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Precision farming: what do Italian farmers really think? An application of the Q methodology

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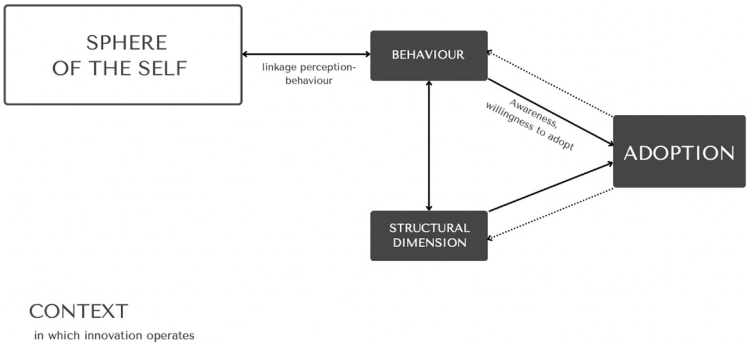
HIGHLIGHTS

- Few efforts were made to better understand the role played by the farmers' perception in the adoption of innovation.
- The Q methodology is used to study the perspectives on innovation in agriculture.
- Different perceptions about innovation reflect the context in which farmers operate.
- Understanding farmers' views can be useful for the policy network.

GRAPHICAL ABSTRACT



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ABSTRACT

CONTEXT: Precision farming (PF) is a term that is now widespread throughout agricultural systems worldwide. It is studied in many ways, from its strictly technical connotation of a farm management strategy that uses information technology to support decision-making processes to the steppingstones and the dissection of the factors involved in the complex scenario of adopting related tools. Starting from the statement "*In my opinion, precision farming is…*", the present work investigates the perspective of the agricultural entrepreneur in conceptualising PF. Some researchers have highlighted the role of the sphere of the *self* in adoption, but few efforts have been made to better understand the role played by farmers' perceptions in the formation of their thinking about innovative tools.

OBJECTIVE: This work aims to deepen the sphere of the self and, in particular, the role played by farmers' perceptions when faced with the innovation adoption choice. The study presents a new conceptual framework identifying key stages for analysing adoption processes, focusing on the relationships between behaviour, structural dimensions and adoption, interpreted from the farmer perspective.

METHODS: The Q methodology (QM) was used with a targeted sample of 23 farmers to identify prevailing discourses. In the first step, the socio-structural dimensions were analysed through descriptive analysis, and in

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the second step, the discourses were extracted by an intercorrelation matrix through the centroid procedure, translating the solution using varimax rotation.
RESULTS AND CONCLUSIONS: This paper highlights that the QM is an appropriate technique for exploring and studying farmers' attitudes when challenged with innovation. The results reveal discourses that summarise three macro perspectives: the "proactive approach", which represents farmers who perceive PF as having a key role for agricultural enterprises; the "conservative approach", which characterises those who distrust innovations; and the "doubtful approach", which is the more sceptical vision.
SIGNIFICANCE: This study demonstrates the importance of moving beyond simply quantitative studies that methodically analyse adoption processes and overcoming the constraints of qualitative research by employing a mixed approach to identify the common perspectives of farmers. This analysis can be used by policy makers as a new survey tool to make stakeholder consultations more effective, as the 3 approaches may help to enrich the discourse on PF. The results provide new perspectives to promote responsible policies to support the effectiveness of PF.

1. Introduction

The European Green Deal includes an action plan aimed at promoting the efficient use of resources by moving to a clean and circular economy and aimed at restoring biodiversity and reducing pollution. The European Commission (EC) has developed guidelines to support the achievement of these objectives by "*investing in environmentally friendly technologies*" and by "*supporting industry in innovation*" (European Commission, 2019). Precision farming (PF) has the potential to meet the challenges posed by the public ambition to produce more while consuming fewer resources (Stafford, 1996; Ogle et al., 2014; Coluccia et al., 2020). PF has been defined as "*a concept of agricultural management based on observation, measurement and response to inter- and intra-field variability in crops or livestock aspects*" (European Parliament, 2014, p.11). Not only are European institutions supporting it as a fundamental practice for the development of agricultural sustainability in the future, but they are also focusing on the political need to act to improve farming practices, for which it is necessary to "*boost investments and uptake of new technologies and digital-based opportunities such as precision agriculture*" (European Parliament, 2016, p. 16). Studies have addressed the crucial role that data management will play in making farmers' work more efficient (Daberkow and McBride, 1998; Finger et al., 2019) through the use of combined technologies (geographic information systems (GISs), remote sensors, smart tractors) and operational focuses (use of fertilisers and pesticides, soil tillage regime, water saving, etc.) (Robertson et al., 2012). In addition to these strictly technical factors, socio-ethical and environmental variables linked to the application of technological innovation (TI), in terms of good or negative impacts on agriculture in the future, should be considered (Lioutas et al., 2021). Today, new responsibilities have been assigned to agri-food systems along with the challenge posed to innovation processes to produce a desired scenario, especially in environmental and socio-ethical terms for the agriculture of the future (Charatsari et al., 2022; Rijswijk et al., 2021). In this sense, the need to boost a more responsible adoption of innovation paths is emphasised within the field of responsible research and innovation (RRI) (Stilgoe et al., 2020; Gremmen et al., 2019). Only a few studies have examined the extent to which RRI principles have been applied to PF (Rose and Chilvers, 2018; Eastwood et al., 2019). In particular, the development of a framework of responsible innovation (RI) in agriculture requires the study of 4 dimensions (Charatsari et al., 2022): anticipation, inclusion, reflexivity, and responsiveness. Anticipation is related to the ability of research and innovation policy to anticipate an unfavourable scenario in terms of potential environmental and socio-ethical risks, while reflexivity has been defined as the promotion of new reflection processes around innovation processes by including all prospective actors to reduce negative impacts while enhancing positive outcomes. Furthermore, the inclusion of stakeholders and bottom-up governance strategies have been proposed as principles for promoting engagement in innovation processes and innovation trust. The last principle, *responsiveness*, includes the ability to support a change of course within innovation processes once new knowledge, emerging challenges or needs have been discovered.

