Chapter 2
The methodology of the survey on the effects of agile working in Italian Public Research Organizations

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ABSTRACT
This chapter describes the methodology of the CNR-IRCrES survey, conducted to investigate the effects of agile working emergency implementation on the research personnel from two Italian Public Research Organizations – the National Research Council (CNR) and the National Institute for Astrophysics (INAF). This survey, based on the CAWI methodology, sought to explore specific aspects of scientific work such as autonomy, creativity and productivity, as well as contextual aspects such as personal well-being, the use of ICT tools and the environmental implications of agile working. The first part of the chapter describes how the survey was designed and the various dimensions that were investigated by the questionnaire. The second part summarizes the implementation phase while also introducing the participants' profile through a descriptive analysis of the sample of respondents.

KEYWORDS: agile working, smart working, Public Research Organisations, methodology; survey.

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1. INTRODUCTION

In April 2020, while the COVID-19 pandemic was underway and the resulting government measures were affecting people's movements and work arrangements, CNR-IRCrES announced a research project entitled *Agile working in research institutions: organisational factors and individual behaviours in the production of knowledge*. The study aimed to investigate – through an online survey – the effects of agile working during the COVID-19 emergency on the research personnel of two Italian Public Research Organizations (PROs) – the National Research Council (CNR) and the National Institute for Astrophysics (INAF). Rather than determining whether agile working is suitable for research activities, the ultimate goal of the survey was to investigate what happened to the personnel engaged in the production of new knowledge, taking into account peculiar dimensions related to scientific work and well-being.

The survey was launched between February and March 2021, one year after the very first extended implementation of agile working for public and private workers. This time has allowed for the consolidation of behaviours, attitudes, and dispositions toward the new working mode.

This chapter outlines the methodological approach implemented for the survey, stressing the analytical dimensions under investigation and the fundamental characteristics of the study design. The first part illustrates the design of the study and the different dimensions explored, relating to the agile working carried out in the PROs, and outlines the structure of the questionnaire. The second part briefly summarizes the structure of the survey (target population, contact with respondents, pre-test phase) and its online implementation. The last part introduces a brief descriptive analysis of the sample.

2. METHODOLOGICAL APPROACH

The survey's methodology was based on the distribution of a structured questionnaire to the entire research personnel – researchers and technologists (including institute directors) – from two selected PROs under the supervision of the Ministry of University and of Research (MUR): CNR and INAF. The data collection procedure was developed using the CAWI[1] approach and the Lime Survey statistical survey software, which was integrated into the CNR survey platform[2].

The availability of the institutional e-mail addresses from the two PROs websites suggested for the feasibility of a web-based survey, considering both strengths and critical elements related to this kind of technique (Alessi & Martin, 2010; Evans & Mathur, 2018). The key advantage of the CAWI method is the space of manoeuvre with which both the research team and the respondents can handle the study. On the one hand, respondents are given a long time to adhere to the compilation invitation, with the option of answering via different devices; on the other hand, the online questionnaire can reach the target anywhere and at any time. The provision of a questionnaire mainly composed of closed-ended questions has been chosen for its effectiveness, as the research items should be well operationalized allowing for an easy and immediate understanding.

2.1. Non-probability sampling

All the researchers and technologists of the two PROs – CNR (considering all its 88 research institutes organised into seven macro-thematic departments) and INAF were contacted and

[1] Computer Assisted Web Interviewing.

[2] At the end of the book the reader can find the text of the entire questionnaire as it has been automatically generated by the online platform.

invited to participate in the survey[3]. The sample design of the survey is therefore non-probabilistic, which means that a sampling method was not applied to select respondents based on inclusion criteria (i.e., structural characteristics of the target population).

The choice of the two PROs is due, first and foremost, to the importance of the two organizations and the possibility to reach respondents from all scientific fields, and secondly, to the possibility to have respondents from an organization which never experimented agile working and another which already experimented agile working. Indeed, CNR had never experienced agile working prior to the COVID-19 emergency, so it activated an *ad hoc* regulation for the emergency implementation; on the other hand, INAF had approved an agile working regulation in 2019, so it re-proposed the same rules during the emergency while ignoring the temporal limitations imposed by the previous rules (Reale et al., 2020).

