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ORIGINAL ARTICLE

Work-related stress in agricultural industry: a preliminary investigation

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ABSTRACT

The present paper investigates the agricultural industry's social aspects, particularly those related to farmers. Starting with an analysis of the literature and official reports, the work describes the current problematic situation for the farmers' well-being. The research focuses on identifying the leading causes of their psychological stress through qualitative analyses made through personal interviews and questionnaires. Several reasons for stress were detected. The most prominent one was found to be harvest uncertainty. Finally, some solutions for actions to tackle the problem are discussed and suggested for further studies and applications.

Keywords: Farming; stress; explorative study.

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INTRODUCTION

Agriculture, the primary form of food production (Ritchie & Roser, 2017; Ritchie & Roser, 2020), is paramount to the sustenance of society and is essential in satisfying the needs of a growing population. It represents 3,55% of the global gross domestic product (GDP) (Statista, 2022). A worldwide epidemic of suicides plagues its workforce (Alicandro et al., 2021; Behere & Bhise, 2009; National Crime Records Bureau, 2015; Perceval et al., 2018; University of Iowa, 2017). Agriculture has been highlighted as the occupation with the highest suicide rate, for instance, in the United States (McIntosh et al., 2016). Although "agriculture" is broad due to a complex supply chain composed of many sectors, this article focuses on farmers (Figure 1).

Existing literature has determined that depression, anxiety, and other mental illnesses are frequent among farming communities (NASD, n.d.). Those traits have been linked to loneliness and isolation inherent to this occupation (University of Exeter, 2021). Furthermore, farmers and their networks (e.g., family) feel unappreciated and are keen to highlight their crucial role in producing food (University of Exeter, 2021). This problem requires intervention, also considering that those issues are increased by poor access to psychological protection services (Alicandro et al., 2021) and the progressive intensification of climate change (Berry et al., 2011a). Indeed, for instance, a European experience-sharing network (Agricall, 2022; BAG, 2015; Solidarité Paysans, 2022), has been created to try and provide farmers with the help they need.

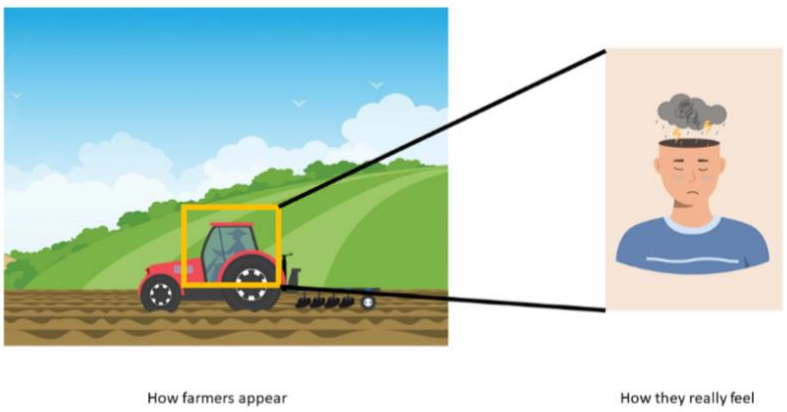

Fig. 1: Problem statement.

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The article aims to investigate and assess the cause(s) behind the high suicide rate among farmers by directly talking to the community. The research has been conducted as part of a project in the program Innovation for Change, a Challenge-Based Innovation program (CBI) during the pandemic (March 2021 - May 2021). Since the authors could not meet the farmers physically because of the pandemic restriction related to COVID-19, the farming community was approached via questionnaires and phone interviews.

THEORETICAL BACKGROUND

The psychological and physical distress of farmers is investigated from academic literature, but several open points are still posed. Accordingly, the literature on the topic shows several problems, lacking a deep understanding and analysis of the reasons. Researchers' interest has been strongly growing in recent years, especially due to the increased focus on human attention and human psychological well-being. The problem is defined as a worldwide plague (Alicandro et al., 2021). For this reason, the present work is based on reports of global organizations and bodies that focus on agriculture.