The RRI literature has risen to prominence in relation to numerous technologies that have high potential but considerable uncertainty. However, applications to precision farming technologies (PFTs) are limited (Bronson, 2019). Analysing the desirability of PF through the RRI lens may be very useful since scholars have highlight the notable difficulty in the transfer and adoption of TI. As a demonstration, many authors have described several barriers to adoption, from the costs incurred to the difficulty of use (Aubert et al., 2012; Long et al., 2016), which can be fully captured by the concept that Vecchio et al. (2020a) defined as the "complexity" perceived by farmers. Starting from these considerations, the aim of this study is to understand farmers' perspective on the theme. Specifically, "*In my opinion, precision farming is…*" is the relevant issue from which this research starts. To answer this question, it is necessary to emphasise that the optimisation of production processes involves many dimensions of farms, such as the technological, economic, institutional, and behavioural dimensions (Barnes et al., 2019). These aspects can be interpreted as pieces of a conceptual puzzle, of which some have been widely investigated, while others have not. In the field of research on agricultural innovation, the aspects involved in the sphere of the self of the farmer, that is, "*a set of behavioural aspects such as motivation, emotion, relationships, perception and cognition*" (Markus and Kitayama, 2010 p. 421), have been less explored. Only a few authors have explored this dimension, mainly addressing the theme of perception (Reimer et al., 2012; Methorst et al., 2017; Knickel et al., 2018; Vecchio et al., 2020a). These studies have described perception as a functional variable in the adoption process, defining the main links with other pieces of the puzzle. In the complex adoption framework, our aim is precisely to colour the picture of farmers' sphere of self and, more specifically, farmers' perceptions. This study, however, intends to attribute to perception a character of exceptionality due to its subjective nature as an element belonging to the cognitive sphere. For this reason, this work proposes to study the adoption process by proposing a theoretical framework in which perception is isolated and analysed on a different level than that of the other pieces of the puzzle. Such analysis enables us to capture the views of farmers by overcoming the inevitable bias caused by the design of surveys aimed at establishing functional links (Barnes et al., 2019). To that end, our survey focuses exclusively on farmers' perceived meaning of the term "precision farming". Furthermore, we accept the relevance of subjectivity in filling the content of the sphere of the self. Going into the cognitive sphere in the context of the self means carrying out an in-depth investigation. As with any survey and methodology chosen, it involves having biases but at the same time being able to collect very detailed information that is difficult to capture with quantitative techniques and tools. Although the results obtained cannot be generalised, they represent important insights and enrich the knowledge of the subject under analysis.

Consistent with these aims, we use the Q methodology (QM), theorised by Stephenson in 1935 and defined by Brown (1980) as a "bridge". According to Durning (1999) and Ellis et al. (2007), the QM is useful for analysing the transition between positivism and post-positivism

(Durning, 1999; Ellis et al., 2007) aimed at the study of subjectivity. It mixes qualitative approaches, which are necessary to capture the multiple facets of subjectivity that escape numerical reduction, with quantitative techniques that help to measure results. Our work takes into account a purposive sample of 23 farmers, and the application of the QM has allowed us to identify prevailing discourses whose interpretation contributes to enriching the debate on PF, providing a new perspective on the subject to policy makers. Additionally, the QM can be used to rethink policies for the dissemination of innovative tools, and, in this regard, provide a better understanding of the transfer of innovation to the agricultural sector to improve the effectiveness of innovation policy. Finally, the discourses of this study can provide new insights to boost responsible policies, even more so since RRI applications to PF are quite limited.

The article consists of an introduction, followed by the theoretical background in which the transfer of technology for innovation processes is explored. Then, the key dimensions influencing PFT adoption are discussed, including the sphere of the self. In the third section, the methodology is presented, followed by the results. The discussion and conclusions close the work.

2. Theoretical background: the complexity of technology transfer for innovation processes

In the period of agricultural modernization, innovation has been conceptualised as a linear and unidirectional flow of knowledge of a top-down type from researchers to farmers (Rogers, 1962). During the 1960s, the innovation process shifted from a “science push” model to a “market pull” model, underlining the role of demand (Cook and Morrison, 1961; Hayes and Abernathy, 1980; Rothwell, 1994). These approaches, defined as technology oriented, aim to study the innovation process only through technical and economic factors (Knickel et al., 2009). Over time, these trajectories, strongly disconnected from the needs of farmers and from the context in which innovation operated, led to explorations of more systemic approaches to innovation, such as the agricultural knowledge and information system (AKIS) and, later, the agricultural innovation system (AIS) (Röling and Engel, 1990; World Bank, 2006; Knickel et al., 2009; Schut et al., 2014). In fact, it was only in the 1990s that innovation was conceptualised as a contextualised "networking process", implying a learning process between actors. It is precisely this new conceptualisation that marked a change from "top-down" to "bottom-up" approaches, where science and technology are embedded within a social and institutional context (Klerkx et al., 2012). The contextual inclusion of "innovation processes", well explained by Elzen et al. (2012) with the term "anchoring of innovation", has been highlighted for adoption in the PF field (Welter, 2011; Tey and Brindal, 2012). The literature has shown how anchoring mechanisms are an optimal strategy fostering an environment that is conducive to scaling innovation in this field (Geels and Shot, 2007; Schut et al., 2020; Seifu et al., 2020; Vecchio et al., 2020b). On the one hand, this evolution reflects the complexity of anchoring innovation processes in agricultural systems; on the other hand, it reflects that farmers’ thinking has played an increasingly active role in innovation processes over time (Klerkx et al., 2012). Hence, there are numerous contributions that researchers have proposed to try to identify the drivers of and barriers to adoption at the farm level.

2.1. The process of adopting PFTs and the role of farmers' perceptions

Even though governments, industry and funding agencies have made efforts to persuade farmers of the benefits of PF, adoption has been low or fragmented. Together with the analysis deepening the complexity of the transfer of innovation, researchers have tried to assess the reasons for this low uptake. First, numerous studies have tried to determine the characteristics of adopters and the contextual factors based on which farmers may more easily accept a new technology in their management (Ghadim et al., 1999; Reichardt and Jürgens, 2009; Barnes et al., 2019).

Most studies have pointed out that young farmers appear to be more involved in agricultural innovation (Kutter et al., 2011; Watcharaanantapong, 2012). The reasons for this propensity lie in the fact that new generations report a higher level of education and, at the same time, a growing need for information, which is similarly positively correlated with adoption, in addition to greater exposure to and familiarity with virtual technologies (Tey and Brindal, 2012; Läpple et al., 2015). The need to acquire skills in the use of these tools is also combined with the high investment cost of these tools. In fact, with their ability to absorb costs, large farms have been described as being more willing to adopt innovation. Small enterprises can become PFT adopters through contractors or partnerships (Hategekimana and Trant, 2002).

At the same time, the labour intensity indicator gives a clearer idea, in relation to the production activity analysed, of how much agricultural activities are accompanied by new tools or whether manual labour is still present. A relationship emerges between high values and the propensity to adopt PFTs (Vecchio et al., 2020c).

The role of adopters in the context in which innovation operates has been widely investigated in the literature by identifying numerous dimensions concerning not only the structural dimension and farmer perceptions but also the institutional context (Welter, 2011; Barnes et al., 2019; Kebebe, 2019). In particular, the institutional context includes social and cultural dynamics and environmental and policy aspects (Archer et al., 2008; Markus and Kitayama, 2010).

To understand adopters, researchers have explained how the decision to adopt is only partly linked to the structural and institutional dimensions of farms (Barnes et al., 2019). Among the factors already mentioned, some studies (Tey and Brindal, 2012; Methorst et al., 2017) also include the perceptions of farmers.

Perception is the result of a subjective assessment made by the potential user regarding the attributes of innovation (Aubert et al., 2012) and the influences exerted by the structural and institutional dimensions in orienting behaviour in the adoption process (Markus and Kitayama, 2010; Reimer et al., 2012). Among the attributes, many authors have focused on the perceived relative advantage (Rogers et al., 2005; Long et al., 2016) and, in particular, farmers’ profitability (Walton et al., 2008). Others have highlighted that the perception of the technological and organisational complexity of innovation can significantly influence adoption (Larson et al., 2008; Robertson et al., 2012; Vecchio et al., 2020c).