The CNR is the major PRO in Italy, and its mission is to conduct scientific research in the major disciplines of knowledge and apply the findings to the country's growth, supporting innovation, internationalization of the research system and industrial system competitiveness. The activities are carried out by a large human resource base of approximately 8,500 individuals spread across the country, with around 5,500 units engaging in research activities (87% researchers and 13% technologists)[4]. The 88 CNR research institutes are divided into different technical and scientific sectors and are geographically distributed across Italy.

INAF is the main Italian PRO for astronomy and astrophysics; its research activity spans the entire spectrum of Universe sciences, from solar system studies to cosmology, and includes observational, experimental and theoretical aspects. It has over 1,200 employees, working in 16 research units in addition to the Headquarters, whose around 750 are research personnel, 73% researchers-27% technologists[5]. INAF seats are divided into observatories and research sites and can be found all over Italy.

Personnel from the two PROs were manually listed from the websites of their respective units or institutes. The final list included 5,677 CNR units and 783 INAF units. Due to the "manual" collection of respondents' contact information from websites, list errors were taken into account – these could include incompleteness (or under-coverage) or non-existent/unrelated units (over-coverage), which could lead to the eventual participation in the survey of units not belonging to the target population. The bias was remedied by the respondent's self-declaration of role in the PRO to the first question of the survey (Section A of the questionnaire): if the respondent declares that he or she was not a researcher, a technologist, or a director, the advancement of the questionnaire would have been stopped.

2.2. Questionnaire design

The questionnaire, which is available in its entirety in the Annex of this book, has been structured into eight main sections, five of which (the final part of C and D-E-F-G) were designed for the analysis of the five main research dimensions (see par. 3); two of them – the initial part of Section C and Section H, were respectively aimed at collecting structural data of the respondent and information on future guidance on applying agile working after the end of the pandemic. One section (B) was totally dedicated to the respondents' understanding of the definition of agile working used for the survey:

> Mode of execution of the subordinate employment relationship, governed by the Law No. 81/2017, established by agreement between the parties, also with forms of organization by phases, cycles and

[3] Research fellows, research associates and technical-administrative personnel from the two selected PROs are excluded from the target of the survey.

[4] Source: CNR PTA 2020-2022 – Aggiornamento del Piano di Fabbisogno del Personale – Anni 2020-2022. The number of researchers includes the number of unit directors.

[5] Source: INAF – Piano triennale delle attività 2019-2021. Data on researchers include the number of the role of "astronomer (old system of role classification)" and unit directors.

objectives and without precise constraints of time or place of work, with the possible use of technological tools for the performance of the work activity.

Surprisingly enough, the definition was unfamiliar to a share of the respondents: 81.1% of CNR respondents identified the correct definition of agile working, while the remaining 18.9% confused it with that of teleworking or preferred not to answer. INAF respondents answered 94.1% correctly, while 5.9% did not identify the correct definition. For moving on with the questionnaire, the respondents were asked to refer to the definition, reported once again, adding that the subject of the questionnaire is the agile working intended as the working mode made necessary by the health emergency linked to the spread of the COVID-19 epidemic.

The questionnaire included 55 questions in total and the estimated time to complete the interview is approximately 10-12 minutes. The duration of the interview has been studied considering that the time taken for each question decreases as the number of questions increases, causing the possible presence of inaccurate answers[6].

Most of the questions are closed-ended, and the respondent is asked to choose an answer from a structured list of options. Being aware that the inclusion of every possible option could have led to excessively long response lists, the strategy chosen was to limit the number of responses that included an "other" option accompanied by a "specify". The choice to avoid open questions on specific research items was made due to the risk of incompleteness and the potential loss of motivation of the respondent as the answers could have been difficult or long to transcribe. However, some open-ended answers were added to allow respondents to comment on specific issues and encourage them to share their opinions and attitudes. In order to detect attitudes towards an object or phenomenon, scaling techniques have been adopted. The Likert scale was chosen in a 4-option variant, omitting the neutral response option to "force" the position of respondents in one way or another.

