EITRM105985: Reviewed Final Report of Survey

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Name of the author/Responsible partner: Paolo Dambruoso – Consiglio Nazionale delle Ricerche

Version

This activity has received funding from the European Institute of Innovation and Technology (EIT), a body of the European Union, under the Horizon 2020, the EU Framework Programme for Research and Innovation

CARBONITE

Professionals' behaviour and perceptions about searching and managing information at work

Reviewed Final Report of Survey

CNR – Paolo Dambruoso, Silvana Mangiaracina, Ornella Russo, Irene Aguayo

CENTOFORM – Danilo Brucchi, Stefania Marzocchi, Chiara Pancaldi

Consell General de Cambres de Comerç de Catalunya – Montse Monedero

CSCS – Giovanni Crisonà

DIMECC – Essi Huttu

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Introduction

This report is the first output of the CARONTE (Continuing educAtion and scientific infoRmatiON literacy on raw maTerials for profEssionals) project. CARONTE is an education project of the KIC EIT (Knowledge Innovation Community of European Institute of Innovation and Technology) Raw Materials, coordinated by the Italian Institute of Organic Synthesis and Photoreactivity (ISOF), and developed in collaboration with the Bologna CNR Research Area Library and with European partners (Centoform, CSCS, Zanardi Fonderie, DIMECC, Magnesitas Navarras, Consell General de Cambres de Comerç de Catalunya).

CARONTE project aims to connect the scientific research world with SMEs professionals on the topic of retrieval, management and use of scientific information. The goal of this project is to verify if the knowledge and the techniques part of information competencies know-how in the scientific and digital field could constitute relevant soft skills for SMEs professionals, and therefore could be transmitted through specific training modules.

The first step of the CARONTE project work plan was the "Analysis of the target audience" (WP2). The main goal of this activity was to find out which value R&D Managers attribute to scientific and technical information and their degree of interest in improving their information management skills at an individual level.

The specific objectives of the survey were the following:

- To explore the habits of SME's professionals, in general, and R&D Managers, in particular, in searching and accessing scientific and technical information;
- To identify their needs and perceptions concerning scientific and technical information;
- To identify the "information-related" challenges and issues they face during their day-to-day work;
- To collect stories of real cases and specific examples that could be used as scenarios in the learning modules.

The survey was carried out by the CNR in collaboration with the partner CENTOFORM. There was also one specific collaborator for each country: CENTOFORM in Italy, CGCC in Spain, and DIMECC in Finland.

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1. Methodology of the survey

The sampling method used for the survey was based on opportunity, to facilitate the response rate. Each project partner selected the SMEs active in the Raw Materials sectors from their internal databases (and local area) and invited them to participate in the survey. Therefore, most of the responses collected come from three areas: Catalonia (CGCC), Emilia-Romagna (CENTOFORM) and Finland (DIMECC). A total of 867 SMEs were involved: 829 from Italy, 29 from Spain and 9 from Finland. This method was also selected with a view to involve local SMEs and to test any possible issues of the project at a regional level.

A mixed-methods approach, combining both quantitative and qualitative methodologies, was chosen in order to be able to triangulate results and obtain a wider explanation of the issue.

The data collection techniques selected for this purpose were:

- Questionnaire (quantitative data)
- Interview (qualitative data)

The questionnaire collected 3 groups of data:

- Demographic and professional data: gender, age, country of residence, area of study, company sector, job position, team role, team size
- Behaviours and perceptions around the use of scientific and technical information: importance, scope, frequency and efficacy of search, training needs
- Behaviours and perceptions around the archiving and managing of scientific and technical information: composition of personal archive, use of management tools and methodologies, sharing preferences

The interviews deepened the habits of searching and archiving information, with the aim of collecting personal examples and experiences, and any need for training on these issues.

The difficulty of reaching significant numbers in the Finnish context resulted in the need of adding a new research method: a case study [see 6. Case study].

The questionnaire [see Appendix A] was prepared in the three languages of the project (English, Italian and Spanish) and made available online through a Google form from November 13th, 2017 to January 24th, 2018.

The questionnaires are available through the following links:

- Italian/English questionnaire: https://docs.google.com/forms/d/e/1FAIpQLSeJhV-IBSo2gw-rntZUEUUrhdM1UJvSmNxEWj0cArSgvSpiGQ/viewform

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- Spanish/English questionnaire: https://docs.google.com/forms/d/e/1FAIpQLScZm-s1wJ7hqiTh1XDpKSYKO89PpJoJY2q6yGdXKGVWcmMOyw/viewform
- English questionnaire: https://docs.google.com/forms/d/e/1FAIpQLScNCbQTA5Jt5D9298W7189GjaE6SmmffShYY0lZL6FH-fajog/viewform

In order to briefly introduce the purpose of the CARONTE project and the aim of the questionnaire, a short video presentation was created (only in English language) and it was included as an introduction in the online form. The video is available here.

The selected companies were invited to fill out the online questionnaire and, among those who were available, interviews were carried out (a minimum 4 interviews for each country).

The semi-structured style was chosen as way to give flexibility to the interviewer and interviewees to express different and/or new ideas without missing a common guide. It was deemed as the most suitable for this case, where there was not a common interviewer and interviewees came from different countries and contexts.

The text of the interview was translated into English, Spanish and Italian [see Appendix A] and was accompanied by some relevant indications for a proper interview conduction.

A total of 867 SMEs from the three countries were invited to fill in the questionnaire and 66 responses were received (response rate of 8%). A total of 11 interviews were carried out in Italy and Spain (4 and 7 respectively), among all those who gave the availability to be interviewed.

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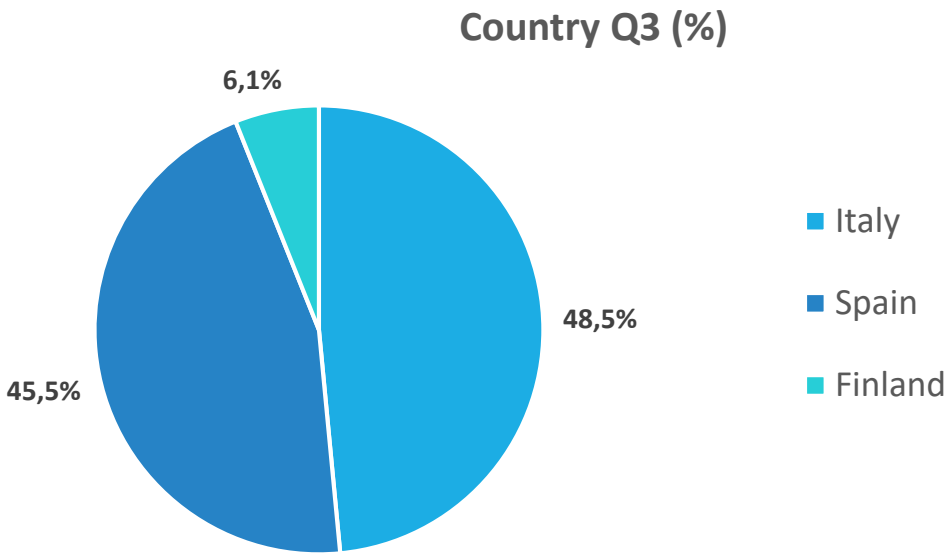
2. Profile of respondents

As shown in Figure 1, the respondents to the questionnaire came mainly from Italy (49%) and Spain (46%). Only 6% of respondents came from Finland.

Finnish companies have expressed a very limited interest in participating in the survey. For this reason, the working group considered it useful to prepare a case study focused on the information habits of DIMECC internal staff. DIMECC is a company partner of CARONTE project, who offers advanced services to SMEs, supporting the digitalization of industries processes. The company is interested in activating new information mediation services, such as the forecast of future trends, which partly intersects with some of the issues of CARONTE training modules/project. The case study is analyzed in section 6. Case study.

Figure 1: Respondents by country (%) - Question No. 3



The number of respondents by job role in the company shows a clear prevalence of the "other" professional roles (61%) compared to the R&D Managers (around 40%), who were the focus of the survey. Of these, the majority is a R&D Manager within the company (88%), while 12% work as an external consultant.

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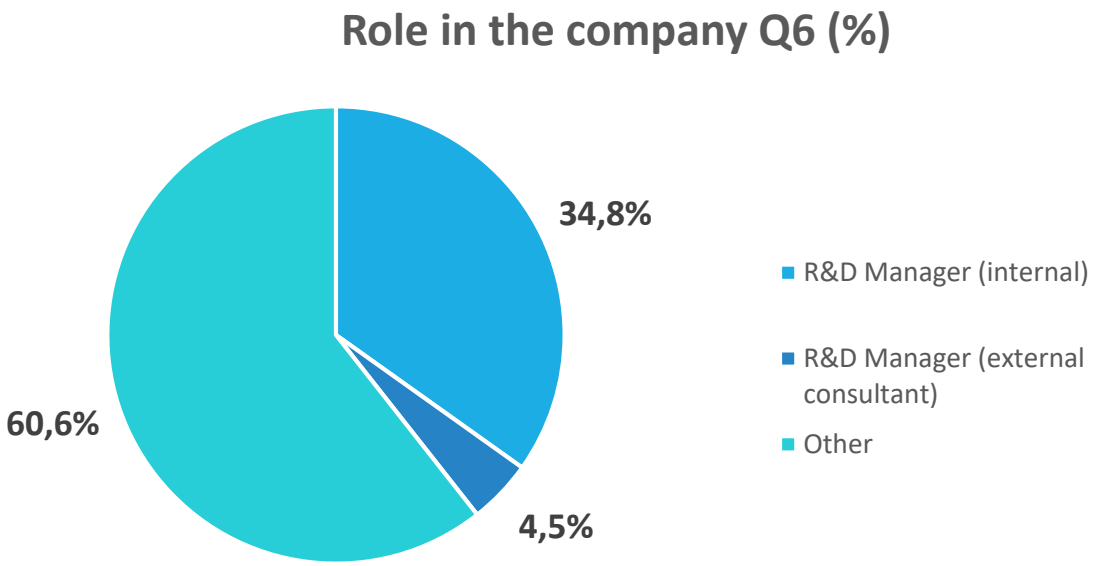
Figura 2: Respondents by role in the company (%) - Question No. 6



As shown in Figure 3, among those who declared another role, the figure of Project manager prevails (30%), followed by that of the researchers (18%).

In general, defining a specific role is maybe easier for professionals in large and very structured companies that for those included in this survey, that are part of SMEs. The choice of leaving an open field for other options has also led to a dispersion of profiles and its difficult standardization.

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Figura 3: "Other" breakdown by stated profession (AV / %) - Question No. 7

Other role	**Nº**	**%**
CEO	2	5%
Project Manager	12	30%
Knowledge Manager / Information specialist	1	3%
Researcher	7	18%
Intellectual property expert	3	8%
Chief officer	2	5%
Business developer / manager	3	8%
Country facilities manager	1	3%
Administrator	1	3%
Collaborator	1	3%
Engagement partner	1	3%
Export sales director	1	3%
Quality assistant	1	3%
Technical director	1	3%
Technician	1	3%
Not specified	2	5%

The respondents of the survey studied Engineering (36%), Economics (21%) or Chemistry (14%). R&D Managers studied Engineering (38%) or Material Sciences (21%), while other professionals studied Engineering (36%) or Economics (29%).

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Figura 4: Area of study (AV / %) - Question No. 4

Area of study	**Nº**	**%**
Chemistry	9	14%
Computer sciences	1	2%
Engineering	24	36%
Economics	14	21%
Humanities	4	6%
Material sciences	5	8%
Physics	2	3%
Social sciences	1	2%
Other	6	9%
Totale	66	100%

The question related to the activity sector of the company in which the respondents work explored the presence of companies active in the four key sectors of EIT Raw materials market: Energy supply, Machinery and equipment, ICT, and Mobility, with the addition of the 'other' option.

As shown in Figure 5, only 34% of respondents work in the EIT Raw materials market sector: 31% work in the Machinery and equipment sector, and 3% in the Energy sector. In all other cases respondents work in other sectors (66%). However some of the "other company sectors" stated -for example Water and environment, Materials, or Recycling- also match with the EIT Raw materials innovation themes.

In Italy, over two thirds of SMEs (71%) involved in the survey work in the Machinery and Equipments sector, while almost all the Spanish companies (95%) declared to operate in other sector, where "Water and environment" and "Industry services" sectors prevail.