Many theories have tried to explain behaviour in the adoption process by emphasising the role of perceptions, the figure of the adopter and background factors (Joffre et al., 2017; Taherdoost, 2018). Since the 1960s, the early theories and models of technology acceptance and adoption have emphasised the role of behaviour and perception as key variables in the adoption process. Fishbein and Ajzen’s theory of planned behaviour (TPB) (1975) and later extensions postulated that the individual's behaviour is the result of multiple components, such as attitude, subjective norms, and perceived behavioural control.

In social cognitive theory (SCT), Bandura (1986) reports how behaviour, personal factors (personality, cognitive and demographic aspects), and the external environment of the individual are bidirectionally connected in understanding the adoption process.

Davis (1989) theorised differently in his technology acceptance model (TAM) that attitudes are the determinants of behavioural intentions to perform an action or not and are based on perceived ease of use and perceived utility (Davis, 1989; Bishop et al., 2010; Reimer et al., 2012). The TAM itself has been extended by exploring the determinants of perceived utility and perceived ease of use, introducing the relationship between them into the structural dimension (Venkatesh et al., 2008).

These theories are the starting point and lay the groundwork for investigating the links between i) contextual and structural factors, ii) perceptions, and iii) behaviour that could predispose individuals to adopt new technologies. However, in these models, where perceptions

or behaviour is taken into consideration, the agent is always considered rational (Knowler and Bradshaw, 2007). This is the vision offered by classical economics, in which the actor manifests autonomous and fixed preferences disconnected from the context (Kahneman, 2003, 2011; Hoff and Stiglitz, 2016).

In contrast, in behavioural economics or in the field of sociology, researchers have spoken of "quasi-rational actors" and even "enculturated" decision makers, whose perceptions and behaviours are shaped by the context (Fiske et al., 1998; Markus and Kitayama, 2010; Hoff and Stiglitz, 2016). The perception-behaviour link has been widely recognised in the psychological research field, which addresses how "*perceptions guide action but so too do actions influence what is perceived*" (Vernon et al., 2015 p.1). The role of the self in this linkage has been highlighted by Jaswal (2016, p.1), affirming that "*perception-action coupling is not only manifest in the behavioural arena, but also shows up in the internal processes of the agents, particularly those related to the self*". This is confirmed by Markus and Kitayama (2010), who discuss a mutual and dynamic constitution of context and the self. For example, regarding the concerns of the self, perceptions are subjected to profound social and non-social influences exerting lasting effects on the behaviour and in the moment of decision making due to the context to which individuals have been exposed until that moment (Di Maggio, 1997; Cialdini et al., 2006). Reimer et al. (2012) is one of the few studies that in the field of adoption that analyses how the characteristics of farmers and farms as well as the and farm context can shape the perception of a new technology and, consequently, the individual's behavioural intentions towards it.

The literature shows the enormous efforts made, especially regarding three aspects: codifying the phases of technology diffusion, theorising adoption models, and identifying the major drivers of and barriers to adoption and all its influencing factors. It is possible to summarise the points previously discussed as follows.

- Adoption is a social process that should be studied with structural factors, the concerns of the self, and institutional factors, which probably cannot be explained by a single theory (e.g., TAM, TPB, theory of diffusion, SCT) but, rather, by a combination of theories (Fishbein and Ajzen, 1975; Bandura, 1986; Davis, 1989; Venkatesh et al., 2008; Straub, 2009; Reimer et al., 2012).
- The role of the self in the adoption process has been highlighted in the sociological field, based on which an "encultured" decision maker is described (Jaswal, 2016; Markus and Kitayama, 2010; Hoff and Stiglitz, 2016)
- In the agricultural field, progress has been made in investigating the role of the self. In particular, a few studies have deepened the understanding of adoption, proposing models by emphasising the perception-behaviour link and their relationships with structural dimensions (Lugandu et al., 2012; Reimer et al., 2012; Schirmer and Bull, 2014; Methorst et al., 2017; Knickel et al., 2018; Ntshangase et al., 2018; Acheampong and Cugurullo, 2019; Vecchio et al., 2020a).

Despite the extensive literature dealing with this subject, there is a lack of research evaluating the direct perspective of farmers based on the sphere of the self. Against this backdrop, it is necessary to find approaches to understand the real perspective of farmers. This paper tries to answer the question "What do farmers really think about PF?" to arrive at a more systemic and holistic understanding of innovation processes in agriculture.

In this framework (Fig. 1), several elements known in the literature about the transfer of innovation are underlined: the process is not linear but holistic (Knickel et al., 2009), with a circularity of influences; and behaviour and structural dimensions play crucial roles in the intention to adopt (Barnes et al., 2019). The most important aspect to emerge is the role played by the self, which represents the "*cornerstone*" for the whole process, the piece of the puzzle that summarises all the external and internal variables of the individual and that generates and conditions the whole sequence.

3. How can farmers' real perspective be analysed? An application of the Q methodology

To analyse the sphere of the self, agricultural research has used either quantitative or qualitative methods. According to studies (i.e., Pierpaoli et al., 2013; Ahmed and Haq, 2019), both methods present limitations: quantitative methods are not suitable for modelling that which falls within the sphere of subjectivity (Durning, 1999), while qualitative methods, despite being able to better capture the cognitive sphere, translate the results with ambiguity and pose the problem of generalising the results (Lawlor, 1996).

To overcome this limitation, the literature has suggested the use of hybrid methodologies (Guerin et al., 2018), and among them, the QM is increasingly appreciated by researchers and analysts (Cools et al., 2009; Yarar and Orth, 2018). The QM starts from the theory of limited independent variety (Keynes, 1921) or from what Stainton Rogers (1995) calls "finite diversity", with the aim of collecting and exploring the variety of relationships that individuals construct (Kitzinger, 1987). This is possible when, in QM-based studies, participants are presented with a heterogeneous set of stimulus items, i.e., the "Q set", which they must actively rank in order (Watts and Stenner, 2012). This task allows them to focus on their subjective experience. Thus, it is not only the "builders"

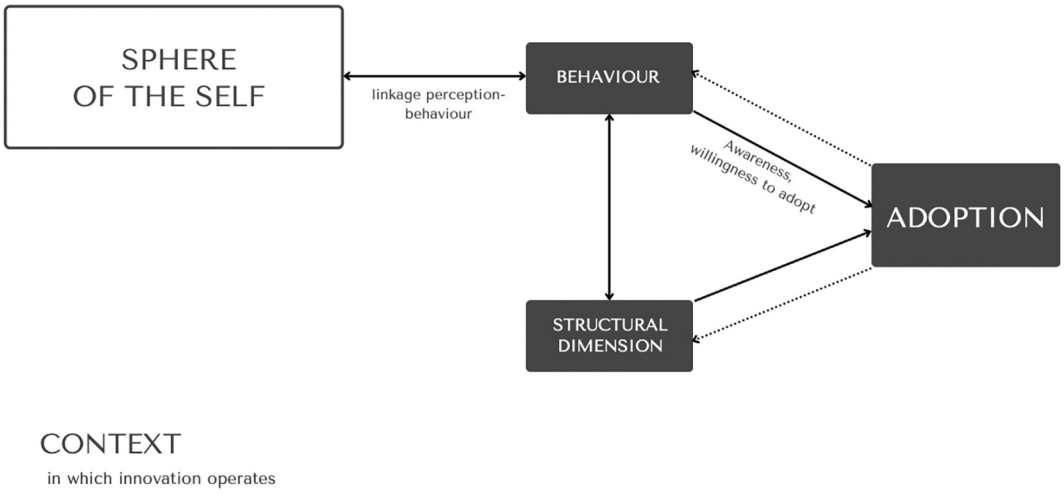

Fig. 1. Conceptual framework.