To understand the problem, the analysis of the context is essential, starting from the farm dimensions. There are several differences in the harvest and environment where farmers work. Most farmers (ranging from 40% to 80% by country of all farms) work in farms that are smaller than 2 hectares (Lowder et al., 2014), considered to be small/medium sized. Data analysis shows a trend that "seems to connect" the share of farms represented by larger cohorts with each income category. Farms with a surface greater than 5 hectares constitute only 27% of all farms in low-income countries. This value grows to 43% and is applied to lower-middle-income countries. The share rises to 96% in the upper-middle-income and reaches its peak in high-income countries, with 97% of farmland constituted by farms greater than 5 hectares in size.

The geographic distribution of the farms is strongly related to the climate conditions. Considering the number of farms by country, the country population is the best predictor: China and India represent 76% of the global number of farms (Ritchie & Roser, 2021). If the socio-cultural aspects can affect most of the psychological studies, with farmers this aspect is fundamental in the investigation of their mental well-being. Different locations offer different resources and conditions for farming, generating different drivers for the well-being. The weak investigation of the problem shows some discrepancies, without considering the regional aspects. For instance, one of the main reviews on the farmers well-being (Daghagh Yazd et al., 2019) shows that more than 50% of the studies in the literature are focused on English-speaking countries and only 3% of them considered China and India. For instance, this review ranked the main mental illness risk factors as pesticide exposure (with 19% of studies naming it), finances in general (18%), weather uncertainty (11%), poor physical health/past injury (10%), general farming conditions (8%), and isolation/loneliness/lack of social relationships (6%). This ranking could be strongly biased by the regional factor (e.g., countries where pesticides are not widely diffused).

The most common methodologies applied to investigate the topic of the farmers' mental health issues are based on qualitative and quantitative methods, mainly on interviews, surveys and questionnaires. The studies adopting other approaches, such as biometric and clinical, represent less than 20% of the total (Daghagh Yazd et al., 2019).

One additional discrepancy derived from valuable results of the review is related to investigating if the farmers are a category with a higher level of mental distress compared to the other occupational groups. This difference is investigated in a few studies (28), and more than 70% of those suggest that "farmers have worse mental health issues than the general population". On the other hand, a few studies suggest that farmers show a lower stress level than the other occupational groups without exploring whether any regional factor is recognizable. Then, in general, we can affirm that the farming occupation can be linked with a more common appearance of mental health issues. This analysis leaves several open points. The present work developed a qualitative research method to investigate the partially and lacks identified problems, as described in the methods and data section.

The methodology was defined from the design literature to investigate the industry adequately. The initial phases of new product development (NPD) are crucial for defining the design space and are broadly referred to as the fuzzy front end of the innovation process. Moreover, around 80% of the product costs are defined in this phase (Cantamessa & Montagna, 2016), mainly characterized by clarifying the design problem and assessing the market according to the strategic, operative, and financial requirements. The research focuses on identifying the customer needs that represent a crucial sub-activity of the product planning phase in the NPD process (Cantamessa & Montagna, 2016; von Hippel, 1986).

Figure 2 shows the positioning of this study in the NPD process.