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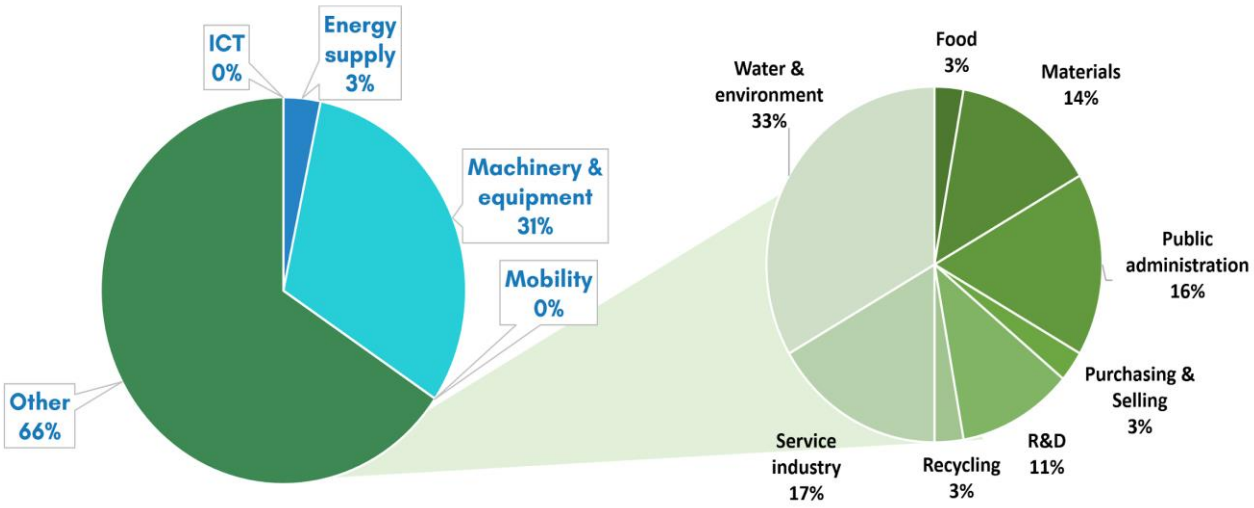
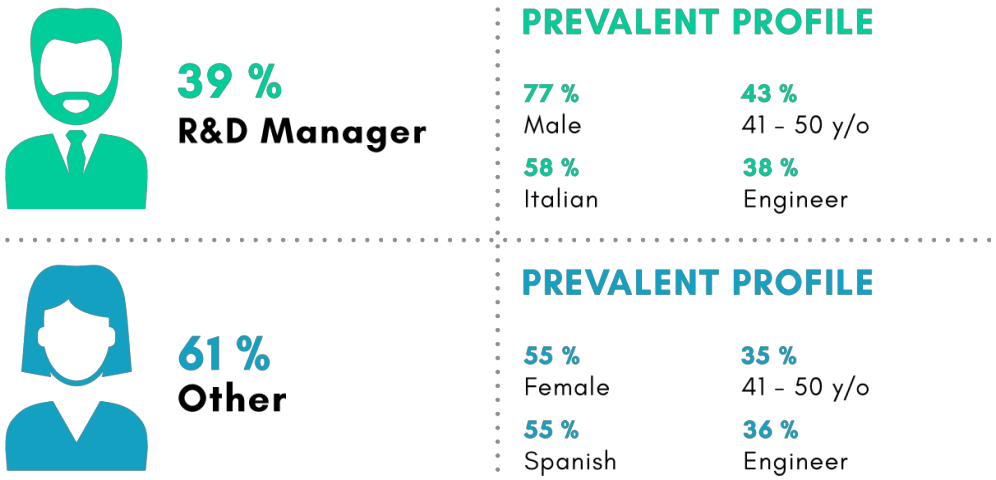
Figura 5: Distribution of respondents by company sector (EIT Raw materials target markets) (%) - Question No. 5



In general R&D Managers are prevalently Engineer, male, Italian and 41-50 years old; other professionals are predominantly Engineer, female, Spanish and 41-50 years old. Both R&D Managers and other professionals declared to work in more than one very small (2-3 components) or small team (4-8 components).

Figura 6: Distribution of the respondents by prevalent profiles (%) - Questions No. 1, 2, 3, 4, and 6



Interviewed participants were prevalently from Spain (64%), male (64%), 31-40 years old (36%), R&D Managers (64%), Engineering (45%), and from the following company sectors (all with a percentage of 18%): Machinery & equipment, Industrial and infrastructure engineering and construction, Service industry, and Recycling.

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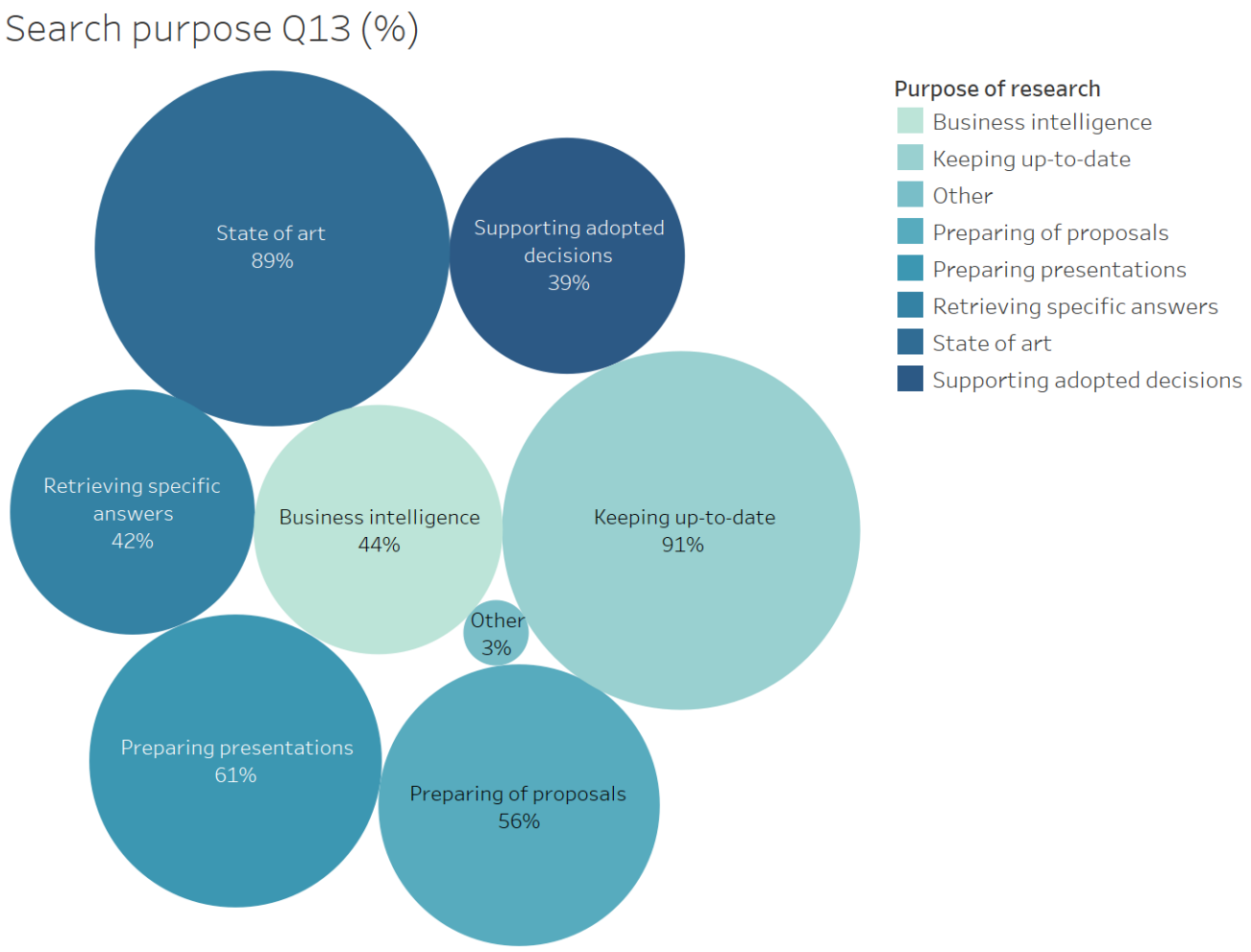
3. Searching for scientific and technical information

> *'The first thing is the source, to be truly reliable, where does the source come from, and the second thing is that to be accessible, that you could acquire it in an accessible way.'*
>
> Spanish R&D Manager and CEO

The purposes for which professionals seek information are mainly three: keeping-up-to-date (91%), deepening the knowledge of a specific topic (89%), and preparing presentations (61%).

Figure 7a: Searching purposes selected by respondents (%) - Question No. 13



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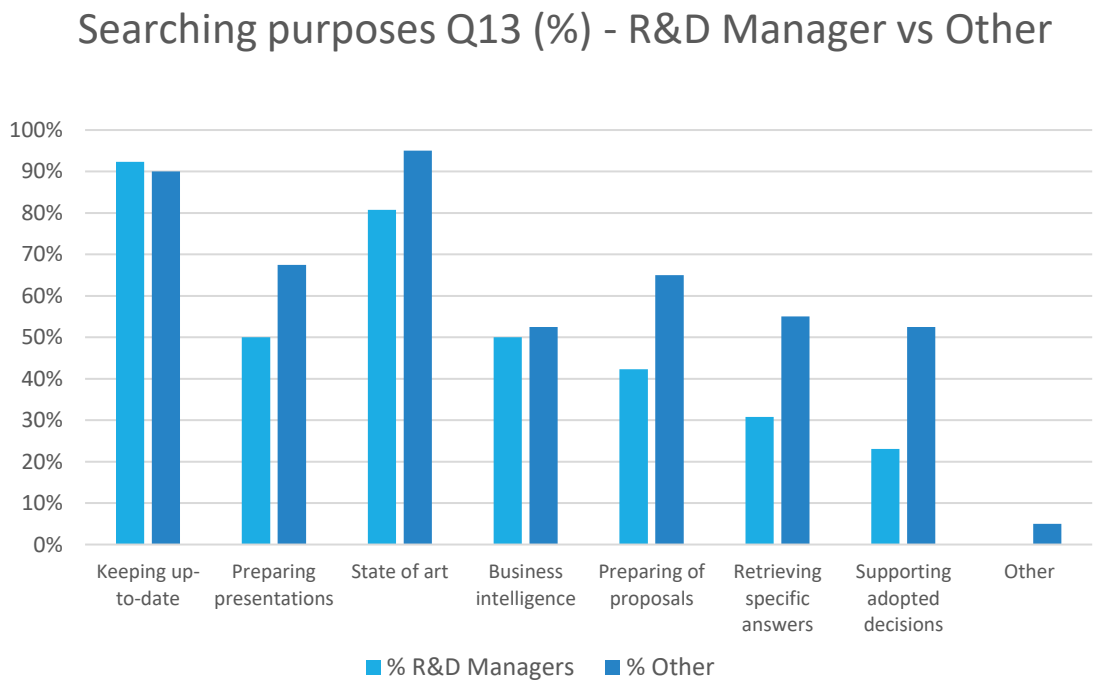
The graph n. 7b show the comparison between R&D Managers and Other professionals. The purpose of research identified by R&D Managers was very focused in the two first activities cited above (92% and 81% respectively), and in two other options, even if with a much lower percentage: preparing presentations and analyzing competitors' activities (at least 50%).

Other professionals chose among all the available options instead (all above 50%) and distinctly the first three identified (with a 90%, 95%, and 68% respectively) plus the option "Preparing of proposals" (65%).

Figure 7b: Searching purposes selected by R&D Managers and by Other professionals (%) - Question No. 13



The interviews confirm the questionnaire results about the purpose of research. The stages of the work activities in which emerge the need to search and access scientific and technical information are linked with three main purposes:

- Starting new internal company projects (for example for developing a new technology). It becomes fundamental to find technical solutions for specific problems and to know if a certain technology or process is already in use or has been recently developed or updated.
- Participating in financing calls. It is necessary to be able to summarize the current state of knowledge and research on a specific topic.
- Preparing public presentations and dissemination activities. It is important to find or update background data to put context into one's own speech.

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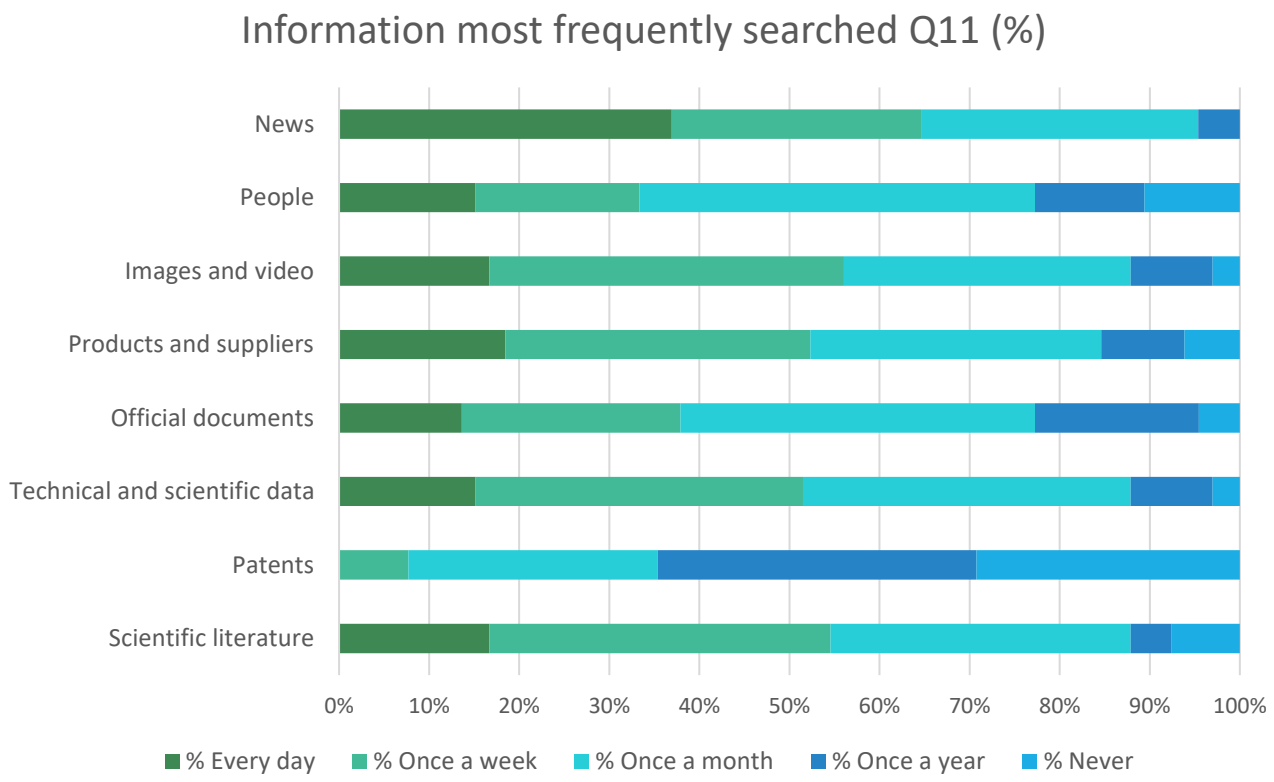
Other situations where the information highlighted is required are those of writing documents: technical offers for customers, annual sustainability report, or internal proposals.