(the participants) who are at the centre of the method but also the "constructions" themselves (Stainton Rogers, 1995). The main purpose of the methodology is to discern the perceptions of people about their world from the self-referential perspective, making it possible to comprehend subjectivity (McKeown and Thomas, 2013). This approach permits us to obtain "socially less desirable" responses than Likert measures (Fluckinger, 2014). Socially desirable responses influence psychometric tests, especially if obtained with a Likert scale (Hough and Oswald, 2008), and can hardly be regulated with an artifice or a measure after detection, which generally occurs with a scale involving social desirability (Podsakoff and Organ, 1986; Spector, 2006). Thus, the QM represents a strategy for analysing socially desirable responses, distinct from the social desirability trait as commonly measured (Zerbe and Paulhus, 1987), trying to limit the individual's behaviour and allowing a significant non-cognitive construct. As defined by Brown (1997), the QM is a quali-quantological approach that allows the study of complex phenomena on which various different perspectives can exist, thus representing a bridge between quantitative and qualitative approaches (Sell and Brown Steven, 1984; Dennis and Goldberg, 1996; McKeown and Thomas, 2013). For these reasons, the methodology is often used to observe attitudes (Cross, 2005), allowing a reactive but statistically rigorous approach to subjective perceptions (Barry and Proops, 1999). In fact, while a typical quantitative analysis (for example, factor analysis) focuses on the discovery of correlations and models through variables, the QM aims to reveal correlations with a measure of the nature and extent of the relationship between people (Watts and Stenner, 2012). The "quantitative" analysis step is then used to identify correlations within individual responses, followed by a qualitative interpretation to investigate personal beliefs, perspectives and meanings regarding a given topic (Previte et al., 2007; Vecchio et al., 2020d). Therefore, the QM allows researchers to compare the similarities and differences between subjective viewpoints and, ultimately, to construct consumption segments that share an "underlying secular theory" (Brown, 1993), with the aim of assigning an a posteriori significance through the researcher's interpretation of the selection distribution (Brown, 1980).

4. Method

The QM that we employed in this work is based on the five-step procedure shown by McKeown and Thomas (2013). The five steps are outlined in Fig. 2.

To carry out this analysis, the first two steps are the most important; defining the "concourse" and creating the Q set can affect the whole analysis. The former is the raw material of the Q study that provides the "self-referent notions" (Stephenson, 1953) arising from shared understanding, whose specific meaning may differ depending on the context (McKeown and Thomas, 2013). Since the volume of the concourse can be infinite, it has to be dimensionally reduced to obtain the Q set, which is the collection of statements related to the most important aspects of the study theme (Brown, 1980). The sentences included here should represent a variety of different opinions and feelings rather than being limited to concrete facts (Brown, 1993). Following the procedure shown by McKeown and Thomas (2013), the concourse was built using scientific publications, newspapers, farmer blogs or interviews, conversations, commentaries, and texts related to the subject. From this review, we defined a final concourse composed of 80 statements (annex 1 - Concourse). Using an inductive approach (Glaser and Strauss, 1967), the analysis shows that several dimensions influence farmers' perceptions of PF and its adoption. These dimensions are not a strict categorisation; rather, they represent a guide to ensure coverage of the most relevant aspects related to farmers' opinions on PF. Several rounds of discussion were implemented among researchers to delete and rephrase redundant and unclear statements. At the end of the described procedure, the initial list was refined into a more comprehensive Q sample composed of 33 statements. Q samples must be composed of statements that are "natural" in the language of the participants and "comprehensive" in their representation of the subject (McKeown and Thomas, 2013) to provide individuals with the opportunity to best express their personal opinions (Watts and Stenner, 2012). Consequently, the use of academic language should be avoided to facilitate understanding, and a balanced number of positive and negative statements should be included to avoid opposites or similar statements (Stephenson, 1953). Small sheets of paper are used to print the declarations, which are also identified with a code (Brown, 1993) that cannot influence the participant during the process. Before being administered to the sample, the test was tested by a collaborator. In our case, the list of declarations was chosen based on the literature on precision agricultural tool adoption, focusing on drivers and barriers. In the third phase, it is necessary to select participants (the so-called P set) who are theoretically relevant to the research question (Van Exel and De Graaf, 2005) and who have a defined perspective to express what matters in relation to the topic (Watts and Stenner, 2012). This interview method was first tested among the members of the research group to

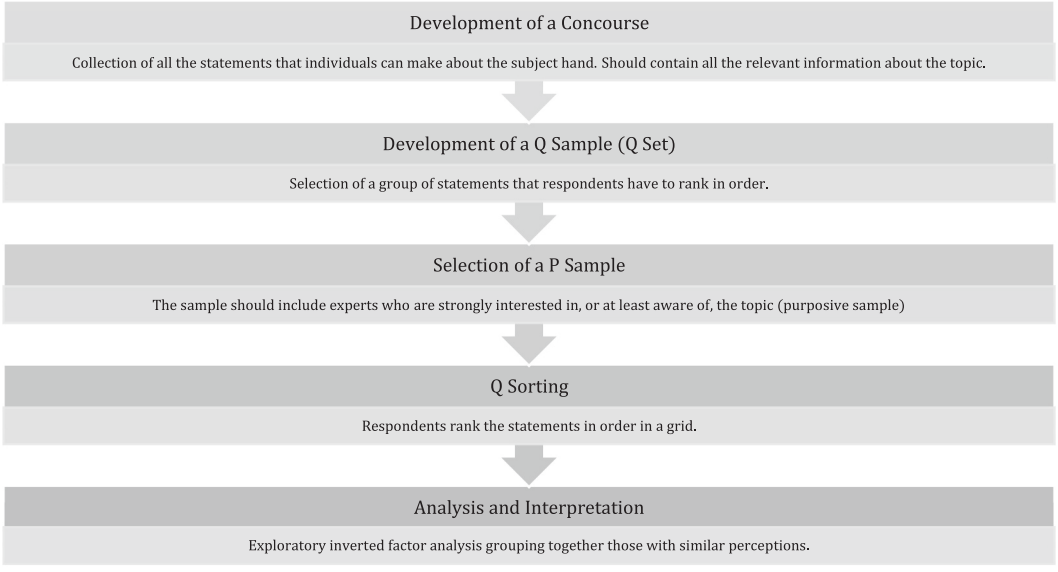

Fig. 2. Steps in the Q methodology.
Source: our elaboration based on the five-step procedure of McKeown and Thomas (2013).

determine the best way to submit the questionnaire. After a test, it was decided to proceed from the socio-demographic questions and then proceed to the Q sorting phase. The P set is usually smaller than the Q sample, typically from 10 to 40 people (Brouwer, 1999). The reason for this can be found in an ancient maxim attributed to Roman Emperor Marcus Aurelius, who stated that "*the opinion of 10,000 men has no value if none of them knows anything about the topic*", leading us to the choice of a purposive sample of farmers who have at least "heard of" PF (Coleman et al., 1955). Therefore, an intentional sample of 23 farmers was selected. The interviews were conducted by two researchers who selected the respondents based on the question "*Have you ever heard of innovation, technological innovation, or precision farming in agriculture?*" This allowed us to select only those agricultural entrepreneurs who had the necessary conditions to carry out our questionnaire.

