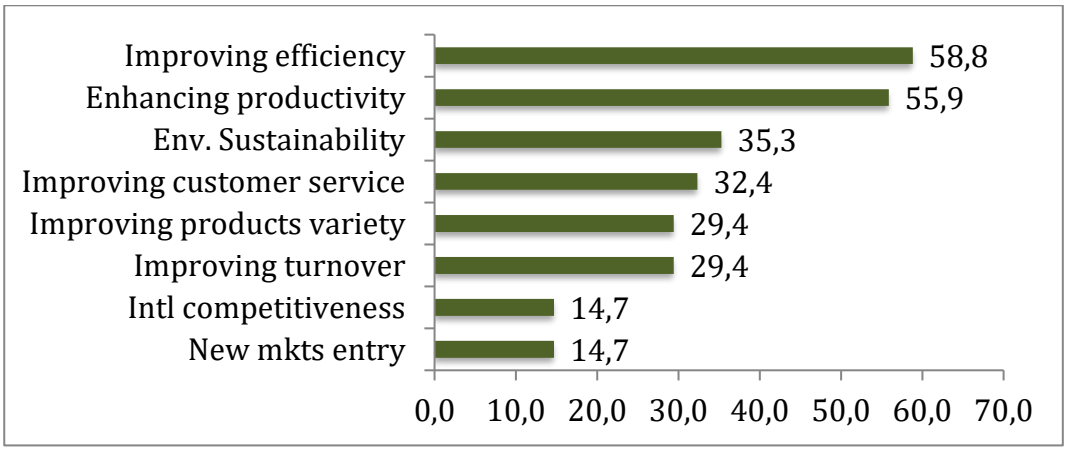
Almost half of the SMEs have adopted at least one technology related to smart farming applications (Figure 1).

Figure 1 Smart farming in SMEs



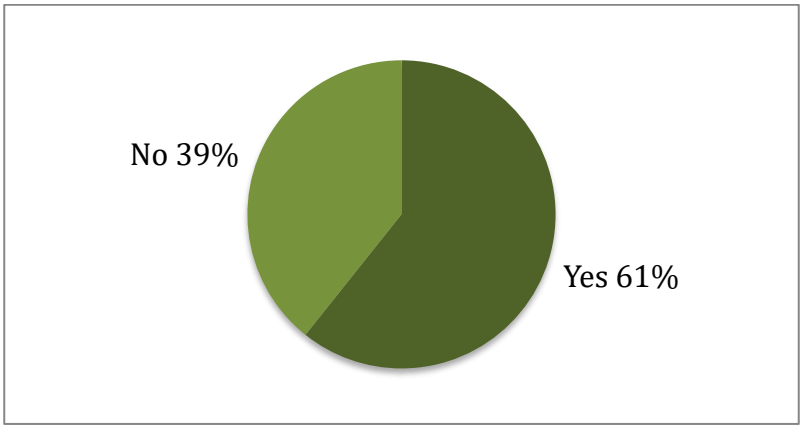
The most diffuse technology is robotics (28.4%), followed with similar percentage of adoption by the use of drones and satellite imagery, Internet of Things (i.e. sensors), and big data/cloud. Robotics and IoT have been adopted since 2014, while the most recent technology is 3D printing (i.e. for spare parts).
The majority of farmers consider the lack of economic resources the main motivation for not investing in technological innovation, followed by limited knowledge concerning industry 4.0 technologies. With almost the same rate of responses there are the difficulties in interpreting the potentialities of such technologies and lack of internal competences.
If we consider instead motivation for adoption, the most important is the possibility to gain efficiency, followed by environmental sustainability and market-driven reasons (offering).
Results obtained are aligned with goals (Figure 2). By far, efficiency and productivity are the two dominant results obtained, where the others are less important. This result is consistent with the promises of the technological scenario related to smart farming, enabling a more accurate use of resources.

Figure 2. Results achieved through smart farming



More than half of adopters exploit public incentives (i.e. fiscal incentives) to support their investments in smart farming technologies and 69% will do it in the near future.
In terms of competences, the majority of farmers perceive to be ready and competent in the selection and management of smart farming technologies. The impact on productivity and efficiency is perceived also when considering for the impact on employment. 72% of farmers observe no changes in the employment, while about one fifth increases the number of employee.

Figure 3 Availability of internal competences for technology selection and management



According to the institutions sustainability and market-driven motivation are the most important, followed by efficiency, international competitiveness and other reasons.
Concerning the reasons for not adopting smart farming solutions, it emerges the relevance of lack of knowledge as the main obstacle, while the lack of economic resources ranks behind.
According to institutions, the main competences required for farmers for a positive adoption of smart farming solution are as follows:

- Technical knowledge (ability to work/exploit data)
- Basic vs. advanced ICT skills and knowledge
- Capability to identify business opportunities related to technologies (entrepreneurial competence)
- Competence related to process/organizational change (readiness for change)

3. Conclusions

As it emerges from the survey as well as through case studies, there are high investments in robotics, followed by other technologies for control and data management (drones, IoT, big data/cloud). Farmers carried out often multiple activities and a variety of them, so also such dimension has to be considered.

In general farmers have invested in smart farming solution since 2014 on average. It is not a recent process, which instead started about 4-5 years ago depending on the technological solution considered (3d printing is the most recent technology adopted).

Investments are oriented to increase efficiency and environmental sustainability, while results achieved refer to efficiency and productivity. There are also positive results in terms of employment, where adopters have in few cases also increase employment.

In the process of implementation technological partners as key partners, while DIH are not considered as point of reference for innovation purposes and support.

Farmers stress the relevance of financial resources both as a limitation for adoption and as a difficulty perceived for adopters. This result is consistent with present and future use of public funds for smart farming by farmers interviewed.

As far as the competences are concerned, most of adopting farmers stress the presence of internal competences supporting technological innovation, while the difficulty in implementation is more related to financial resources. Non-adopting farmers rank 2nd lack of knowledge related to smart technologies (4.0) as reason for not investing, beyond economic resources. From the institutional perspective, motivation for not adoption are related to the lack of competences with respect to financial constraints and further investigation is required in this respect.

Two open issues that require further attention during the project.

First, from the empirical analysis it emerges that farmers are interested in simple and easy-to-use technologies, where data become accessible and easy to be used. Instead, data elaboration should be carried out by technicians (agronomists, veterinarians) that help farmers with data analysis in their context of applications. From this point of view, technological platforms could support an integrated view of data only in alignment with knowledge supporting services (KIBS – knowledge intensive business services).

Second, the level of technological competences of farmers is relevant, but has to be managed taking into account the priority on financial resources that farmers highlight when considering smart farming investments.