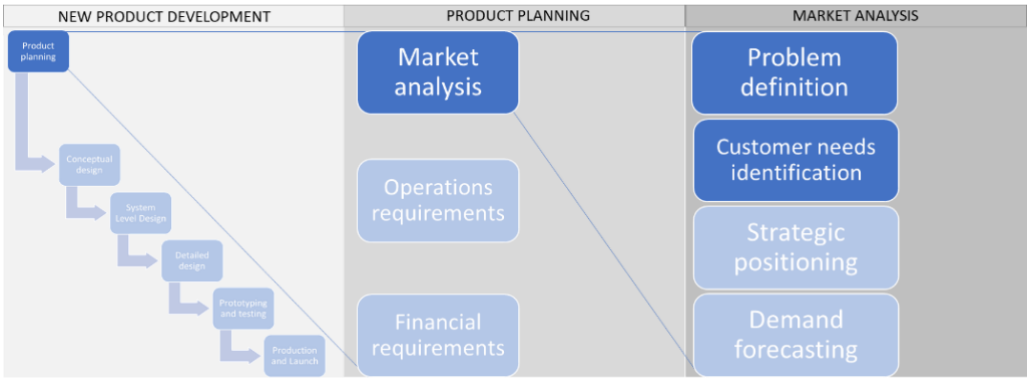

Fig. 2: New product development: problem definition and customer needs identification.

METHODS AND DATA

In the literature, several different methodologies have been developed for customer needs identification (Geyer et al., 2018). Surveys and interviews have been selected as the most suitable for the present research methodology (e.g., considering the discussed problems in reaching the customer segment). These methodologies are generally applied in around 80% of the customer need identification processes and they showed great performances in the identification of the customer problems, needs and specifications (Geyer et al., 2018).

Thus, in this study, the methodology adopted to investigate the research question and reach data is mainly qualitative as summarized in Figure 3 where the exploratory interviews, questionnaire (reported in Appendix A), and the validation interviews are described.

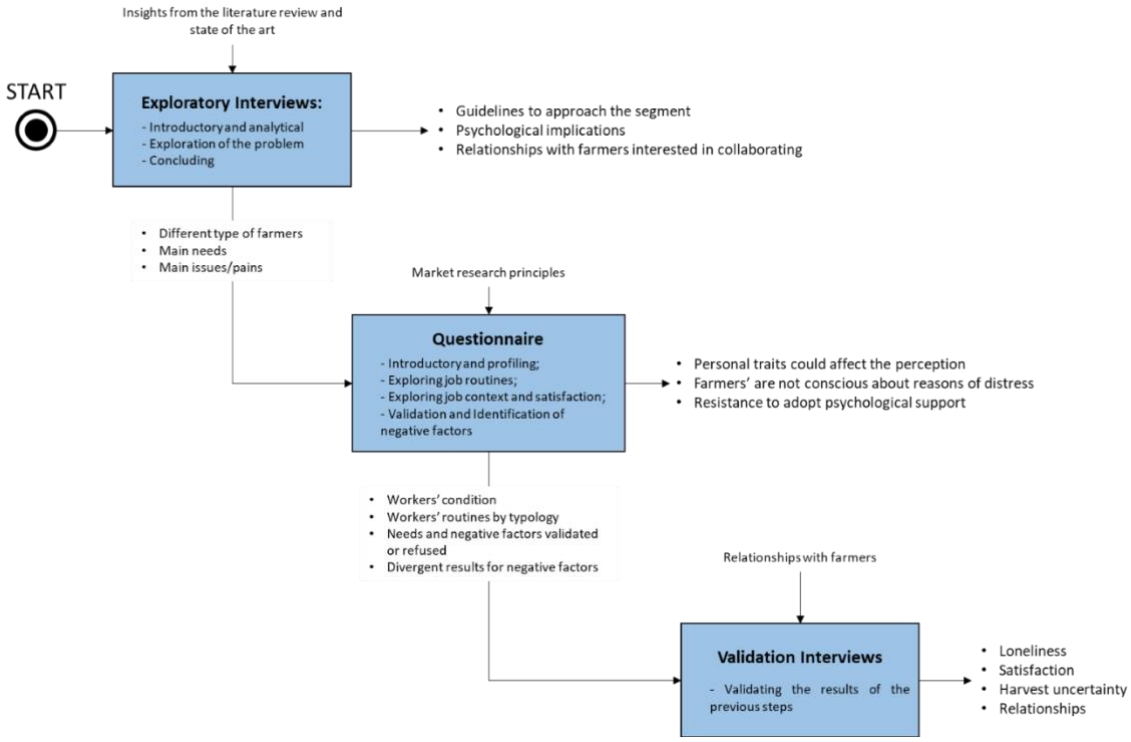

Fig. 3: Research flow diagram.