The interviewees were asked to voluntarily participate in the study. No financial compensation was promised or subsequently awarded. They were informed of the objectives of the investigation, the duration of the interview, and the possibility of abandoning the investigation at any time, and they were given the contact details of the principal investigator for any clarifications or indications on the matter. The interview was conducted by starting with a conversation to retrieve some basic information, such as the socio-structural characteristics of the farm, and it then proceeded to the Q sorting phase. This was carried out by making a sign with the grid, which was completely white so as not to influence the respondents, and providing them cards with statements. The researchers actively supported the respondents in case they had questions. Each interview lasted between 45 minutes and 90 minutes.

The interviews were carried out based on the respondents' knowledge ("heard of ") of PFTs, and they were conducted during three agricultural fairs, one in Bologna (representative of northern Italy), one in Rome (representative of central Italy) and one in Matera (representative of southern Italy). The interviews were conducted in a face-to-face manner through the use of a poster. Based on the traditional scheme, this format has favoured the Q sorting phase. The composition of the sample defined itself through the filter question "*In my opinion, precision farming is…*", and the number of interviewees was defined a priori by the authors in a manner consistent with Watts and Stenner (2012), who reported that the number of respondents should be less than 70, representing nearly half of the selected items. Phase 4, Q sorting, is the moment when the interview takes place. All participants received detailed instructions (in writing) to complete the questionnaire together with the statements and a card for the socio-demographic data. Initially, the participants classified the declarations (reported in Table 3) about "In my opinion, precision farming is…" into three groups (agreement, disagreement or neutrality) and subsequently ordered these in slots of an almost normal forced choice distribution of 9 total points on paper (Fig. 3), ranging from "completely disagree" (−4) to "neutral" (0) to "completely agree" (+ 4) (Brown, 1980; Davies and Hodge, 2007). In this way, the numbers of the Q sample items are recorded in the slots that replicate the distribution of the items for each of the Q sorts (McKeown and Thomas, 2013).

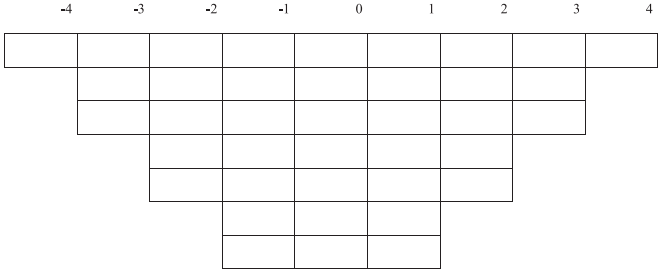

Fig. 3. Example of the fixed quasi-normal distribution. Values are ranked in a range from −4 to 0 to +4. A total of 33 items could be accommodated in the distribution illustrated.

INSERT HERE FIGURE 3

This type of distribution, which follows a normal distribution and thus forces a number of items towards the midpoint, should facilitate the process of standardisation of the sorting procedure and was considered by Stephenson to be the pre-arrangement of choice for gathering QM data. This process has become the standard approach of the methodology (Watts and Stenner, 2012). Watts and Stenner (2012) suggest collecting more information after the Q sort to better interpret the answers. For this reason, after sorting, additional data were collected, particularly regarding the respondents' personal data (age, gender, education, income, position, etc.). Finally, an inverted factor analysis is carried out (Stephenson, 1935; Fleiss, 1971) since a typical factor analysis directs its focus on the discovery of correlations between variables, while the QM correlates and factorises people (Watts and Stenner, 2012; McKeown and Thomas, 2013). Factor analysis is then used to identify correlations within individual answers, and it is followed by a qualitative interpretation to show personal beliefs, perspectives and meanings regarding a given topic (Previte et al., 2007). The analysis was run with KADE v1.2.0 software.

5. Results

5.1. Sample characteristics

The analysed sample (Table 1) has a slight prevalence of men (53%). The age of the interviewed farmers is wide, varying from 25 to 55 years. The farm size is also quite varied, although the average farm size is higher than the national farm size of 8.4 ha (CREA, 2020) and amounts to more than 43 hectares. All companies employ family manpower with a minimum of 1, i.e., only the spouse, and up to 5 members. Approximately 60% of the sample claims to have organic production. The degree of PFT adoption is quite high (1 out of 3 respondents says that he/she is already adopting), while 50% say they will adopt in the near future. As shown in the table, the companies interviewed have an equal distribution between northern, central, and southern Italy.

5.2. The analysis

The QM allows us to identify some common factors in individuals' perceptions of the PF theme. The intercorrelation matrix was realised through the centroid procedure, translating the solution through the use of varimax rotation, which is considered the best solution for the QM (Watts and Stenner, 2005). Subsequently, through the criterion of eigenvalues greater than one (Rajé, 2007), 5 factors were selected, and the characteristics of the factors are presented in Table 2.

The five groups of discourses we discovered are shown in Table 3.

Table 1
Sample.

Variable	Minimum	Maximum	Average
Age	25	55	38
Utilised Agricultural Area (UAA)	1	130	42.09
Family component involved in the farm	1	5	2.5
		Frequency	Percentage
Education	*Primary*	0	0
	Secondary	7	30.43%
	Bachelor's degree	10	43.48%
	Master's degree	6	26.09%
Organic production	*Yes*	13	56.52%
	No	10	43.48%
Innovation adoption	*Adopter*	6	26.09%
	Non-adopter	7	30.43%
	Planner	10	43.48%
Location	*North*	9	39.13%
	Central-South	14	60.87%

Table 2
Factor characteristics.

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
No. of Defining Variables	7	4	3	4	5
Avg. Rel. Coef.	0.8	0.8	0.8	0.8	0.8
Composite Reliability	0.966	0.941	0.923	0.941	0.952
S.E. of Factor Z scores	0.184	0.243	0.277	0.243	0.219

The factor scores are the result of weighted averages (Z scores) of the values given to each statement during the Q sorting phase. In Table 2, the Z scores are converted into the original scale values (-4 to +4) to provide a clearer representation (Ellingsen et al., 2010).

The five discourses were analysed by examining the statements that most represented the discriminating points or the points of contact between the different perspectives. Once this had been done, it was possible to define the discourses as follows:

Discourse 1: "The key to success"

Members of this group strongly agree that PF is the use of new technological tools in agriculture to increase product quality and yields and that it gives the adopter a competitive advantage. These respondents do not think that PF is too complex for their knowledge or experience, and they do not associate the use of new technological tools with economic risk that is too high for their business. The entrepreneurs in this group do not think that PFTs are technologies that involve only young farmers or that they are a very widespread technology in their territory and in the Italian sector. They agree on the fact that PFT are a technology that supports decisions by monitoring their activity, and they think that PFTs develop in the presence of innovation services.