The types of information most frequently searched (daily or weekly) by respondents are: news (65%), images and videos (56%), scientific literature (55%), technical-scientific data (52%) and data on products and suppliers (52%). Patents are marked as the typology of document that is searched the least.

Figure 8a1: Information most frequently searched (%) - Question No. 11



From the interviews it emerges that the search is carried out mainly through -or starting from- the Google search engine (and in some cases Google Scholar). Some interviewees said that when they need bibliographic references to scientific data and literature they obtain it through university partners who have access to commercial scientific databases. In few cases interviewees stated that the companies they work for pay for access to specific commercial databases.

There are no substantial differences in the types of information most sought by the two groups of respondents, but the order/priority in terms of search frequency is different: for the R&D Managers, the most sought-after information is that relating to products and suppliers (62%), technical-

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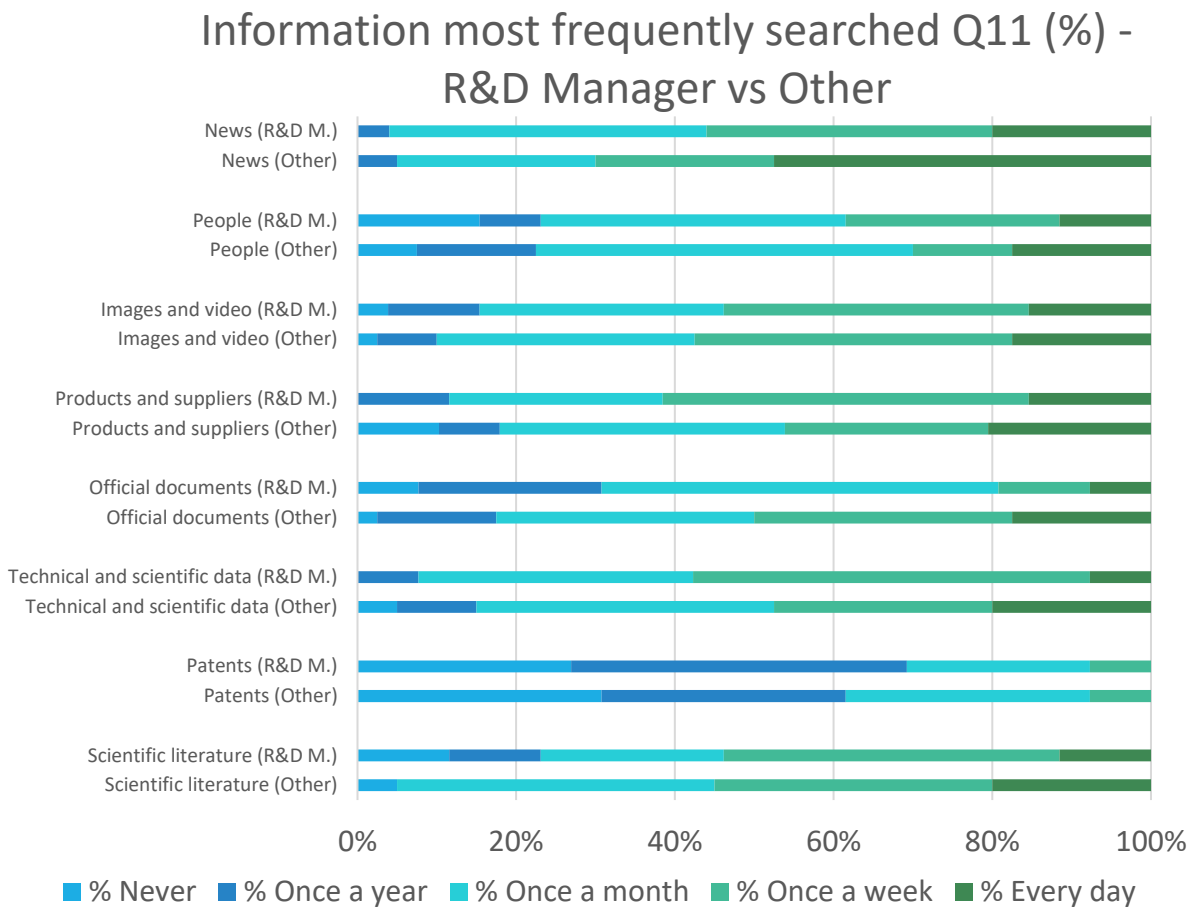
scientific data (58%), news (56%), scientific literature (54%) and images and video (54%); while for the Other professionals, searching for news (70%), images and videos (58%), scientific literature (55%) and official documents (50%) are significantly more frequent.

Figure 8b: Information most frequently searched (%) by R&D Managers and by Others - Question No. 11



In general, almost all types of information proposed are judged relevant by respondents for their work (adding those considered "the most important" with those considered "very important"), with percentages that exceed 50% for each item. Particularly significant, with percentages exceeding two thirds of responses, are: technical-scientific data (85%), official documents (77%), news (71%) and people (68 %).

It should be noted that scientific literature and images and video, although among the most frequently searched information, are not considered among the most important. A higher value is instead given to information about people, as also emerged from the interviews.

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The search for people is an activity that has been pointed out by almost all the interviewees. According to the participants, the people needed to be found could be:

- experts in the field, for consulting purposes and obtaining further detailed information;
- possible partners to involve in common projects;
- creators / implementers of a technology, process or product;
- potential competitors;
- future contacts from which you need to know their profiles for visits, meetings and collaborations.

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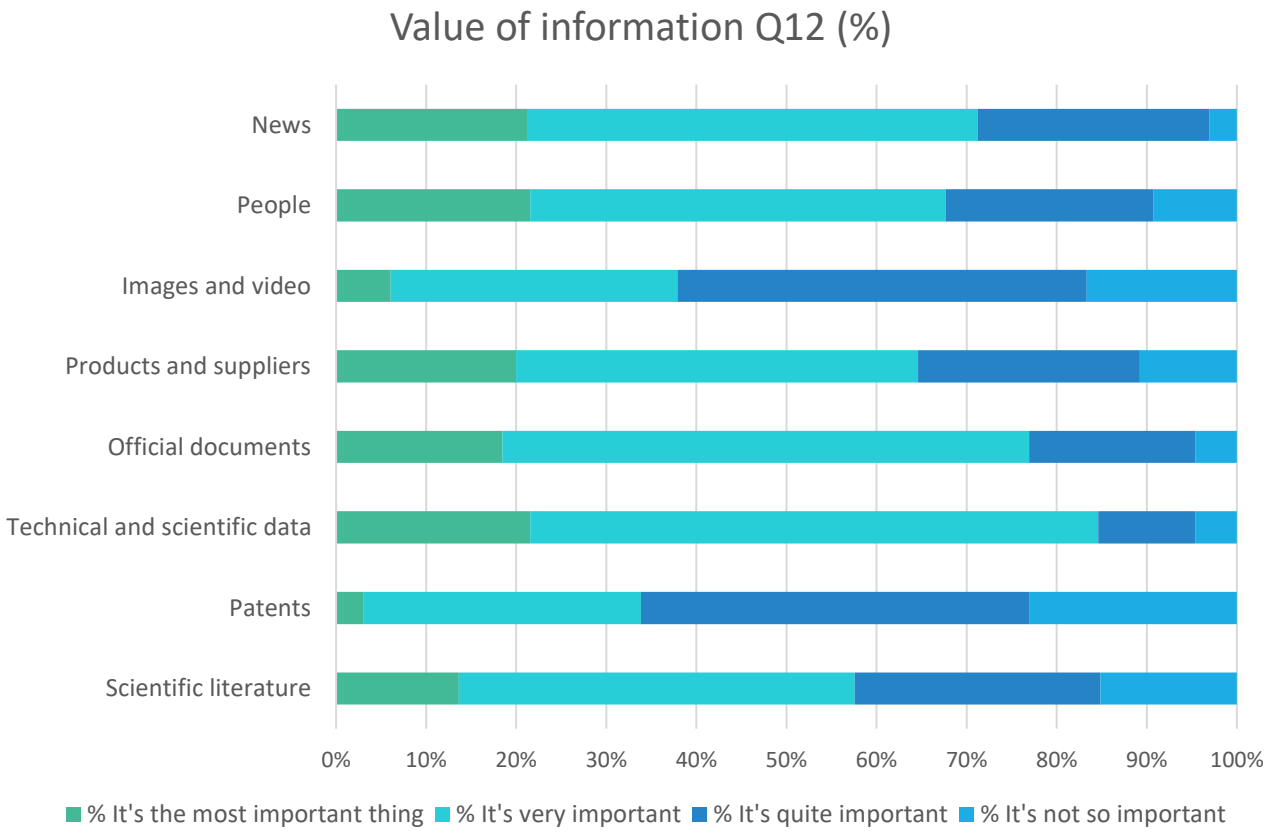
Figure 9a: Information considered most important - Question No. 12



As well as the type of information considered important, the interviews made it possible to identify some of the characteristics that the information must have to be truly relevant and useful for their jobs. In particular, technical and scientific data have to be:

- up-to-date
- well-grounded and reliable
- verified and applicable

Interviews showed also the importance of obtaining aggregated data and summary reports from the scientific literature about some specific topics: technological state of the art, markets trends, and forecasting or business opportunities.

Another element deemed fundamental by interviewees is the possibility of accessing and reading - freely and immediately - full text documents.

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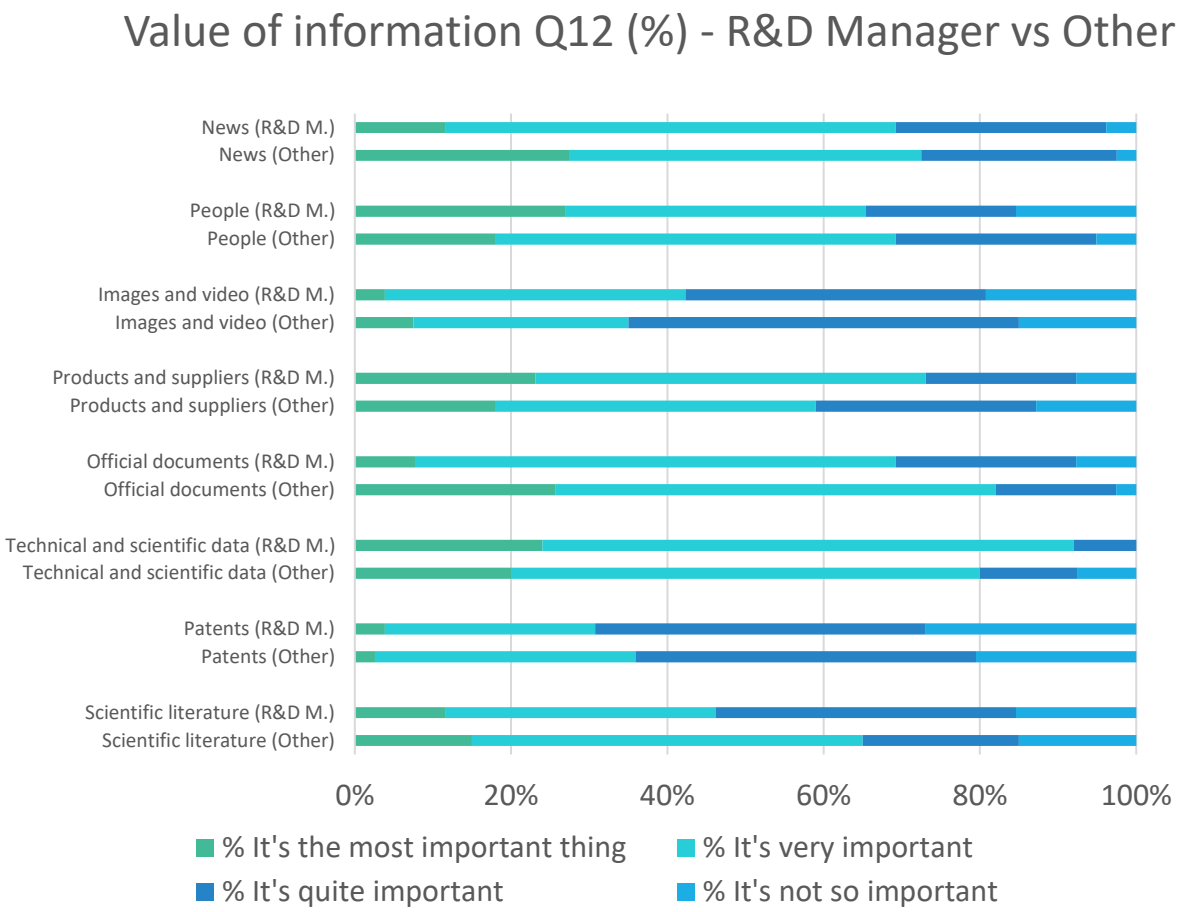
Scientific literature is considered more important by other professionals than by R&D Managers, while both consider technical and scientific data as the second most important type of information for their work. Looking in more detail, for the R&D Managers, the technical-scientific data (92%) and the products and suppliers (73%) are the most relevant, in addition to official documents (69%), news (69%) and people (65%); while for the "Other" group the official documents (82%), the technical-scientific data (80%) are the most relevant, in addition to the news (73%), the people (69%) and the scientific literature (65%).