The exploratory interviews were required due to the not homogeneous analysis of the situation in the literature (Daghagh Yazd et al., 2019).

Then, the questionnaire was conducted through Google Forms and was structured on the evidence of the exploration activity to investigate the farmers' lives, job satisfaction and the factors that influence their job distress. Discrepancies were shown in the questionnaire's answers across all expected options to the questions. For this reason, we decided to proceed with the validation

interviews that would allow us to understand better the issues addressed.

The exploratory interviews were structured in three phases: (i) the introductory phase, (ii) the exploratory phase (iii) the concluding phase. The first phase summarised the psycho-physical characteristics of the respondent. The second phase focused on investigating work routines and social conditions problems. Instead, the final phase investigates the attempts to solve the identified issues. Each part was composed of open-ended questions only.

The methodology adopted to reach the respondents was primarily word-of-mouth based. Due to pandemic restrictions, interviews were conducted by phone calls or online.

The questionnaire was organized into four phases: (i) introductory and profiling participants; (ii) understanding work routines; (iii) understanding the participant's work context and assessing job satisfaction; (iv) validation and identification of any negative factors of life as a farmer.

Specifically, the questionnaire was structured through a combination of closed and open questions.

The closed questions can be of two types: profiling questions (e.g., investigating socio-cultural aspects) and questions designed to measure factors identified by researchers as important.

The open questions were structured mainly with two types of Likert scales, ranging from 1 to 4 or 1 to 10. The minimum of the scale was always given the negative extreme of the measured factor; respectively, the maximum was associated with the positive extreme.

The researchers grouped the data from each question and identified the response frequency for each of the provided options. The final stage of the questionnaire was crucial to derive useful information for our main research question because the participant was asked to provide three critical factors connected to work well-being.

The validation interviews were conducted with open questions respecting the structure of the questionnaire (following the 4 phases previously described), having the main purpose of identifying the cause of the divergent evidence collected during the previous part.

RESULTS

The first general result concerns the definition of research method adopted in this work due to the difficulties in reaching people. Since agriculture is a segment with a strong social identity, after several attempts, the present study concluded that the people embedded in agriculture are difficult to contact, especially for market research. Several aspects have been identified that render such a questioning difficult:

- Digitization has not fully penetrated the segment, so these people are unlikely to respond to a digital questionnaire, which is a pandemic context creates a strong constraint.
- Scepticism, related to the adoption of new technologies and habits, creates significant inertia even when discussing new solutions.
- Geographical distances and work-oriented lifestyles mean that farmers tend to have few interpersonal relationships outside of relatives and colleagues and thus live in a social bubble; this creates significant difficulties for word-of-mouth activities.
- The workload required by their job does not allow for much flexibility (in terms of vacations, illnesses, leaves, etc.). Researchers had troubles in fitting the interviews into the time schedule of farmers, because they do not feel (or) to have spare time. A respondent tried to clarify this point saying that they are not particularly inclined to "*waste time with these things*" (Ignacio).

Through the exploratory interviews, some critical points affecting the sector were identified, which differed according to who the respondents of the interviews were:

- The farmers: discordant opinions were collected on the well-being of farmers. Although an overload and management of work that must follow natural rhythms was expressed as a common factor, some farmers consider their lives to be extremely satisfying from a social interaction perspective, and only a few were dissatisfied.
- The stakeholders: mainly represented by suppliers. It emerged that the problems at the level of reaching the sector and of limited openness towards change, even when it may entail a gain for the farmers, represented the main problem for the people who work there; the second important evidence is the lack of trust by people operating in the sector, in particular to newness.
- The comparison with psychologists (not involved as researchers): difficulties emerged linked, on the one hand, to the awareness "*it is difficult for people born and raised in certain environments to mature the awareness of some lack of social relationship independently and/or because for them that life represents normality*"; on the other hand, the sensitivity of the segment that, having the social stigma of being a sector of people with high physical strength, robustness, etc., and being in a sector where seeking professional advice on mental health (e.g. psychologists) are regarded poorly.