Discourse 2: "A way for sustainability"

The members of this group agree on thinking that PFTs are a technology that supports their decisions by monitoring their activity and strongly believe that they would be impossible to use without a computer or an internet connection. They strongly agree with the fact that PF is a strategy that can be pursued only through the development of an environment that sees the collaboration of research institutions, the territory and the agricultural world, and in contrast, they do not consider producer organisations to be a necessary element to achieve it. PFTs are considered an easy-to-use technology that does not involve only young farmers. The farmers in this group do not see PFTs as a suitable technology for large companies, and they do not think that they are difficult to implement without financial support such as bank loans. They strongly disagree with the fact that PF is difficult to enforce in the agroecological context in which they live, and they connect the use of PFTs with major environmental sustainability.

Discourse 3: "Something far from me"

The entrepreneurs in this group agree that the use of new technological tools in agriculture can increase their yields and the quality of their products. As PF is considered too complex for their knowledge and experience and impossible without a computer or an internet connection, they think that PF requires organisational and structural adaptations that are difficult to implement and that a producer organisation is not enough to practice it. The members of this group do not consider PFTs to be a widespread technology in their territory or in the Italian agricultural sector. PF is not considered relevant to their current practices, and they do not feel that PF could improve the working conditions

Table 3
Statements.

N.	Statement	Group 1	Group 2	Group 3	Group 4	Group 5	Z Score variance
1	the use of new technological tools in agriculture to reduce production costs	0	2	−2	3	2	0.698
2	the use of new technological tools in agriculture to increase my yields	3	−1	3	−1	3	0.483
3	the use of new technological tools in agriculture to increase product quality	4	1	3	1	−1	0.518
4	the use of new technological tools in agriculture to be more environmentally sustainable	1	3	−1	−4	−4	1.686
5	relevant to my current practices (not optional)	0	0	−3	1	−3	0.703
6	the use of new technological tools in agriculture to be more efficient (maximise the ratio between input and output)	2	1	2	2	1	0.041
7	difficult without financial support (e.g., bank loans, etc.).	0	−3	−2	−1	3	0.85
8	too complex for my knowledge/experience	−3	−1	4	1	0	1.07
9	an easy-to-understand technology	−2	−2	−2	−4	4	1.342
10	an easy-to-use technology	−2	3	1	−2	−1	1.161
11	a very expensive investment	−1	−1	0	0	2	0.265
12	a technology that develops with the presence of innovation services	3	0	2	−3	0	0.754
13	a very widespread technology in my territory	−4	1	−3	1	−4	0.853
14	a practice that fits my business model	−1	−1	1	4	−2	0.937
15	the use of new technological tools in agriculture to make the management of my farm easier	1	2	2	−1	1	0.138
16	the use of new technological tools in agriculture requiring organisational and structural adaptations that are difficult to implement	−1	0	4	−2	−3	1.239
17	the use of new technological tools in agriculture requiring radical changes in current agricultural practices	−1	−1	0	2	−2	0.273
18	the use of new technological tools in agriculture requiring training/information costs	2	1	1	−3	3	1.021
19	the technology that supports my decisions by monitoring my activity	3	3	0	2	0	0.266
20	the use of new technological tools in agriculture that is associated with economic risk that is too high for my company	−3	0	−1	3	−1	0.878
21	the use of new technological tools in agriculture that partly replaces the labour force	1	−2	−1	−1	1	0.351
22	necessarily supported by economic or training support measures	1	0	1	−3	−1	0.345
23	a practice that makes my job easier to do	2	−2	2	3	0	0.503
24	a practice that gives me confidence and that I would recommend to others.	0	2	1	2	−2	0.505
25	a technology to improve the working conditions of the employees in the company	0	−2	−3	−1	0	0.343
26	a widespread reality in the Italian agricultural sector	−3	2	−4	4	1	1.524
27	a technology suitable for large companies	−2	−4	−1	0	4	1.709
28	a technology that involves only young farmers	−4	−3	0	0	2	0.814
29	impossible without a computer or an internet connection	−2	4	3	0	1	1.321
30	difficult in the agroecological context in which I live	−1	−4	0	0	−1	0.59
31	a strategy that can be pursued only through the development of an environment that sees the collaboration of research institutions, the territory and the agricultural world	1	4	−2	1	−3	1.266
32	a technology that gives me a competitive advantage	4	1	−1	−2	2	0.642
33	practicable if supported by a producer organisation	2	−3	−4	−2	−2	0.813

of the employees in the company.

Discourse 4: "I don't really realise the usefulness"

The farmers in this group strongly consider PF to be a practice that fits their business model and that can make their job easier to carry out, even if it is not easy to understand how it works. They are the only respondents to strongly think that PF is a widespread reality in the Italian agricultural sector and that it can develop without the presence of innovation services. The entrepreneurs in this group consider it the use of new technological tools in agriculture to reduce production costs but not to be more environmentally sustainable, and for them, PF is associated with an excessive economic risk for the company. PF is not considered the use of new technological tools requiring training and information costs or support by economic and training measures.

Discourse 5: "Yes, but no thanks"

The members of this group consider PFTs to be an easy-to-understand technology that is suitable for large companies, but they do not think they are relevant for their current practices or that they are widespread in their territory. They think that PFTs are difficult to implement without financial support and that they requires training and information costs. The necessary structural and organisational adaptations for this kind of activity are considered to be difficult to implement, but the farmers in this group do not consider external collaboration the only way that can be pursued. They strongly disagree with the fact that PF corresponds with the use of new technological tools to be more environmentally sustainable, but they agree with the use of these tools to increase yields.

The analysis of the discourses shows us five different thoughts on PF. The five thoughts have in common two key dimensions that are interrelated to each other, which are the propensity to innovate and the perceived complexity of using tools, which can be represented in a graph by classifying the two dimensions (Fig. 4)

INSERT HERE FIGURE 4

6. Discussion and conclusion

The aim of the work was to understand Italian agricultural entrepreneurs' perspectives on PF to determine the role and strategic importance that PF tools could have for the sector. To achieve this aim, it was necessary to explore the sphere of the self. To measure the role of farmers' sphere of the self in the adoption process, this paper proposes the use of the QM to identify discourses that could play a predominant role in the formalisation of the adoption process. From the analysis conducted through a quali-quantitative approach, 5 predominant perspectives that contain and summarise many of the barriers and drivers found in the literature (Long et al., 2016) emerged, highlighting how the complexity of use and the understanding of these innovative tools are the most important components from the entrepreneur's perspective (Aubert et al., 2012; Vecchio et al., 2020a). The perspectives have elements of contact and strong differences. Discourse 1 is the only discourse that sees PFT as something that could give farmers a competitive advantage and the only discourse that sees it feasible when supported by a producer organisation. Discourse 2 is the only discourse to strongly think that PFTs are a set of technologies that can increase the environmental sustainability of the company, while the others, especially Discourses 4 and 5, strongly disagree with this statement. Discourse 2 is also the only discourse that relies more on collaboration with others, especially compared to Discourse 5. Discourse 3 includes those who consider PF too complex for their knowledge and experience and those who see it as the use of new technological tools in agriculture requiring organisational and structural adaptations that are difficult to implement. Their idea that PF is something difficult to achieve without equipment such as computers and the internet is shared with Discourse 2. Discourse 4 includes those who have the highest consideration of PF as a practice that fits their business model even if they have the strongest idea of it as a technology that is not easy to understand, and they are the only farmers to see it as a widespread reality in the Italian agricultural sector. He members of this discourse are the only ones who do not see it as the use of new technological tools in agriculture requiring training and information costs; furthermore, they have the lowest agreement on the fact that PF has to be supported by economic or training support measures. Discourse 5 is the only discourse that considers PFTs to be an easy-to-understand technology that is suitable for large farms. They think that PF requires training and information costs and that it is a difficult activity to be carried out without financial support. Nevertheless, they have the strongest consideration of PF as a strategy that can be pursued even without the collaboration of institutions or other farms. The members of all groups consider PF to be the use of new technology to be more efficient by maximising the ratio between input and output to a slight extent.