Figure 9b: Information considered most important by R&D Managers and Others - Question No. 12



With regard to the possibility of finding the information that professionals need, the population is more distributed. The types of information most founded (frequently or very frequently) by respondents are the news (61%), the official documents (53%) and the scientific literature (52%).

The types of information most difficult to find (very rarely or rarely) by professionals are the patents (38%), products and suppliers, images and video, and people (all with the percentage of 21%). However, across all types, information is only occasionally found by about 30% of respondents for each item.

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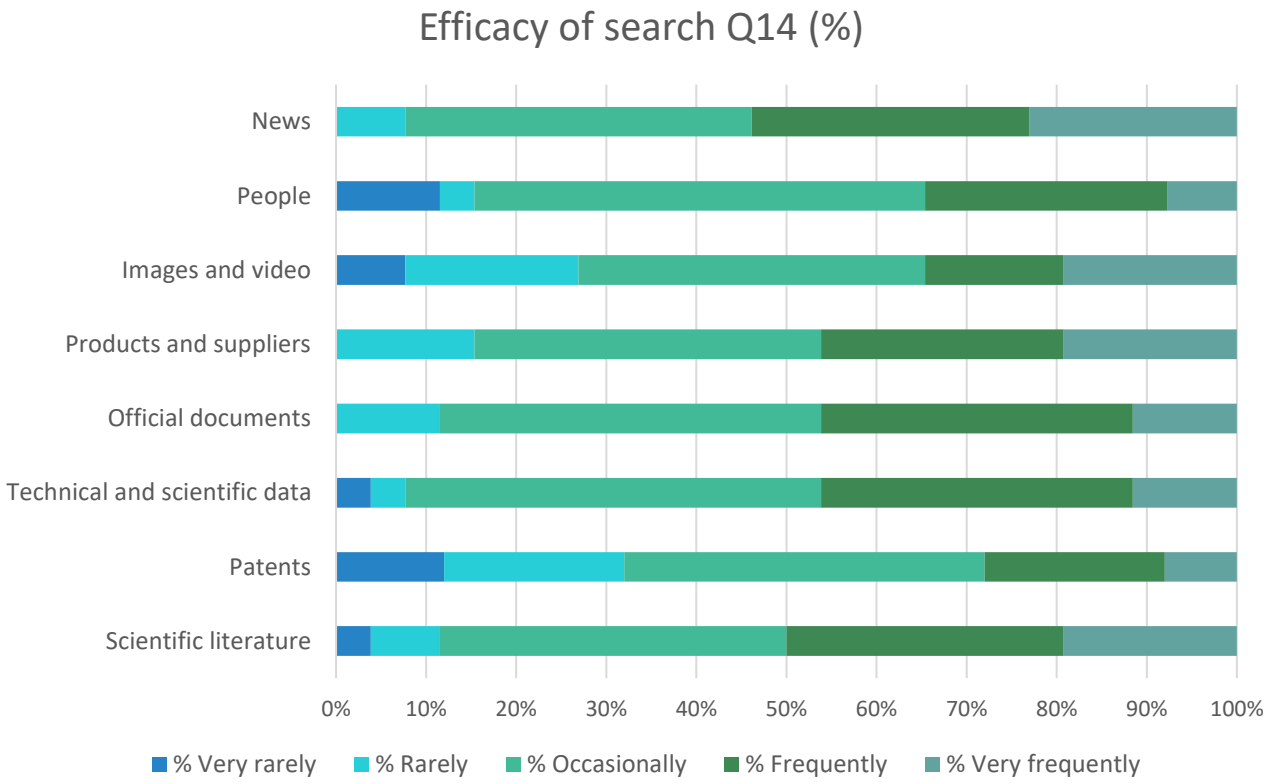
Figure 10a: Efficacy of search (%) - Question No. 14



The interviews highlighted difficulties, particularly with regard to the possibility of accessing the full text version of the documents (perhaps after reading an interesting abstract found on the Internet) and the challenges of finding data with certain characteristics (well-founded, reliable, updated, verified and usable).

One of the problems that emerged from some interviews is that usually there are not major difficulties in finding the needed data for a specific technical problem, but, once applied, these data later prove to be inaccurate or inconsistent, and do not have the expected consequences for the solution of the problem. In other cases, interviewees expressed difficulties in finding up-to-date background data while developing presentations or reports.

In general, the interviewees declared to contact external professionals (information specialist, universities, associations, people in their networks, etc.), when they face difficulties accessing specific types of information.

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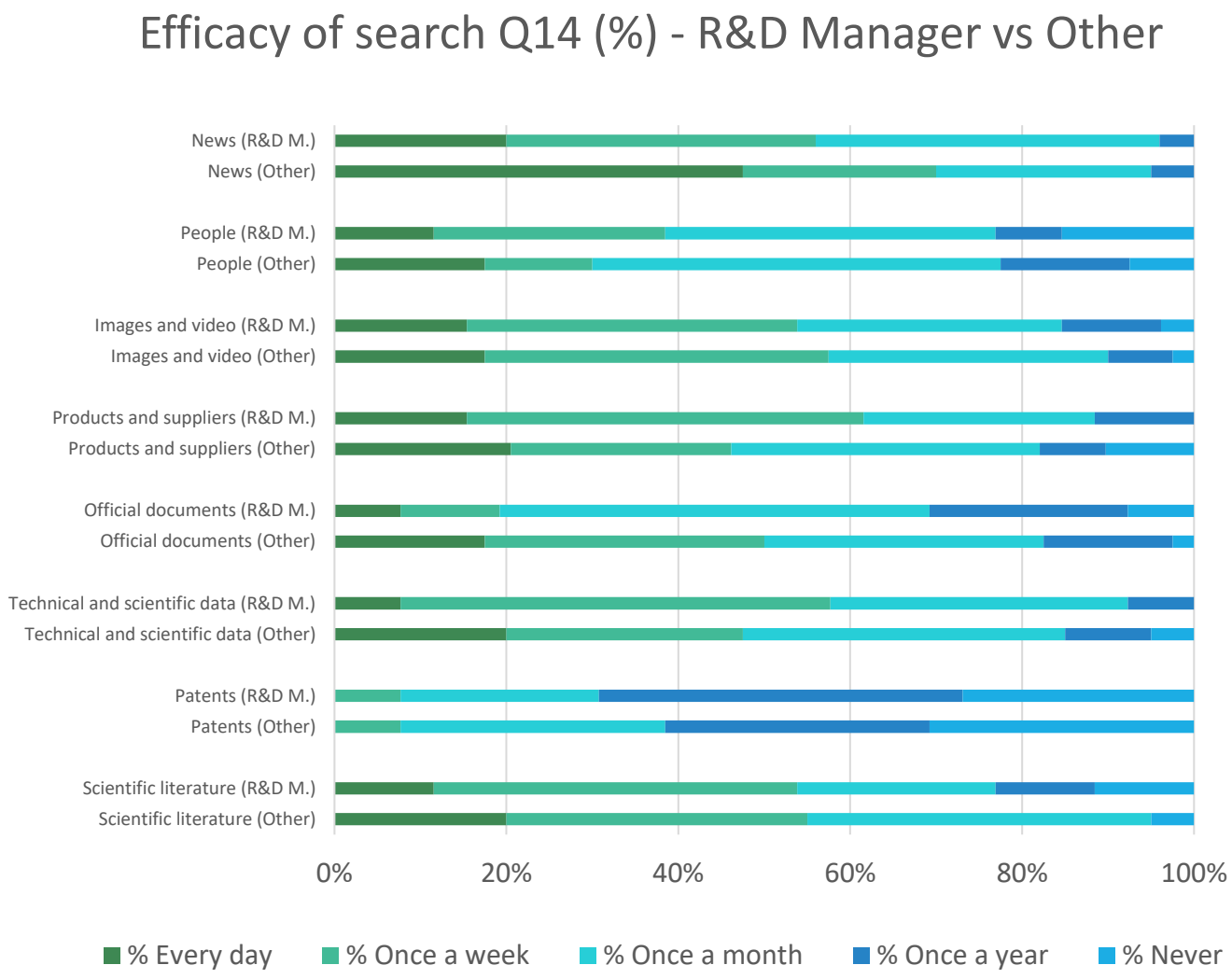
As shown in graph n. 10b, the comparison between the percentages of distribution of R&D Managers and Other professionals with respect to the frequency with which they find the information, makes it possible to highlight, in general, a greater difficulty on the part of R&D Managers for finding almost all the items. Information about patents, products and suppliers, images and videos, and people is what R&D Managers consider most difficult to find.

Figure 10b: Efficacy of search by R&D Managers and Others (%) - Question No. 14



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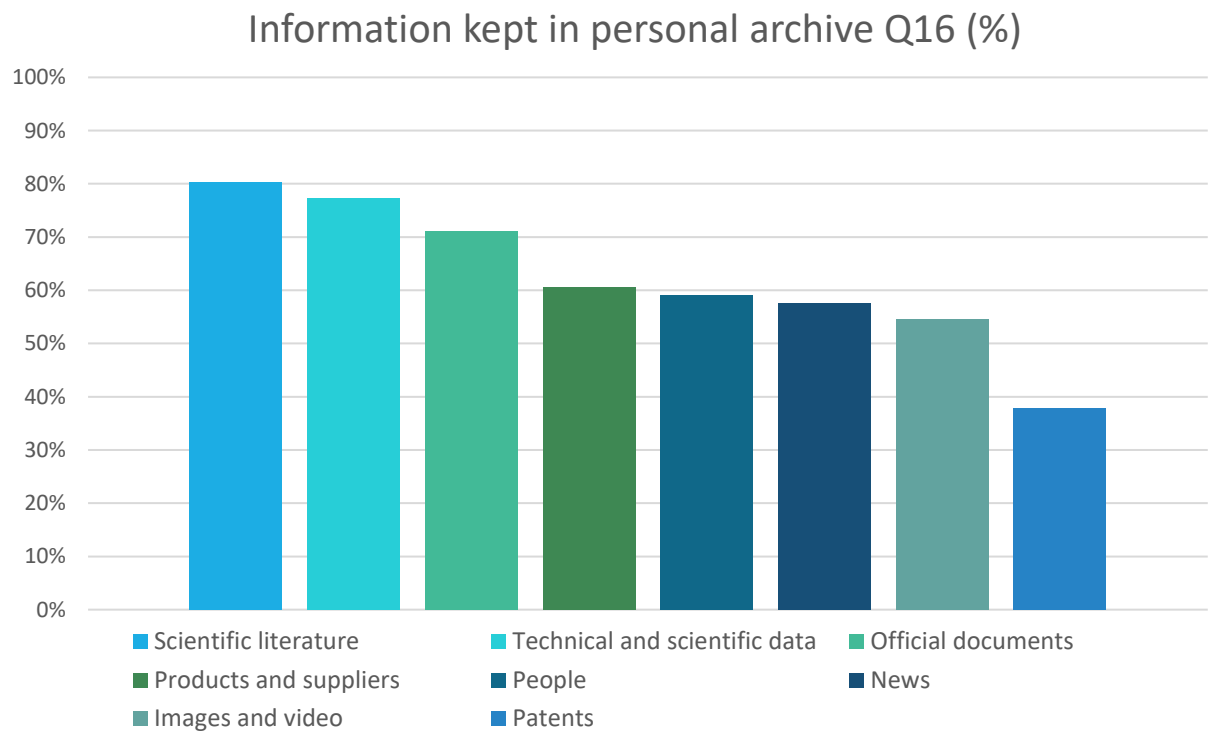
4. Archiving and managing of scientific and technical information

> *'I find myself saving the information in Post-it notes. Convenient, but not organized.'*
> Italian R&D Manager

In general, every type of information is kept by more than half of the professionals, with the exception of patents (62% of professionals declare that they do not keep/conserve them). Scientific literature (80%), scientific-technical data (77%) and official documents (71%) are the information most frequently kept in one's personal archive.

Figure 11a: Information kept in a personal archive (%) - Question No. 16



R&D Managers declared that they archive mainly technical and scientific data, scientific literature and product and suppliers data (with percentages of 85%, 81% and 73% respectively); other professionals indicated that they keep mostly scientific literature, official documents, and technical and scientific data (with percentages of 85%, 81% and 73% respectively).