3. Analytical dimensions

The COVID-19 pandemic outbreak has imposed a massive introduction of the agile working, mostly done from home. Even highly qualified workers, used to work independently and flexibly, had to adapt to the new ways of working, with the benefits and limits connected with an almost uneven condition. Through the questionnaire designed and implemented by CNR-IRCrES and administrated to PRO researchers and technologists, five dimensions have been operationalized in batteries of items and measurement scales:

a. autonomy and creativity in scientific work;
b. scientific productivity;
c. workers' wellbeing;
d. use of ICT tools and services;
e. environmental implications of agile working.

The research team has operationalized the dimensions mainly through specific Sections of the questionnaire, but also used a transversal approach to investigate specific sub-dimensions using items from different sections. The operationalization of the topics was included starting from the end of Section C, after the development of some classification questions related to the respondent's characteristics, such as gender, age group, demographic range of the hometown, characteristics of the house, information on presence of children in the household, professional classification by role, CUN research area and the type of research activity that is carried out (experimental, non-experimental, etc).

[6] SurveyMonkey, a professional service for online surveys, reports that if an online survey exceeds 7-8 minutes, dropout rates can go up to 20% (https://www.surveymonkey.com/curiosity/survey_completion_times/).

The last questions from Section C of the questionnaire allowed to investigate the different dimensions related to the autonomy in scientific work. In particular, the autonomy in deciding the mode and timing of doing research before the pandemic was examined through the questionnaire item C17. Emphasis was put into the importance of the organization of activities by deadlines and objectives, the possibility to consult materials or resources in an office setting, having the greatest possible operational autonomy and having opportunities for constant discussion with colleagues or supervisors (C18). This Section also covered preferences in terms of places where specific tasks were carried out before the pandemic (i.e.: paper drafting, peer review activities, data analysis, literature review, project management) through the question C19. Though the last questions from Section C were specifically designed to investigate autonomy, Other questions in the survey were created in order to reinforce the analysis. In particular, the questions highlighting the limits and benefits in the organisation of individual work of researchers and technologists during agile working (D11-12) were useful to complete a preliminary framework related to the work conditions in which the concept of autonomy is embedded. The analysis of autonomy intersects with that of *creativity* with items from section D introducing two main dimensions:

i. the variation of some research activities from the pre-pandemic period to the pandemic;
ii. the analysis of the dimensions that have caused changes in terms of scientific production, that is the difficulty of carrying out some work activities; the instructions received from the research organization's management; the logistics of domestic spaces; the reorganization of working times and activities.

Furthermore, opinions related to autonomy and creativity and work organization were the core of the battery presented by question D1, by which the respondent was invited to express his agreement on a battery of phrases on agile working. Section C and some contents taken from Section D gave the research team the possibility to answer to the two research questions explored in Chapter 3, dedicated to Individual autonomy and research creativity in time of COVID-19:

> did the agile working during the COVID-19 pandemic affect the capability of the researchers to explore both already existing and new research questions/trajectories, and technologists' attitudes towards finding innovative ways of supporting the research activities? Was agile working during the pandemic a threat or an opportunity for knowledge creation?

Section D of the questionnaire was mainly aimed at investigating limits and advantages in term of workers' wellbeing during agile working. After a short series of questions regarding the agile working experience before the pandemic, the questionnaire focuses on investigating the mode of working during the pandemic period, through multiple choice questions (D11-12): *Based on your experience, please indicate the most relevant limits/benefits of the agile working during the COVID-19 health emergency.* This section is strictly related to section F which allows to analyse two other dimensions of wellbeing: the work-family balance and the risk of workaholism to the detriment of the right to disconnect from job requests. In particular, question F3 *During the COVID-19 emergency, how does agile working affect your work-family balance?* provides four answer items:

a. agile working does not affect time balance,
b. agile working determines a redefinition of time in favour of family/leisure with respect to work,
c. agile working determines a redefinition of time in favour of work with respect to family/leisure,
d. agile working favours the conciliation between family/leisure time and work time.

Thanks to section D and F, it was possible to answer to the research questions explored in Chapter 5 on Agile working and well-being during the COVID-19 pandemic: "does agile working

favour the reconciliation between work and free/family time? Are there specific characteristics that influence the respondents' well-being?"