The extracted perspectives answer the research question we asked ourselves at the beginning of the work, that is, "*precision farming for me is*…", delving into the cognitive sphere of entrepreneurs. Unlike other works in the literature, this study extends beyond the perception-adoption link (Reimer et al., 2021), but we try to outline those thoughts that can be useful to stakeholders and policy makers to better understand the PF phenomenon. The aim of this paper was "*to colour the picture of farmers' perception*", and the analysis provided five different "*colours*" to better outline the picture of the puzzle pieces. In fact, using

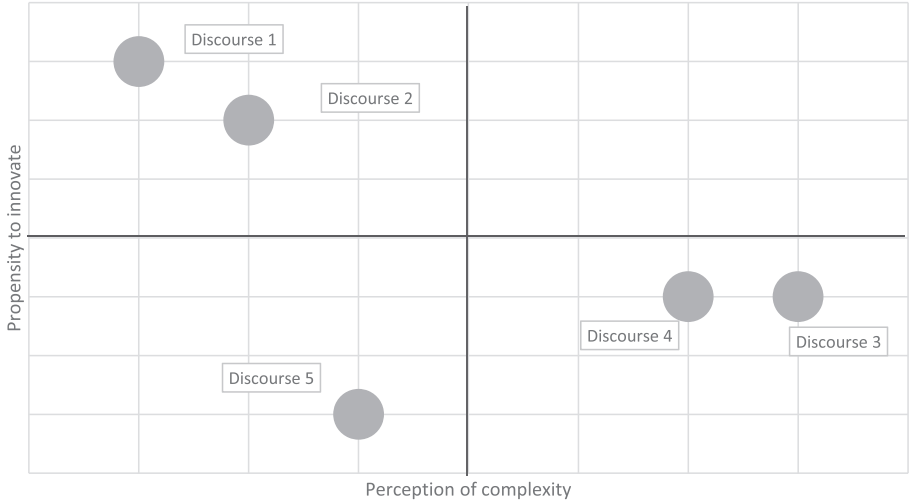

Fig. 4. Discourse positioning diagram based on the propensity to innovate and perceived complexity.

the QM, we were able to outline 3 macro approaches:

- The "proactive approach" shared by Discourses 1 and 2. The first two discourses share a proactive attitude towards PF. The first perspective summarises the PF concept as the only possibility to face the challenges of the future and as the only way to adapt to a changing scenario. The second summarises the utilitarian vision of these instruments as the optimal solution to improve the environmental and economic sustainability of businesses. In both visions, it is perceived that PF now plays a key role in agricultural enterprises.
- The "*conservative approach*" shared by Discourses 3 and 4. The two discourses are connected by the perception of complexity that individuals have with regard to PF. The third discourse is characterised by distrust of innovations, while the fourth is characterised by a conservative vision.
- The "*doubtful approach*", introduced by Discourse 5. This approach summarises the more sceptical visions.

Furthermore, it could be important to emphasise that the self-selected sample of respondents belonging to these 3 approaches is, on average, composed of young people (under 40 years of age), confirming studies reporting that the propensity for knowledge and adoption of new technologies in agriculture is a prerogative of young actors (Larson et al., 2008; Kassie et al., 2013). This study highlights a possible lack of knowledge and information in the advanced age groups, who decided not to respond to our investigation and who, according to the literature, rely mainly on their experience rather than digital support in their farm management (Khanna, 2001) and rarely appear as experts in this kind of study. The QM could be a useful method for answering the question "*What do farmers really think about PF?",* revealing in our results some relevant perspectives of Italian farmers and overcoming the limitations of qualitative and quantitative methodologies in studying the self.

Given our results and in the context of innovation processes in agriculture, we believe that a mixed method, such as the QM, allows us to colour the piece of the cognitive sphere, which we have set ourselves to investigate. This opens the door for future developments to research to understand the interactions between the cognitive sphere and the other pieces of the puzzle to arrive at a more systemic and holistic understanding of innovation processes in agriculture.

This analysis provides new contributions to the study of PF adoption, focusing all the attention on the perspectives of entrepreneurs rather than making another classification of the business types more or less inclined to adopt PFTs.

The results contribute new evidence for the debate on PF, providing policy makers with a new perspective on the subject, giving them new insights to rethink policies for the diffusion of innovation technologies and, likewise, to encourage actions to prevent the eventual negative impacts of PF. This work provides insights to overcome the constraints highlighted by the doubtful and conservative approaches and to improve PFT knowledge by going beyond socio-demographic barriers.

These considerations are truly topical, in light of what has been discussed at the European level in recent documents on the new programming period (2021–2027). Among the key factors in the development of the European Union, these documents include two themes concerning precisely the cognitive sphere: information and knowledge (European Commission, 2019). These aspects, if valorised, could represent a turning point to remove doubts and transform negative perspectives into approaches that see PF as a successful way and a useful tool to improve not only agriculture but also the environment.

Analysing the desirability of PF through the RRI lens can give us a further key to interpreting the 3 approaches, as they could have a role in informing *responsible* policies. Indeed, if we were to ask whether PF is capable of changing agriculture in a positive way, it might be likely that the 3 approaches would produce different answers. The "*conservative approach*" is represented by those who could answer this question with a vision of PF that is sceptical of producing positive impacts on the agriculture of the future. Similarly, the "*Doubtful approach*" presents uncertainties related to the perceived effectiveness of innovation. In contrast, the "*proactive approach*" is represented by those who support the potential of TI more, with even different opinions on the type of benefit generated on the basis of the discourses involved (Discourse 1, Discourse 2).

Studies that have proposed the application of RRI dimensions to PF are still limited. Most of those that have done so have concluded that efforts to develop RRI in this field are needed (Eastwood et al., 2019). Additionally, from the present study, it emerges, for example, that the "*conservative approach*" reveals gaps in the inclusiveness of stakeholders, which are linked to the uncertainty regarding how TI can produce benefits for the agriculture of the future. In this regard, the literature has extensively examined the uncertainty surrounding the adoption of technological tools and their consequences from multiple perspectives. First and foremost, uncertainty has been linked to difficulty in recognising the beneficial and negative effects of technology. In this way, exploring farmers' perceptions of expected benefits offers us some insights. Second, the difficulty of communication between PFT providers and users, which is linked to the challenging adaptation and implementation of these tools, adds to the uncertain situation. Finally, market conditions and policy uncertainty play a role in this framework (Long et al., 2016; Eastwood et al., 2017; Eastwood and Renwick, 2020).