For these reasons, the interviews were conducted on a sample of 21 respondents: 15 farmers, three stakeholders and three psychologists. The stakeholders were related to one of the biggest companies in the global agricultural machinery market.

Because of the evidence from these interviews, we set out to write a questionnaire investigating these factors. The questionnaire allowed us to dwell on a sample of 20 respondents.

The sample refers to sociodemographic characteristics that sufficiently represent the population to be considered acceptable. Indeed:

- the gender distribution of respondents is 70 % men and 30 % women, which is close to mirroring the distribution of industry employment (adopting Europe as a proxy worldwide; European Commission, 2021);
- the age of the respondents [M=41.2; ST. DV. =10.88] is slightly reduced compared to the industry average in Europe as the sample is somewhat skewed due to the difficulties explained above;
- a type of farmer (employees, landowner, etc.);
- geographic distribution of the sample.

Nevertheless, the global focus of the research and the effort to include farmers worldwide, all the respondents are from Italy, probably due to the personal network of the researchers.

The results from the questionnaire submitted show some interesting evidence regarding loneliness and satisfaction in work and relationships. The main results are reported below.

Loneliness is not perceived as a problem. We asked to rank it on a scale from 1 (no perception of loneliness) to 10 (maximum perception of loneliness), and the answers were all concentrated in the rank from 1 to 3 (50% rated 1, 20% rated 2, 20% rated 3, 10% rated 5).

In addition, we asked participants if they would like to have more time to spend with friends and relatives. Around 50% of them said no, confirming that there is no clear answer to the farmers' perception of loneliness and the evidence appears confusing among the answers collected.

Moreover, the results collected from our questionnaire confirm that the majority of farmers perceive their work-life as very satisfying. When we asked them to give an opinion (on a scale from 1 to 4) of their daily satisfaction (considering job satisfaction, relationship with other colleagues or other companies), all answers collected focused on the medium-high rank of the scale (3-4) (40% rated 3, 60% rated 4).

Regarding satisfaction in relationships, 80% say they are satisfied with their lives and do not feel the need to have more opportunities to meet people outside their work environment in general. Furthermore, respondents were asked to rank social satisfaction on a scale of 1 to 4, and the information received is exactly comparable to the information mentioned before. The satisfaction is concentrated in the medium-high rank of the scale (3-4) (40% rated 3, 50% rated 4).

In addition, participants were asked to identify the main negative factors associated with a farmer's life. The data collected was distributed among the proposed responses, so we could not draw any conclusions. Therefore, the validation interviews were conducted via phone to collect more meaningful data with a new sample of 10 farmers. We have found that the main negative factor related to farmers' lives is directly related to the constant uncertainty in harvesting that farmers have to manage daily, considering unpredictable weather events that continue to increase due to climate change (Berry et al., 2011b). Moreover, we discovered a sense of exhaustion from the high workload of these unpredictable events.

The results of this study highlight that identifying a customer's need is complicated, mainly because customers are generally not aware of their needs. For this reason, we designed a process consisting of three phases to investigate the problem and detail and identify the customer need through the information gathered during each step of the process.

Therefore, the results obtained from this study fit perfectly with identifying customer needs for the eventual development of a new product (Cantamessa & Montagna, 2016) for farmers.

DISCUSSION AND CONCLUSIONS

This study seeks to find the deeper reasons behind the high suicide rate in the agriculture industry. To reach this ambitious goal, we designed a three-phase process.

Although for the general public, a high workload (>10 h/day) and limited social interactions are often cited as the main reasons for suicide (Center For Disease Control and Prevention, 2021), the data of this study indicate that these do not translate directly to farmers, as the presence of loneliness was rated low (50% rated 1, 20% rated 2, 20% rated 3, 10% rated 5) and the job satisfaction as medium-high (40% rated 3, 60% rated 4) in the anonymous quantitative surveys (see Results).