In addition to this, section D was also essential to deepen the possible impact of agile working on researchers and technologists' productivity (topic covered in Chapter 4). The research questions were: "Has researchers' and technologists' productivity increased? Can we identify specific characteristics that affected the productivity? Which scientific activities are most difficult to carry out in agile working?". In order to answer these questions, the questionnaire allows to deepen the characteristics that can affect the following activities: writing of papers or scientific monographs; study of the scientific literature; participation in conferences (including web conferences); in presence or virtual meetings related to research projects; scientific dissemination through seminars, lectures or webinars; peer review for scientific journals.

Section E of the survey intended to investigate change in terms of awareness, and the knowledge and use of some ICT tools (commercial cloud, storage with private access, cloud storage made available by the organization, VPN/Proxy server, programs for audio/video conferencing, chat programs, IT support service/help desk, shared online planning for research teams, use of specific software on the institutions' server, remote access to databases) with the activation of agile working. Furthermore, questions E4 and E5 allowed to investigate the possible problems encountered in the use of ICT and the possibility, given by the institution to which they belong, to access training on the subject in question. Through this Section, it has been possible to answer to three research questions treated in Chapter 6:

i. How did the research personnel approach the use of ICTs during agile working in emergency, taking into account their personal preferences and individual and organizational preparation?
ii. What was the research personnel experience with ICT tools and services during agile working, and which tools or services showed the potential to transform the individual work organization?
iii. What were the major obstacles they faced when utilizing ICTs during agile working?

Finally, Section G intended to explore the environmental implication of agile working through a series of closed-ended questions aimed at investigating the commuting time and kilometres of each respondent (G1 and G2). The means of transport mainly used to reach the workplace (G3) and any possible post-pandemic changes in terms of means of commuting to work were treated, as well as change in consumption (paper, electricity, heating, and air conditioning) with respect to the pre-pandemic period (G6). This Section has been used in Chapter 7 to analyse the effects of the intensive use of agile working on environmental benefits, deriving from a decreasing demand for labour mobility. Different preferences and experiences of trips to the workplace before and during the pandemic in terms of advantages/disadvantages are explored in order to figure out to what extent agile working in PROs can have a positive environmental impact. The aforementioned chapter will mainly answer to two questions:

i. to what extent can agile working in PROs have a positive environmental impact on work mobility emissions?
ii. how can the new labor organization maximize this positive impact?

4. SURVEY IMPLEMENTATION

4.1. Pre-test phase

A pre-test phase on a limited subsample of 10 researchers from CNR was developed in January 2021 to verify any issues related to the questionnaire items, and highlight difficulties and technical problems with the online procedure. The clarity of any instructions and the sequence of questions, while respecting the logic of the branching, were given special consideration. The development

of the pre-test also checked the possibility of common errors in the development of an electronic survey (see Andrews et al., 2003).

4.2. Contact method and privacy policy

The invitation to participate in the survey came from an institutional e-mail address that reported the domain of the National Research Council: survey.lavoroagile@ircres.cnr.it. In addition, the text of the e-mail included a brief description of the purpose of the research, specifying the identity and affiliations of the researchers involved. The CNR-IRCrES research group has foreseen three recalls for those who do not respond to the first calls.

Researchers and technicians were asked to follow a link to fill out the questionnaire and refer to a document that illustrates the survey's Privacy Policy. The creation of a privacy policy document is aimed at communicating to the interviewees the guarantees on the security of the information shared through the questionnaire and to ensure that the research group complies with the principles of confidentiality that are set out. The privacy policy clarified that respondents' data would have been processed

i. only for research purposes, in accordance with the principles of lawfulness, correctness, transparency, relevance and non-excess, and to ensure adequate security of personal data;
ii. in a way that the respondent units are rendered unidentifiable, through procedures of contact data separation and pseudonymization with the use of random codes.

4.3. Survey waves and response rate

Two waves were launched – the first at the end of February 2021, targeted to INAF, and the second, targeted to CNR, in mid-March 2021. The interviewees were allowed a large period – 14 days – to adhere to the proposal of participation in the survey.