Finally, we have the "proactive approach", which supports the efficacy of the technology but which advocates two different discourses: Discourse 1 is supported by those who conceive of PF as a viable way to give the adopter a competitive advantage, offering benefits mainly related to increasing product quality and yields; Discourse 2 is supported by those who likewise have a vision of the future strongly mediated by technology, the use of which allows farm management to be easier with the possibility of increasing environmental sustainability. Both see the use of technology as being strongly linked to the prospect of achieving business improvements. In fact, it seems that the vision of the "*proactive approach*" is that which conceptualises innovation as "*business innovation, strongly market-oriented*", with the aim to "*increase the wealth of the actor(s) who initiate or adopt it*" (Charatsari et al., 2022, p. 4).

The strongly utilitarian view that especially belongs to Discourse 2 emphasises that, with regard to PF, these people probably have developed a "*knowledge of how*" rather than a "*knowledge of principles*", justified by the fact that they claim that TI is easy to use. Most likely, then, as Sahin (2006) reports, this kind of knowledge leads individuals to understand how PFT technically works, but they still need to investigate the broader reasons why it should be applied. The risk in this situation is to act in everyday decision-making processes with a distorted view of the future.

The results of this research suggest that the analysis of bottlenecks to PFT adoption is only the starting point of the potential aspects that contribute to supporting an effective path of responsible innovation, from the company perspective to actions implemented at the policy level. Future RRI efforts require additional efforts from all stakeholders to fully incorporate the dimensions of RRI into PF to create more *responsible* policies.

As the limitations of this study, it addressed only the perspective of farmers. Much more needs to be done in future research to consider the views of all engaged stakeholders (i.e., policy network) as well as normative directions to fully assess the application of the RI framework to PF.

These findings underline the importance of promoting *responsible* policies; at the European level, the Green Deal intends to invest in more environmentally friendly technologies and support both the innovation industry and the effectiveness of innovation policy. This initiative emphasises that the development of TI is critical to facilitating the agri-food sector and, more broadly, the European economy's (De Castro et al., 2020) sustainable transition, which is under pressure to be competitive and resource efficient in the face of massive environmental challenges. In this sense, PF has the potential to facilitate this sustainable transition,

although further study is still needed to understand the reasons associated with the low uptake of PFTs, including the sphere of the self. The results of our work, identifying clusters of discourses present in the agricultural sector, could also be useful to inspire non-European researchers to carry out an in-depth research in their own contexts to verify the effectiveness of the measures put in place by local initiatives. In fact, as is well known, the issue of TI in agriculture is not exclusive to Europe and has now become the theme of sector policies at the global level, as shown by the experiences of the Commonwealth Scientific and Industrial Research Organisation (CSIRO) in Australia and the Ministry of Agriculture and Rural Affairs (MARA) in China, for example. In this way, the experience of some studies conducted in non-European countries (e.g., Zhu et al., 2019; Tian and Tian, 2021) underlines the mediating role of RI between stakeholder pressure and final company sustainability performance. The application of RRI principles to PF can broaden the debate on the role of *responsibility* associated with promoting an effectiveness innovation pathway, regarding which efforts are still needed in both European and non-European countries.

Thus, promoting the spread of innovation in agriculture, such as TI and smart solutions for organising the production and sale of food products, has become a fundamental objective not only for the development of a country's primary sector but also for the entire global economic system, which today, more than ever, needs security of supply to meet the challenge of "*zero hunger*", which is one of the sustainable development goals proposed by the United Nations.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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Appendix A. Concourse

N°	Statements
1	the use of new technological tools in agriculture to reduce production costs
2	the use of new technological tools in agriculture that increase production costs
3	the use of new technological tools in agriculture to increase my yields
4	the use of new technological tools in agriculture to be more sustainable
5	the use of new technological tools in agriculture to change the agricultural practice
6	the use of new technological tools in agriculture to increase product quality
7	the use of new technological tools in agriculture to standardise all productions
8	the use of new technological tools in agriculture to be more environmentally sustainable
9	a technology to improve quantity production
10	relevant to my current practices (not optional)
11	a practice not relevant to my current practice
12	the use of new technological tools in agriculture to be more efficient (maximise the ratio between input and output)
13	difficult without financial support (e.g. bank loan).
14	easy also without financial support (e.g. bank loan).
15	only a digital solution
16	too complex for my knowledge/experiences
17	a technology that involved only super specialized farmer
18	a technology that can create a big added value
19	a technology suitable only for multifunctional farms
20	a technology useful only for commercial activity
21	a technology useful only for industrial activity
22	an easy-to-understand technology
23	a technology that could be useful to improve my personal life
24	an easy-to-use technical technology
25	a difficult-to-use technical technology
26	a very expensive investment
27	a cheap investment for my farm
28	a technology that develops with the presence of innovation services
29	a technology that can be introduced without public support
30	a very widespread technology in my territory
31	a tool uncommon for my territory
32	a tool uncommon for Italy
33	a practice that fits my business model
34	a practice that could change my business model
35	the use of new technological tools in agriculture to make the management of my farm easier
36	an instrument that changes the management of my farm
37	the use of new technological tools in agriculture that could be run only if you are a digital expert
38	the use of new technological tools in agriculture requiring organisational and structural adaptations that are difficult to implement
39	a revolution for the organization of my farm
40	the use of new technological tools in agriculture requiring radical changes in current agricultural practices
41	the use of new tools in field not adapt for my business
42	the use of new technological tools in agriculture requiring training/information costs
43	the technology that supports my decisions by monitoring my activity
44	the use of new technological tools in agriculture that is associated with economic risk that is too high for my company
45	the use of new technological tools in agriculture that partly replaces the labour force

(*continued on next page*)

(*continued*)

N°	Statements
46	necessarily supported by economic or training support measures
47	an individual choice of the entrepreneur
48	the introduction of technological tools in farms to create new type of jobs in agriculture
49	the introduction of technological tools that should be support from the state
50	a way to improve financial conditions of my employee
51	a practice that makes my job easier to do
52	a practice that could be too complex for my employee
53	a practice that gives me confidence and I would recommend it to others.
54	a practice that does not make me feel comfortable
55	a technology to improve the working conditions of the employees in the company
56	a non-ethical choice for my business
57	a danger to human health
58	a practice that worsens the quality of products
59	a practice to replace human activity in my business
60	the use of new technological tools in agriculture that join human capital
61	the possibility to improve knowledge in the farm's activities
62	a widespread reality in the Italian agricultural sector
63	a technology suitable for large companies
64	a technology suitable for every type of farm
65	a technology that involves only young farmers
66	a technology that involves old farmers
67	a technology that involves all type of farmer
68	impossible without a computer or an internet connection
69	impossible without a computer
70	useful only for animal husbandry
71	difficult in the agroecological context in which I live
72	not depending on agroecological context
73	a strategy that can be pursued only through the development of an environment that sees the collaboration of research institutions, the territory, and the agricultural world
74	a strategy that can be perform alone
75	a technology that gives me a competitive advantage
76	only a modernization of my farms
77	only an instrument to run my activity
78	practicable if supported by a producer organisation
79	practicable if supported by university
80	a practice to favour consortium with other farms

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