Although the sample size of this study is not significant enough for the study to claim that the underlying issue for farmers is the uncertainty in harvesting and subsequently caused exhaustion, it opens the opportunity to investigate more thoroughly this new explanation for the high suicide occurrence within the agricultural industry into more detail. More in-depth, qualitative, and in-person follow-up research is needed to validate these results, for example, by taking a sizable sample of people and trying to adopt the methods we discussed in this study.

The results obtained can be placed in two meaningful contexts: the first is that this study can be an excellent way to create public awareness about the problem and the possible reasons behind it, and the second is related to a new identification of reasons behind the problem which need to be deepened to identify the customer need for the eventual development of a new product for farmers.

About the latter, further considerations about the present contribution's results are generally referred to the industry. Considering the taxonomy of the innovation (Henderson & Clark, 1990), the results and the market represent a context where a radical and disruptive innovation is likely to happen, also considering the

historical innovation in the industry (Curry et al., 2021). This is a key element for the weaknesses of the results derived from the customer needs identification because usually, customers are unaware of their needs in this context.

Innovative products face a high not-acceptance rate, up to 40%, in their adoption in B2B markets (Griffin, 1996) and more than 70% failure in their launches (Reichwald et al., 2007). This complexity is also increased in long business chains with multiple stakeholders (Griffin, 1997), as the analyzed context.

The main limit of this study is the small sample of respondents which does not allow us to investigate the different customer needs derived from different geographical regions. Indeed, further studies could investigate how customer needs are differentiated by cultural and natural factors.

Finally, the methodology to involve the customer in the customer need identification process represents another crucial aspect to be considered for further research.

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APPENDIX A – QUESTIONNAIRE

This section reports the structured interview adopted for the present work.

Questionnaire for farmers' mental and physical wellbeing

Thank you for agreeing to respond to this digital interview*! It is very important for us and all your colleagues to receive this information.
The interview consists of 5 sections, it will take no more than ten minutes to be completed and at the end you will find contact information in case you would like to learn more, tell us something else, or simply make yourself available for future developments.
Thank you!
* All information provided to us will be treated as confidential data according to the European Regulation 2016/679.

Section 1 – Introductive information

Question 1
Are you
- o Male
- o Female
- o Not Binary
- o Prefer not to say

Question 2
How old are you?
- o < 20
- o 20-35
- o 36-50
- o 51-65
- o >60

Question 3
Do you have a partner?
- o Yes
- o No
- o Divorced or widowed

Question 4
How many children do you have?
- o 0
- o 1 or 2 or 3
- o >3

Question 5
Who do you live with?
- o By myself
- o My parents
- o My wife/husband or my partner, but without the children
- o My wife/husband or my partner, with the children
- o With my other family members (for example: my brother, my cousin, etc.)
- o Other:_____

Question 6
If you don't live with your family, can you easily meet them?
- o I don't have a family
- o I have to travel less than an hour to see my family
- o I have to travel more than an hour to see my family

Question 7
Have you ever had to relocate for business reasons?
- o No
- o Yes, but not by my decision
- o Yes, by my own decision

Question 8
If you relocated for business reasons, how many times?
- o 1
- o 2
- o 3
- o 4

Question 9
If you relocated for business reasons, did you move with your family?
- o No, I do/did not have a family
- o No, I had to separate from my family
- o Yes

Question 10
How many inhabitants does your current place of residence consist of?
- o < 100
- o 100-1,000
- o 1,001-5,000
- o 5,001-20,000
- o > 20,000

Section 2 – Details on your job

Question 11
Which is your role in the agricultural company?
- o I am an employee of a company
- o I work in the family business
- o I am self-employed
- o I am retired
- o Other:_____

Question 12
How many hours are you used to work in a day (on average)?