At the end of the two rounds of administration of the questionnaire, 2,921 responses were obtained with a total response rate of 45.7%. About one researcher/technologist out of two of INAF completed the questionnaire and about 45% of the CNR, with a response rate of the researchers higher than the technologists in the latter case. Table 2.1 presents in detail the response rate of the survey with breakdown by organization and professional role.

Table 2.1. Response rate of the survey with breakdown by organizations and professional role

	Units, A.V.	Respondent units, A.V.	Response rate on total units, %
1st wave - INAF researchers (including directors) (14 days, February 2020)	559	282	50.4
1st wave - INAF technologists (14 days, February 2020)	207	106	51.2
2nd wave - CNR researchers (including directors) (14 days, March 2020)	4,864	2,276	46.8
2nd wave - CNR technologists (14 days, March 2020)	756	257	34.0
TOTAL	**6,386**	**2,921**	**45.7%**

The high response rate could be attributed to several factors:

i. the contacted units identified their current work situation in the survey topic;
ii. the participation proposal came from the same organization (in the case of CNR) or from a similar and reliable organization (in the case of INAF);
iii. a possible word-of-mouth among colleagues who received the questionnaire;
iv. there was an actual different perception of the theme during the historical period of compilation. An unexpectedly large participation of respondents was obtained from the (few) open-ended questions in the questionnaire, testifying to the great interest aroused by the survey and the desire to express themselves on a relevant topic.

The survey allowed respondents to reflect on agile working in general (questionnaire item D2), as well as on the possibility of implementing this method when the pandemic emergency is over (H3). Both questions were not mandatory, but for the first, 564 people responded, accounting for one-third of the total number of respondents; for the second, 2,080 people responded, accounting for nearly all the respondents.

The non-probabilistic nature of the sampling does not allow the use of statistical inference techniques to attribute the characteristics detected on the respondents to the population from which they come; however, the high response rate reasonably allows to consider the results valid to represent the target of the study, especially regarding INAF staff and CNR researchers.

Table 2.2 presents the demographic profile of the survey respondents, due to the analysis of the questionnaire items that were intended to detect their basic characteristics. The characterization of the respondents will be useful for interpreting the data on the different dimensions covered by the questionnaire, highlighting eventual differences in the effects of agile working.

The survey collected complete questionnaires from 1,475 men (50.5%) and 1,409 women (48.2%), while 37 units (1.3%) did not want to disclose their gender. Therefore, a good balance between the representatives of the two genders was achieved. The most represented age group is that of 45-54 years old (37.7%), followed closely by 30-44 years old (32.4%) and 55-65 years old (28.3%). Geographical origin is prevalently linked to Central Italy (37.7%); the North is represented by 33.8% (almost on a par with the North-West and North-East); the South and the Islands are represented by 32.5% of the sample. Most respondents work in large cities – with populations over 250,000 (41.5%) –, while the cities with population between 60,000-250,000 are represented by just under a quarter (23.1%). Nearly 40% of respondents live with minor children at home, 12% with children over 18 years old, 5% with both minor children and children over 18 years old, 28.7% live with no children but a partner or relatives, and 14.3% live alone.

The dominant type of contract is permanent full-time (95.4%); other types are poorly represented. Among both researchers and technologists, those belonging to the third professional level are decidedly the most represented (65.3% of researchers and 82.9% of technologists). The most represented CUN area is Physics (25%), and this prevalence is explained by the presence of INAF. This is followed by Biology (14.1%), Earth Sciences (13.3%) and Chemistry (12.0%). There is also a good presence of respondents from Industrial and Information Engineering (10.0%). The presence of respondents from the Social Science and Humanities sectors is more limited, in line with the composition of CNR research resources. Most respondents conduct experimental research (73.9%).