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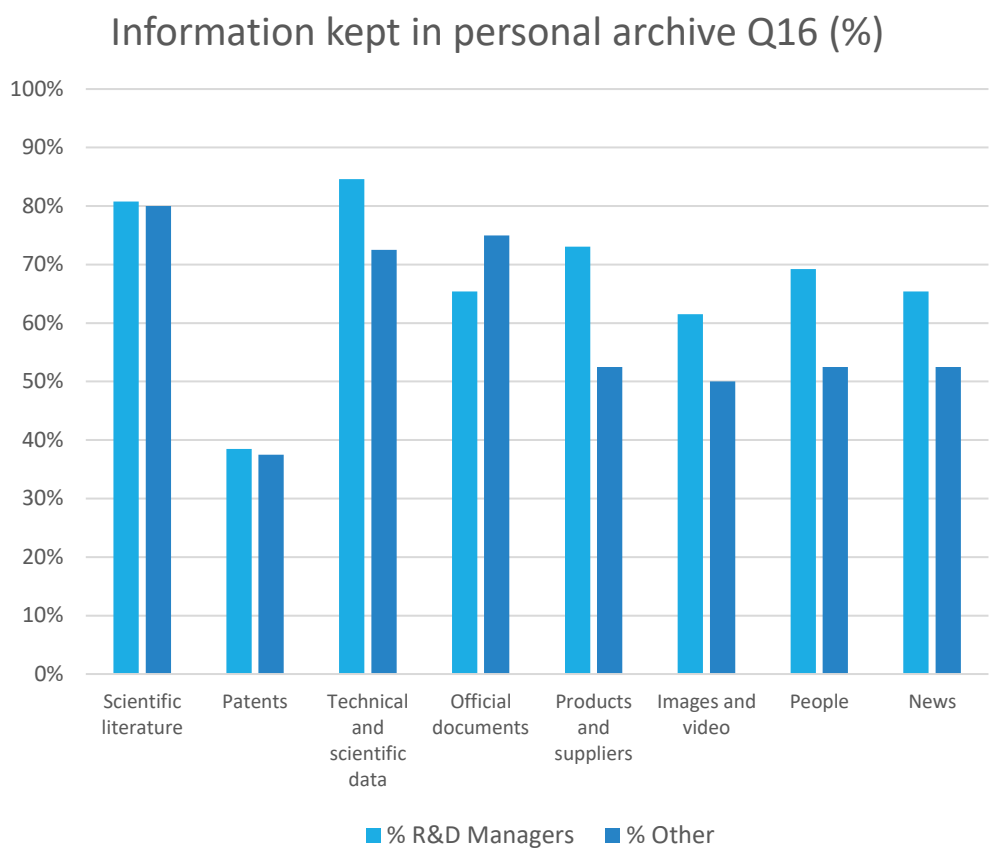
Figure 11b: Information kept in a personal archive by R&D Managers vs Others (%) - Question No. 16



The personal archive is stored using a system of digital folders and subfolders for almost all the professionals (97%), who mainly organize them with a personal approach (70%). 38% of professionals also use a paper filing system (physical folders). Very few respondents use other digital tools for organizing and managing information and documents; some declared using classification systems like tags, keywords, etc. (21%) or digital content management tools (21%).

There are no significant differences for these values in the comparison between R&D Managers and other professionals.

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Figure 12: Information management tools (%) - Question No. 17

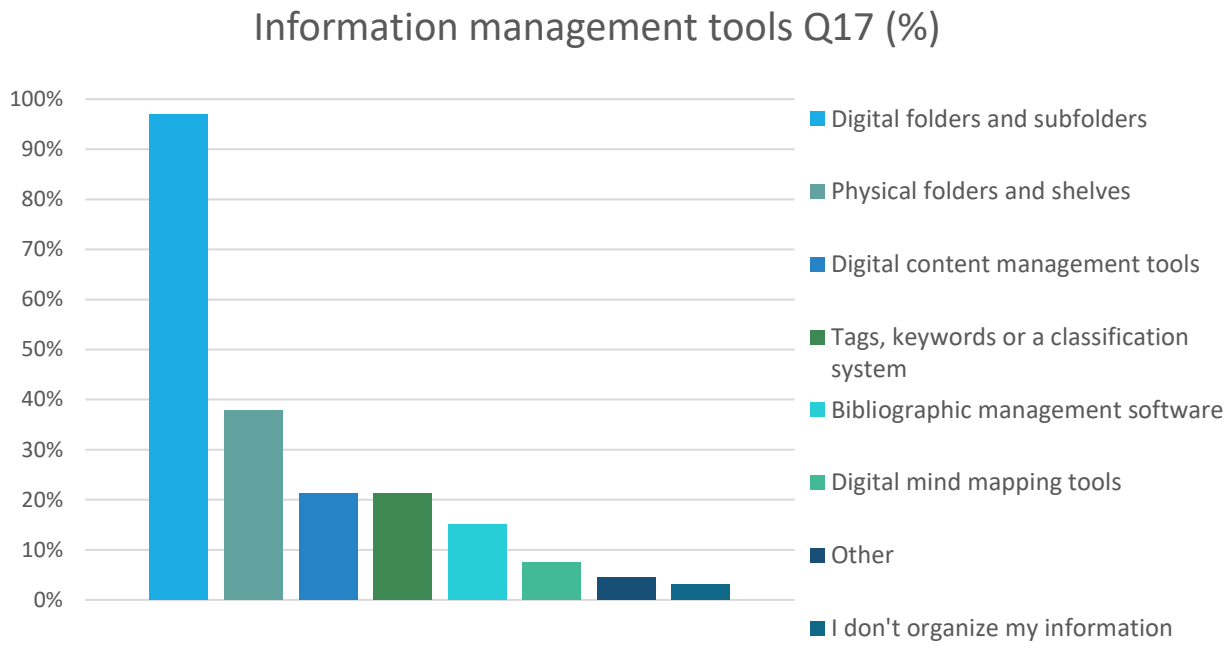
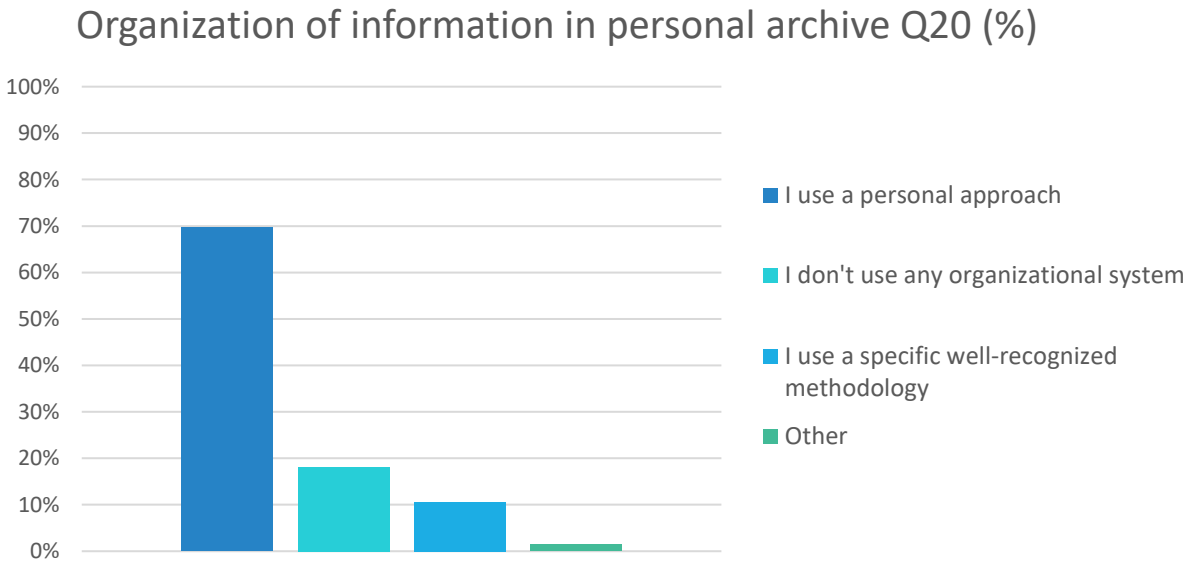


Figure 13: Strategies of organization of information in personal archive (%) - Question No. 20



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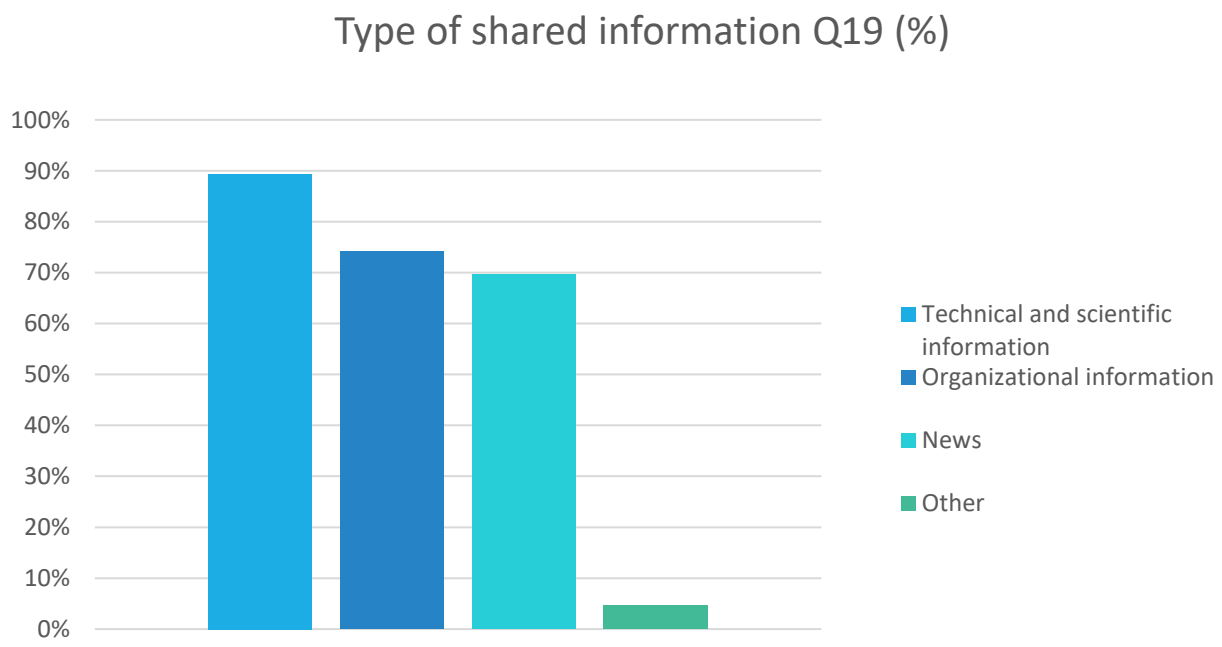
Interviews showed that many participants do not consider CRM-ERP systems to be effective and expressed their reluctance to use them. Some interviewees, about a third of them, declared facing difficulties in finding the documents in their personal archive. They said that even shared storage systems make finding information difficult, especially since each professional organizes and classifies information according to their personal viewpoint and without the use of a common classification system.

Many have expressed interest in receiving training or specific support about information storage and sharing tools and strategies.

Almost all respondents (99%) indicated that they share information with the team they work with. Technical and scientific information is more shared than organizational information or news (with percentages of 89%, 74% and 70% respectively).

Figure 14: Type of shared information (%) - Question No. 19



Almost every participant (95%) selected email as an information-sharing tool. Other tools used are the corporate repository-intranet (44%), digital tools (39%) and cloud storage services like Google Drive or similar (35%).