	< 3 h/day	3-6 h/day	7-9 h/day	>9 h/day
Winter	o	o	o	o
Spring	o	o	o	o
Summer	o	o	o	o
Fall	o	o	o	o

Question 13
How often do you take a break from work? How long does it last (on average)?

	5-15 min	20-30 min	30-60 min	> 60 min
1 break per hour	o	o	o	o
1 break every 2 hours	o	o	o	o
1 break every 3-4 hours	o	o	o	o
1 break per day	o	o	o	o

Question 14
Usually, during these breaks, what do you do?
- o I rest
- o I eat
- o I spend time calling someone
- o I spend time on the phone (e.g., social networks)
- o I spend time with colleagues
- o I spend time with friends
- o I spend time with my family

Question 15
Do you generally work alone or with others?
- o Always alone
- o Occasionally (1-2 time a week or less) with a colleague/friend/family member, but mostly alone
- o I work often (3 or more times a week) with colleagues/friends/family members
- o I always work with colleagues/friends/family members
- o Other:_____

Question 16
If you were to rate your typical day, would it be positive or negative (based on job satisfaction, colleagues, relationships with superiors or the company, ...)?

Extremely Negative				Extremely Positive
o	o	o	o	o

Question 17
In case your judgment to the previous question was influenced by a particular factor (or factors), could you indicate it/them?

_____
_____
_____

Question 18
Would you like to have more opportunities to meet people from outside your work environment?
- o No, I am satisfied
- o Yes, but I wouldn't know how to do it
- o Yes, but I don't have time to do it

Question 19
Do you wish you had more time to spend with friends and family?
- o No, I am satisfied
- o Yes, work takes up too much of my time
- o Yes, because of the distance I can't see them often

Question 20
How important do you think digital media are to your well-being and your social life?

Extremely Useless				Extremely Important
o	o	o	o	o

Question 21
Are you used to use digital media during your day?

	During work	During breaks	During spare time
To keep in touch with friends and family	□	□	□
To listen to music	□	□	□
To listen to podcasts or similar sources	□	□	□
To browse social networks	□	□	□
To keep updated of the news	□	□	□
To monitor the weather	□	□	□
To watch videos or movies	□	□	□
Play videogames	□	□	□
To organize my routines	□	□	□
Work reasons	□	□	□

Section 3 – Your context

Question 22
On average, how many people do you interact with on a normal day (before the pandemic)?
- o None
- o 1 or 2 people
- o Between 3 and 5 people
- o Between 6 and 10 people
- o > 10 people

Question 23
On average, how many people do you interact with on a normal day (during this pandemic period)?

- o None
- o 1 or 2 people
- o Between 3 and 5 people
- o Between 6 and 10 people
- o > 10 people

Question 24
How much are you satisfied of your social life (family, friends, colleagues, etc.)?

Extremely Unsatisfied				Extremely Satisfied
o	o	o	o	o

Question 25
Could you explain the reason(s) for the answer to the previous question?

Question 26
On a scale of 1 to 10, do you ever feel lonely or abandoned?

1									10
o	o	o	o	o	o	o	o	o	o

Question 27
If the rating to the previous question exceeds 5, what do you think is the cause? Do you try to fix your current situation?

Question 28
Still about feeling lonely or abandoned, do you think it can/could affect your job performance?

Extremely Negative				Extremely Positive
o	o	o	o	o

Question 29
How much these last two answers changed during the pandemic period?

- o They have changed negatively
- o They have changed positively
- o They have not changed

Question 30
How often do you have trouble getting to sleep or relaxing?

Never				Always
o	o	o	o	o

Question 31
Which are your strategies to relax?

Section 4 – Main negative factors about agricultural life

Question 32
First factor

Question 33
Second factor

Question 34
Third factor

Question 35
Other factors that you think relevant?

Final Section – Thank you

Thank you for your time and your valuable feedback. Feel free to contact us to share more thoughts and doubts about the present questionnaire and the research in general. If you would like to help us it would be helpful to share the present interview with someone that could be interested and involved in this topic.