Table 2.2. Profile of the participants in the Survey (n=2921)[7]

Variables	N (%)
Gender	
Female	1,409 (48.2%)
Male	1,475 (50.5%)
No Response	37 (1.3%)
Age in years	
30-44	945 (32.4%)
45-54	1,102 (37.7%)
55-65	828 (28.3%)
More than 65	46 (1.6%)
Geographic area (Italy)	
North-West	491 (16.8%)
North-East	478 (16.4%)
Centre	1,003 (34.3%)
South	623 (21.3%)
Islands	326 (11.2%)
Demographic level of the city of the place of work (population)	
Less than 5,000	156 (5.3%)
5,000-9,999	186 (6.4%)
10,000-19,999	253 (8.7%)
20,000-59,999	439 (15.0%)
60,000-250,000	676 (23.1%)
More than 250,000	1,211 (41.5%)
Presence of children in the household	
Living alone	417 (14.3%)
Living with no children but not alone (with partner or relatives)	838 (28.7%)
Living with children under 18 years old	1,166 (39.9%)
Living with children over 18 years old	357 (12.2%)
Living with children under 18 and over 18 years old	143 (4.9%)
Type of contract	
Permanent full-time	2,788 (95.4%)
Permanent part-time	35 (1.2%)
Non-permanent full-time	88 (3.0%)
Non-permanent part-time	10 (0.3%)
Organization	
CNR	2,533 (86.7%)
INAF	388 (13.3%)
Role in the PRO	
Director	34 (1.2%)
Researcher - of which	2,524 (86.4%)
- Research director	*233 (9.2%)*
- Senior researcher	*384 (15.2%)*
- Researcher (III lev.)	*1,907 (75.6%)*
Technologist – of which	363 (12.4%)
- Technological research director	*17 (4.6%)*
- Senior technologist	*45 (12.4%)*
- Technologist (III lev.)	*301 (82.9%)*
CUN Research Area	
01 Mathematics and Informatics	175 (6.0%)
02 Physics	729 (25.0%)
03 Chemistry	351 (12.0%)
04 Earth Sciences	388 (13.3%)

[7] Only a few units reported that they were under the age of 30 and were grouped with the 30-44 cohort to maintain anonymity.

Variables	N (%)
05 Biology	411 (14.1%)
06 Medicine	121 (4.1%)
07 Agricultural and Veterinary Sciences	174 (6.0%)
08 Civil Engineering and Architecture	48 (1.6%)
09 Industrial and Information Engineering	291 (10.0%)
10 Antiquities, Philology, Literary Studies, History of Art	70 (2.4%)
11 History, Philosophy, Pedagogy and Psychology	56 (1.9%)
12 Law Studies	32 (1.1%)
13 Economics and Statistics	42 (1.4%)
14 Political and Social Sciences	33 (1.1%)
Type of research activities (not mutually exclusive)	
Experimental research	2,159 (73.9%)
Non-experimental research	1,099 (37.6%)
Technical support for projects	414 (14.2%)
Technical support in laboratory	118 (4.0%)

The implementation of agile working during the COVID-19 pandemic emergency in PROs is studied as a phenomenon that has effects on work organization patterns, on knowledge production dynamics, on contextual dimensions such as personal well-being, and on environmental dynamics. An online questionnaire was created to detect the most important factors that can influence and determine a change in working methods, with a focus on processes of adaptation and/or reaction by knowledge workers. The study's originality lies in its analytical attention both to the "subjects" on whom the effects are observed – performers of a highly creative work characterized by intrinsic work autonomy – and the "objects" that come into play in the agile working experienced during the COVID-19 pandemic (regulatory context, ICT tools, work settings, limitations). The in-depth operationalization of the main analytical dimensions through the creation of articulated questionnaire sections, structured with special attention to the balancing of themes and questions, has the potential to return a richness of outputs that allows for a deeper understanding of the relationship between agile working, pandemic, and research practices, as well as the definition of the phenomenon's perimeter. It is worth noting that the study enables to address topics that have received little attention in the literature, such as research personnel productivity in relation to work-life balance and the principle of researcher autonomy, by situating them both in the unique context of a sudden and forced change of work settings and routines, as well as with an eye to the future.

The design of the study is based on a non-probability sample, which limits the possibility of generalizations of the results. Nevertheless, the high response rate obtained by the survey gives the results sufficient robustness to be interpreted as expression of the reference population. Considering the type of survey, based on the CAWI methodology, a high percentage of respondents took part and provided a large number of open comments that qualitatively deepened the evidence that emerged from the close-ended answers. The strategy developed for implementing the survey, which considered the topic's current relevance as well as the selection of specific dimensions to be operationalized, could be used as a methodological framework for the study of agile working in the context of intellectual or creative works.

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