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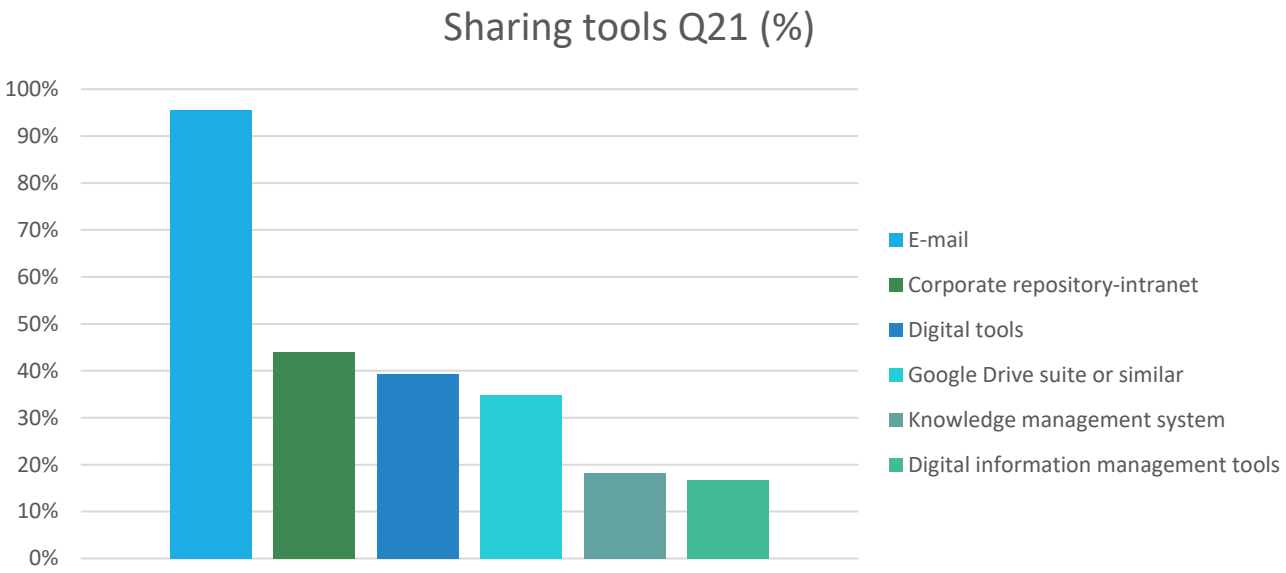
Figure 15: Tools used for sharing information (%) - Question No. 21



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5. Improving skills & training needs

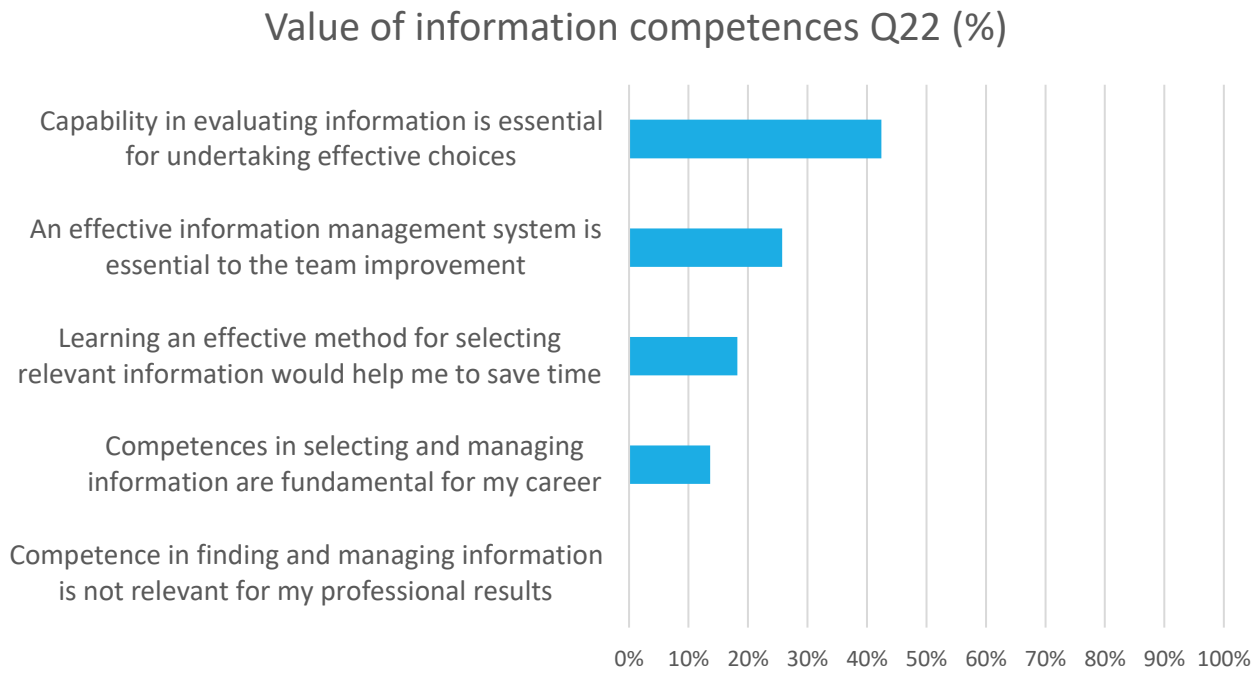
> *'In my opinion, an initial general training could also be done online, while any in-depth studies should be done in the company or also off site. But nevertheless through face-to-face training.'*
> Italian R&D Manager

The value attributed to scientific information and the search for information has been investigated through some questions aimed at detecting the subjective perception of some elements, including its perceived importance, the willingness to pay for it, and the statement of interviewees' training needs.

In general, only slightly more than half of respondents (56%) experienced a situation where finding (or not finding) a piece information was key for the success or failure of their own activities or of the company business.

The graph below shows how the respondents have positioned themselves with regard to certain statements about the value of information competences in their work. Value is given above all to the ability to evaluate information, as a fundamental requirement to be able to make effective choices (42%).

Figure 16a: Value of information competences (%) - Question No. 22



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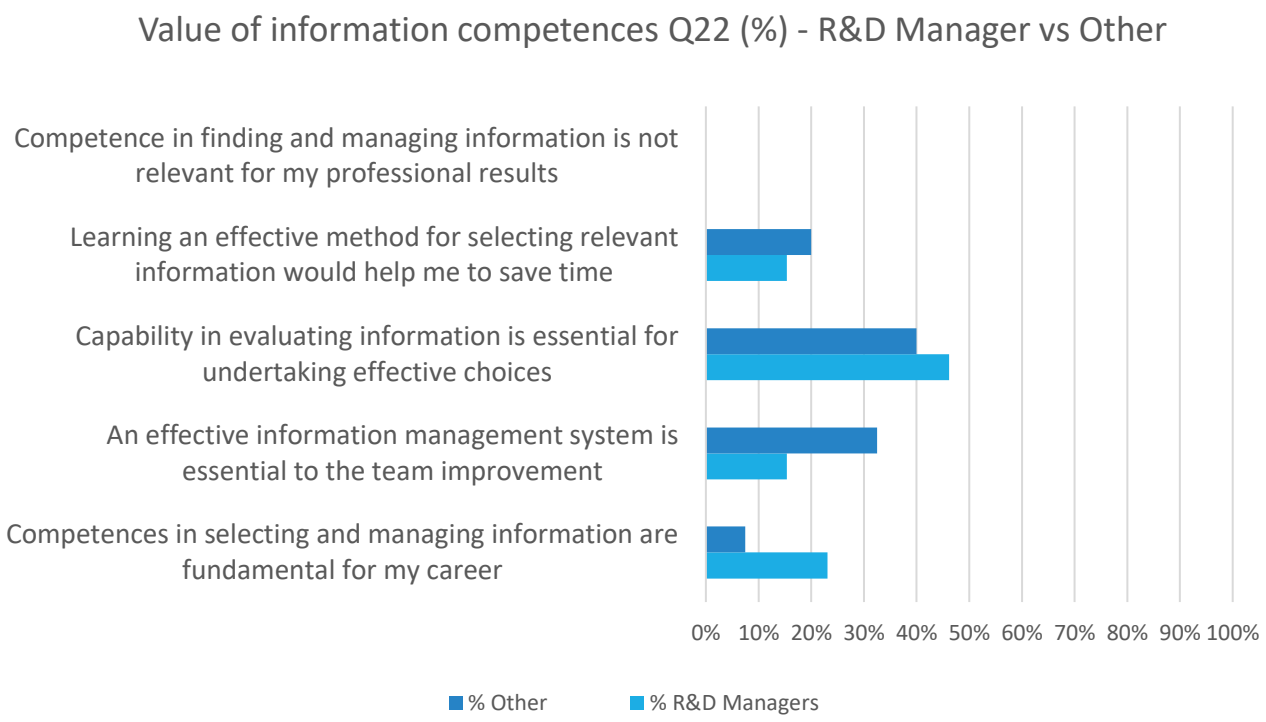
Both the R&D Managers and the other professionals were identified mainly with the sentence "*Capability in evaluating information is essential for undertaking effective choices*" (with percentages of 46% and 40% respectively). However, the R&D Managers also recognized themselves in the statement 'Competences in selecting and managing information are fundamental for my career' (23%), while the others recognized themselves more in the statement 'An effective information management system is essential to the team improvement' (33%).

Figure 16b: Value of information competences by R&D Managers vs Others (%) - Question No. 22



The most selected services for which the professionals indicate that they would pay are the following three: access to databases, access to training resources and advanced information services (all with the percentage of 51% of cases).

Analyzing in detail the responses collected, 43 (66%) professionals have stated their willingness to pay for accessing training resources or receiving specific training on information retrieval. 23 (35% of total) of them would pay only for participating in the specific training courses. The majority of them are other professionals (29 su 43) and respondents coming from companies from the Machinery and equipment (13), Water and environment (7), and Service industry (7) sectors.

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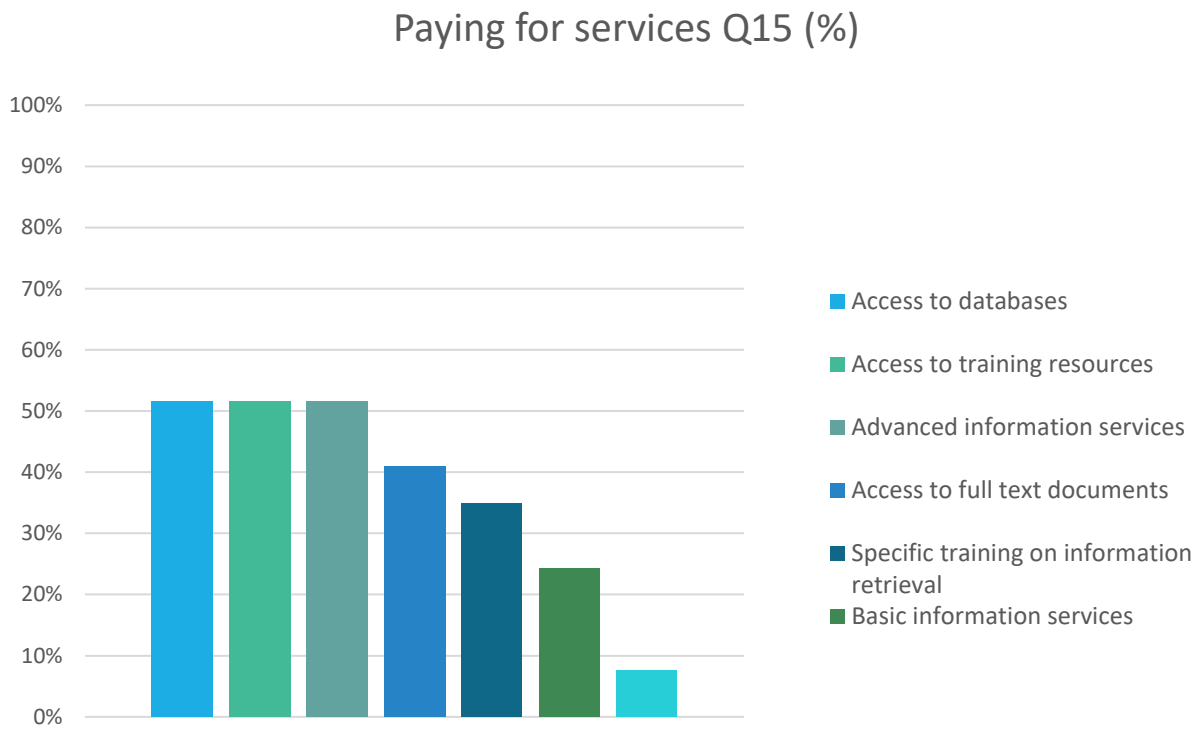
The distribution by country is fairly homogeneous between Italy (20) and Spain (24). No participant of Finnish nationality has expressed any interest in the payment of this kind of services.

The interviews highlighted the interest and readiness for the training on these issues, but at the same time the lack of time to devote to these activities. Some interviewees made an interesting distinction between the possibility of following elearning courses to increase their knowledge and the necessity to work face-to-face for efficiently learning methodologies and strategies of search with relevant repercussions on work activities. Another particular point of attention emerged in relation to the payment of services is the high interest of some to pay for reporting services on the state of knowledge of research on a certain technology or material. According to some interviewees, a service like this should be easily purchased and received in a very short time, without excessive bureaucracy.

Figure 17a: Paying for Services (%) - Question No. 15



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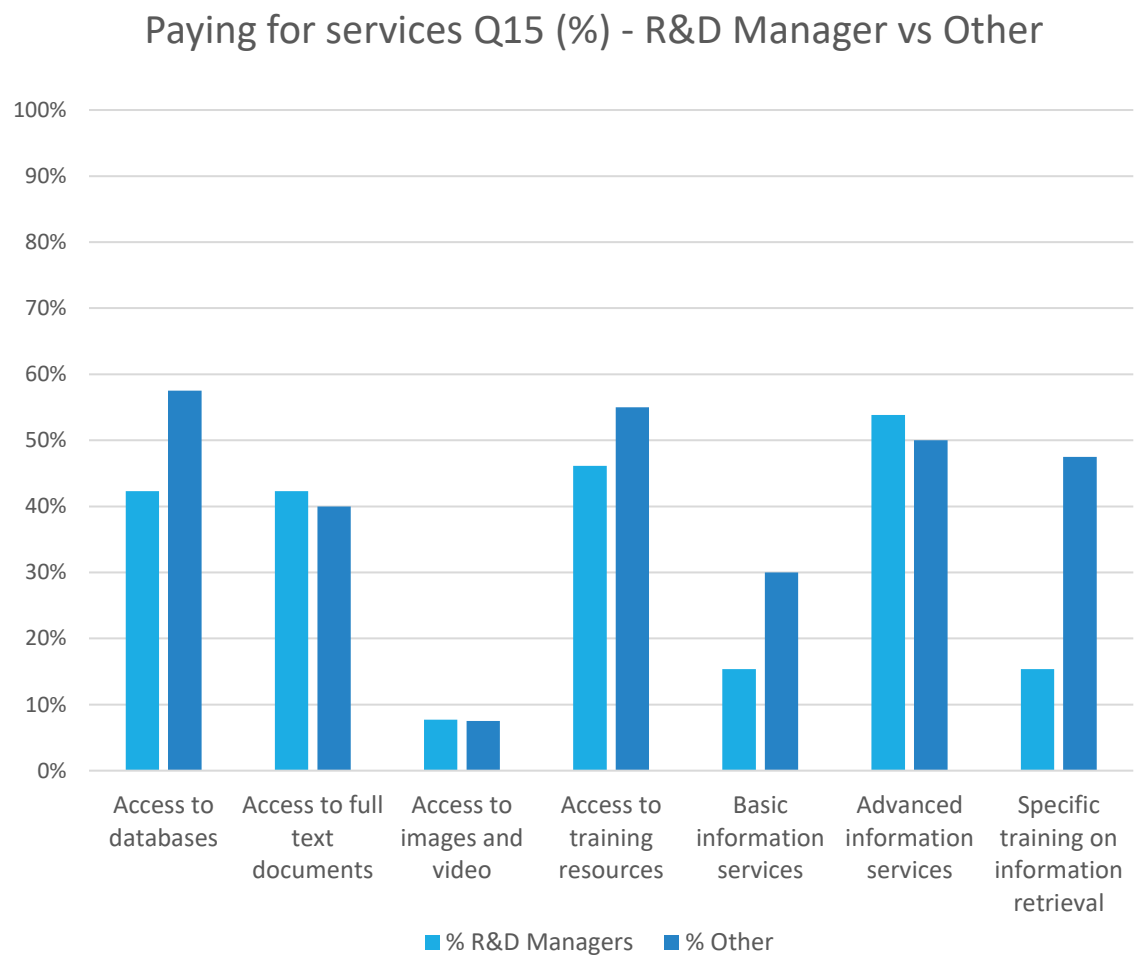
The comparison between R&D Managers and other professionals brings out common interests but also some differences. In both groups 40% or more of the respondents would pay for access to the resources, databases or full text of the documents (in the case of others, the percentage rises up to 58% for access to databases); moreover half or more of the participants in both groups would pay for access to advanced information services (with percentages respectively of 54% of R&D Managers and 50% of the other professionals).

In relation to training services, which are the core issue of the CARONTE project, both groups have expressed interest in paying for accessing training resources (with percentages respectively of 46% of R&D Managers and 55% of the other professionals); while only the other professionals (48%) have declared themselves interested in following specific training courses on information retrieval. The percentage of the RD Managers interested in this type of training is very low (15%).

Figure 17b: Paying for services by R&D Managers and Others (%) - Question No. 15



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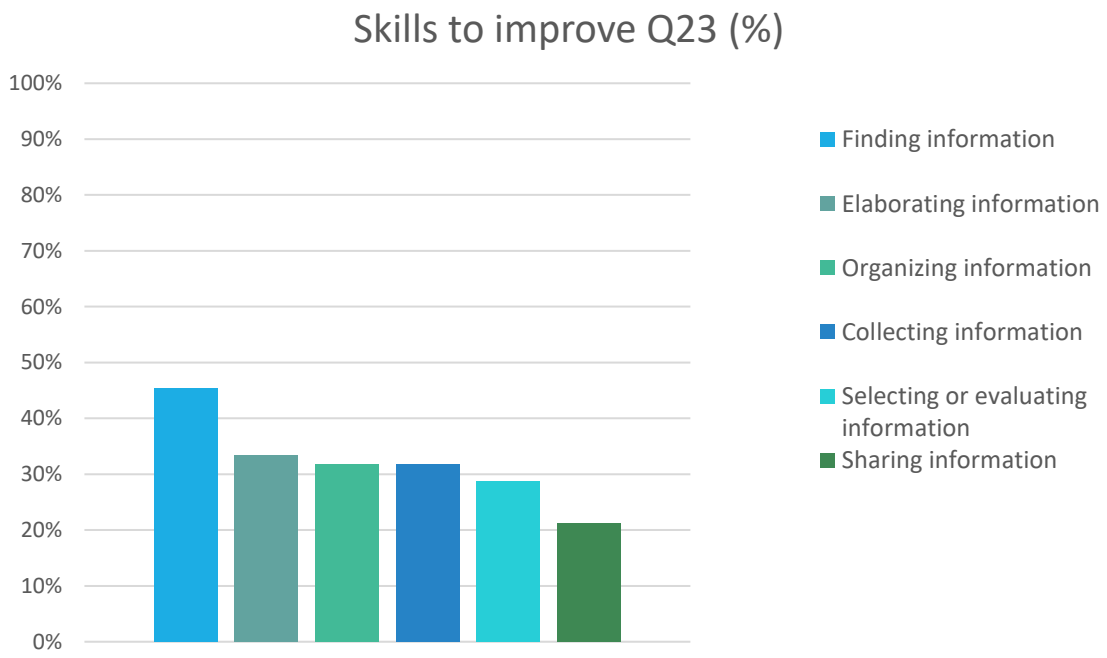
Among the skills that professionals were interested in developing and improving, in general, the ability to find information prevails (46%). Approximately one third of respondents also reported a desire to improve the ability to elaborate information (33%), the ability to collect information (32%) and the skills to organize information (32%).

Figure 18a: Skills to improve (%) - Question No. 23



The interviews highlighted the interest in learning how to:

- know the world of documents;
- acquire a specific research methodology;
- improve the effectiveness of information searches;
- classify documents in the corporate repository;
- effectively organize a personal archive.

Data analysis between the two groups of respondents showed significant differences: for R&D Managers it is more important to develop information elaborating capabilities (46%) and, with lower percentages, finding information (35%) and organizing information (35%); for other professionals it is more important to develop the skills of finding information (53%) and selecting and evaluating information (43%).

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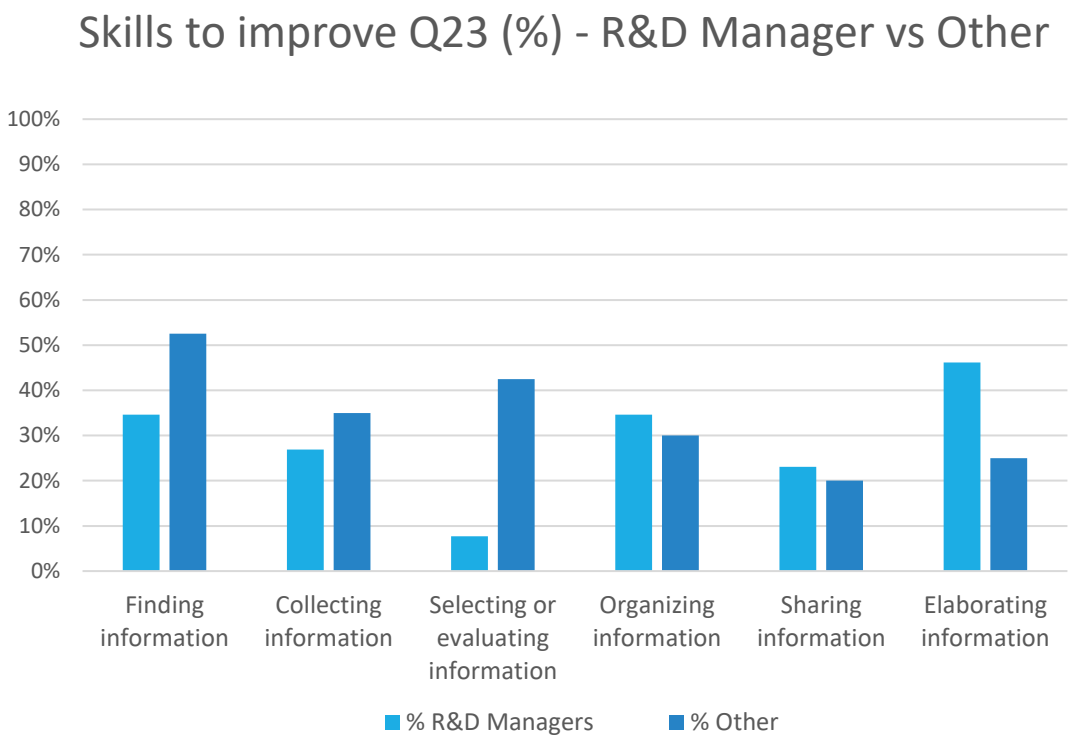
Figure 18b: Skills to improve by R&D Managers (%) and by others - Question No. 23



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6. Case study

As already mentioned, Finnish companies have expressed a very limited interest in participating in the survey (only 4 responses received at the date of the closing of the online questionnaire). Possible reasons concerning this lack of interest, highlighted by DIMMEC itself were:

- lack of a clear added value;
- information management and searching activities being an external service instead of executed internally;
- interest in receiving training only about specific topics, for example in the area of R&D, like artificial intelligence;
- lack of time or other resources.

Taking into account the lack of Finnish data, it was therefore decided to conduct a case study with the objective of better understanding the reality of the Finnish partner context, as a first approach to their environment.

DIMECC Ltd. is an innovation platform for TTM reduction through digital transformations. The acronym stands for Digital, Internet, Materials & Engineering Co-Creation and was born from the merger of two Finnish Strategic Centres for Science, Technology and Innovation (SHOK): FIMECC (Finnish Metals and Engineering Competence Cluster) and DIGILE (non-profit company centered in the development of digital services and the Internet economy). The company operates in a network of 2.000+ R&D&I professionals, 400+ organizations, 69 shareholders and 10+ co-creation facilitators[1].

The sample size corresponds to the total number of professionals working at DIMECC, distributed in two headquarters, Helsinki and Tampere: 10 individuals. The data were collected with the same tools as those used for the rest of the survey.

The questionnaire was completed by 6 employees (60% response rate) during the period in which it was again available online, between February 15th and 21st.

The text of the interview was modified from the original version in order to adapt it to the target. The final document can be found in Appendix B: Interview structure. A number of 3 participants (30% of total sample) were selected for the interview process. Interviews were conducted from February 23rd to March 1st using remote communication tools.

[1] DIMECC Oy (n.d.). Welcome to the open Dimecc hightech ecosystem - Dimecc. Retrieved March 21, 2018, from https://www.dimecc.com/

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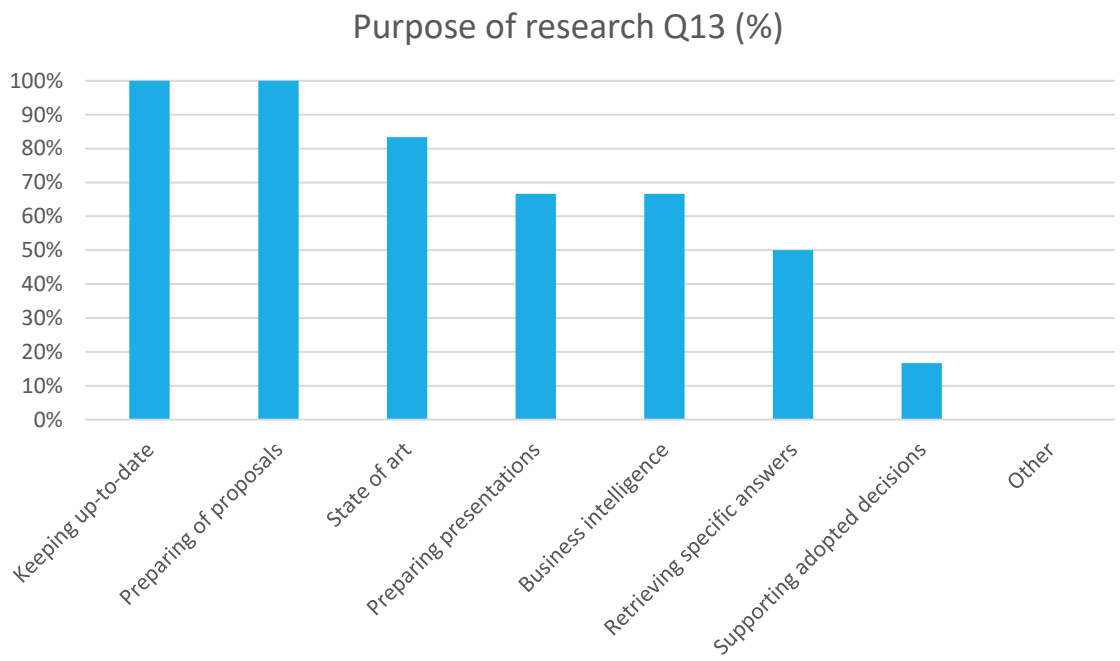
6.1 Result analysis

The sample of participants (6) contained an equal mix (50%-50%) of men and women, as well as R&D Managers and other roles, distributed among the range of 25 to 60 years old, with a certain prevalence of the 41-60 group (66%). The main background is Engineering (50%), that corresponds with the industry core of the company.

There are two common purposes for searching information for all participants of the case study: keeping up-to-date and preparing proposals. Most of them (83%) also selected that they require it for elaborating state of the art reports and a significant number (67%) marked the options preparing presentations and business intelligence activities [see figure 19].

Figure 19: Searching purposes (%) - Question No. 13



Participants did not agree with the selection of a common sector for their company [see figure 20].

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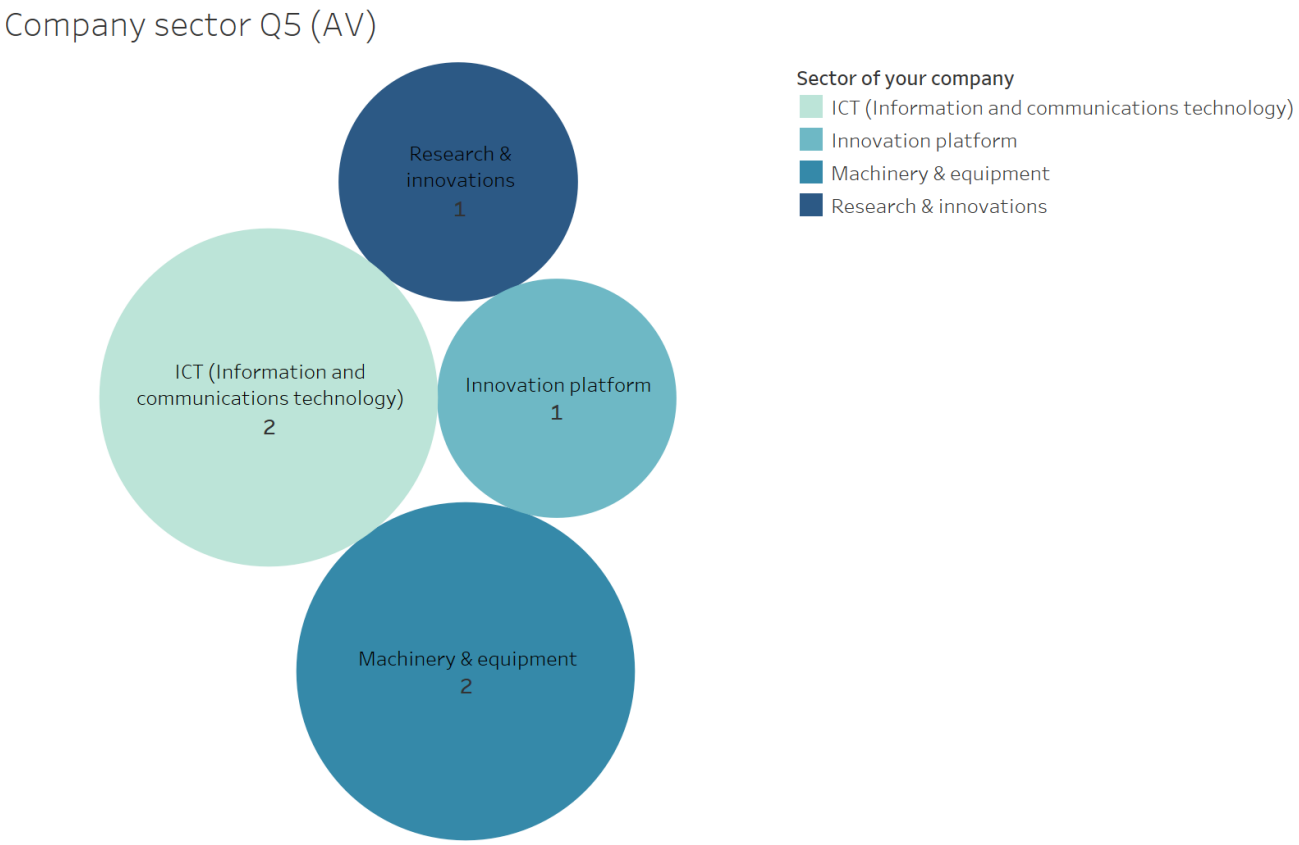
Figure 20: Distribution by company sector (AV) - Question No. 5



The topic of company sector was brought up during the interviews. The interviewee underlined the difficulty in defining a single industry sector and added a new one (Maritime), although she also pointed out that the core of the company is innovation.

All participants worked in a team, mostly in more than one (67%) of medium size (67%).

The types of information most frequently searched (sum of "everyday" and "once a week") are: news (100%), scientific literature (84%), technical and scientific data (84%), people (84%), images and video (83%), and products and suppliers (67%) [see figure 21]. All for except the category "people" matches with the interests expressed by R&D Managers demographic, although the percentages varies. The level of interest for news is however similar to that expressed by Other professionals, being the most frequently searched type everyday for both categories. Patents are again marked as the typology of document that is searched the least.

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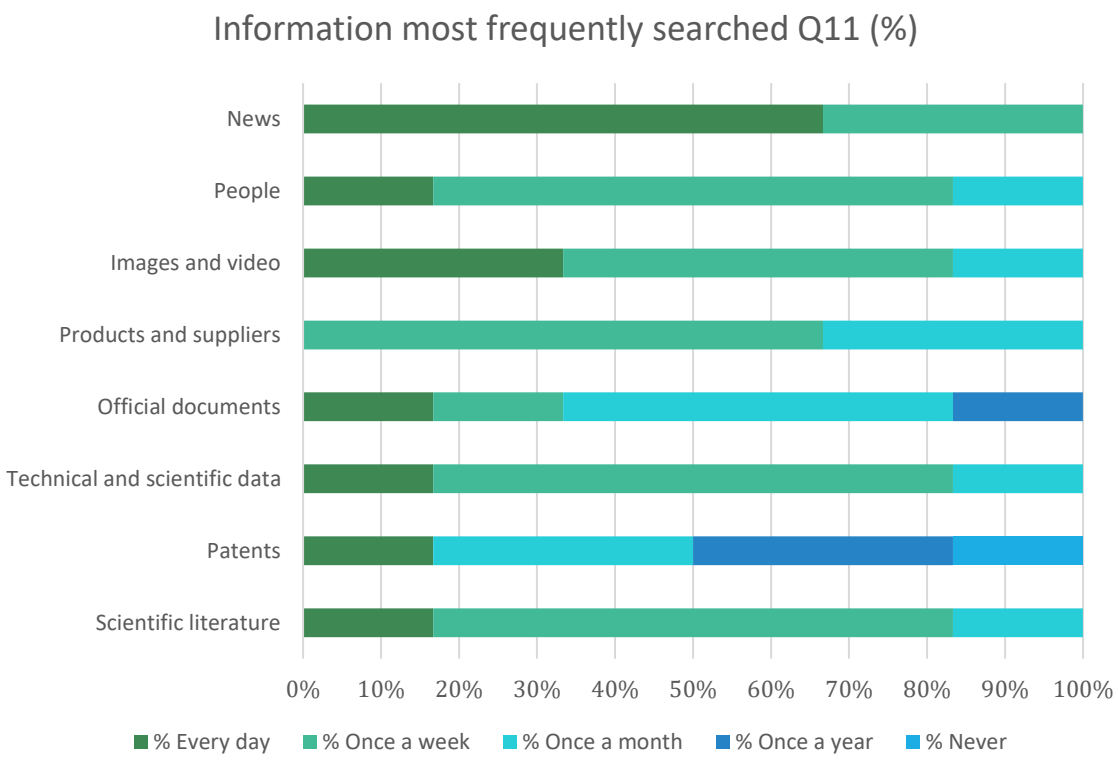
Figure 21: Information most frequently searched (%) - Question No. 11



The importance given to every type of information varies little of how often it is searched. Adding together the options “It’s the most important thing” and “It’s very important”, the following results were obtained: news (100%), technical and scientific data (84%), products and suppliers (84%), people (83%), scientific literature (67%), and images and video (67%) [see figure 22]. These results differ from those obtained from the general survey, where official documents were given more importance, and the typologie images and video, less.

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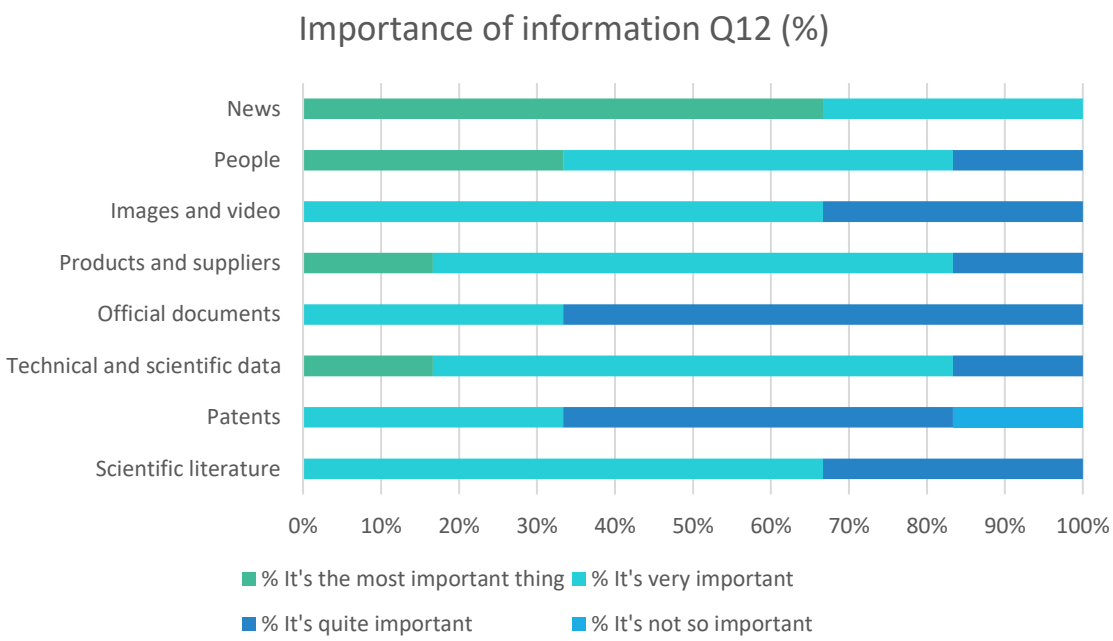
Figure 22: Information considered most important (%) - Question No. 12



The strong value given to the typology "news" by DIMECC (67% of the participants check them everyday and think "it's the most important thing") is also evident from the interviews. The company is subscribed to a tech watch newsletter that all employees receive and share.

Another type of information added as important from the qualitative collection was all data relevant to participant companies, ie. future possible partners (financial situation, news, etc.). This is in line with one of the purposes of searching added in the open text field "other" in the general questionnaire: "Research of potential commercial partners".

Similarly to the results of the general data, patents are the most difficult type of information to find (34% very rarely to rarely locate what they are looking for). In contrast, Finnish staff can find people with a much higher frequency (100% very frequently to frequently). This facility could stem from the numerous shareholders of the company and the diverse networks in which is included.

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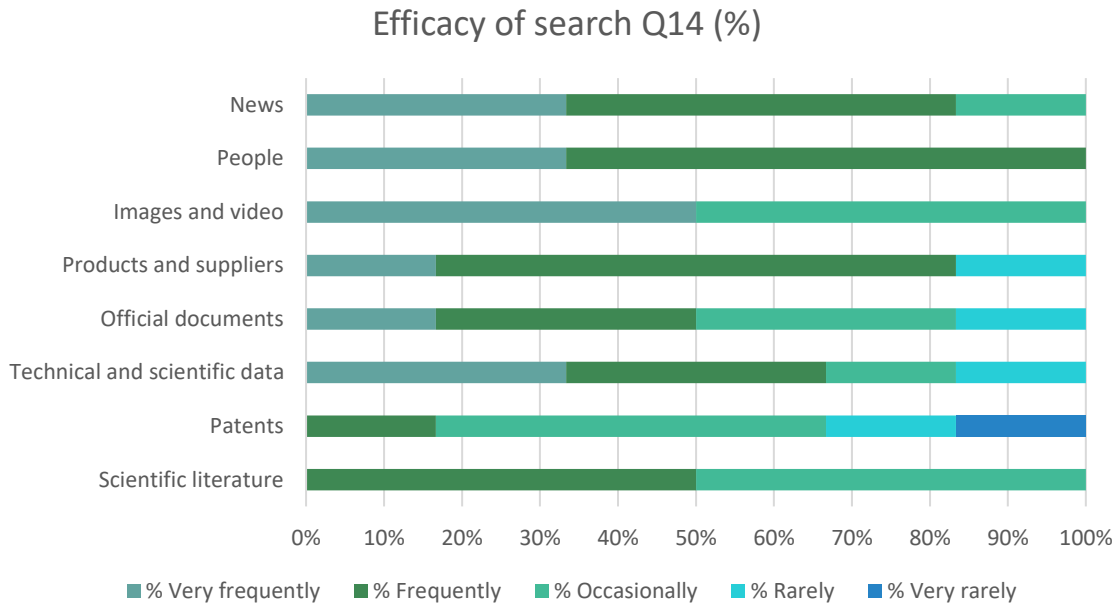
Figure 23: Information most frequently found (%) - Question No. 14



There is a strong contrast in the efficacy of search for some types of information. The typologie images and videos is divided in half between who find them very frequently and who does it only occasionally. Equal division between frequently and occasionally can be found for the type scientific literature and between rarely plus occasionally and frequently plus very frequently for official documents.

Regarding the structure and contents of the personal archive, all participants use a subject hierarchy of digital folders and subfolders to keep scientific literature (100%), products and suppliers (83%), technical and scientific data (67%), official documents (67%), and images and video (67%), organized with a personal approach (67%). The selection corresponds approximately with the typology of documents that are more searched or considered more important, excepting news (50%) that by its nature its importance may be time-dependent, and people (50%), that, according to interviews, it is frequently a type of information used only once.

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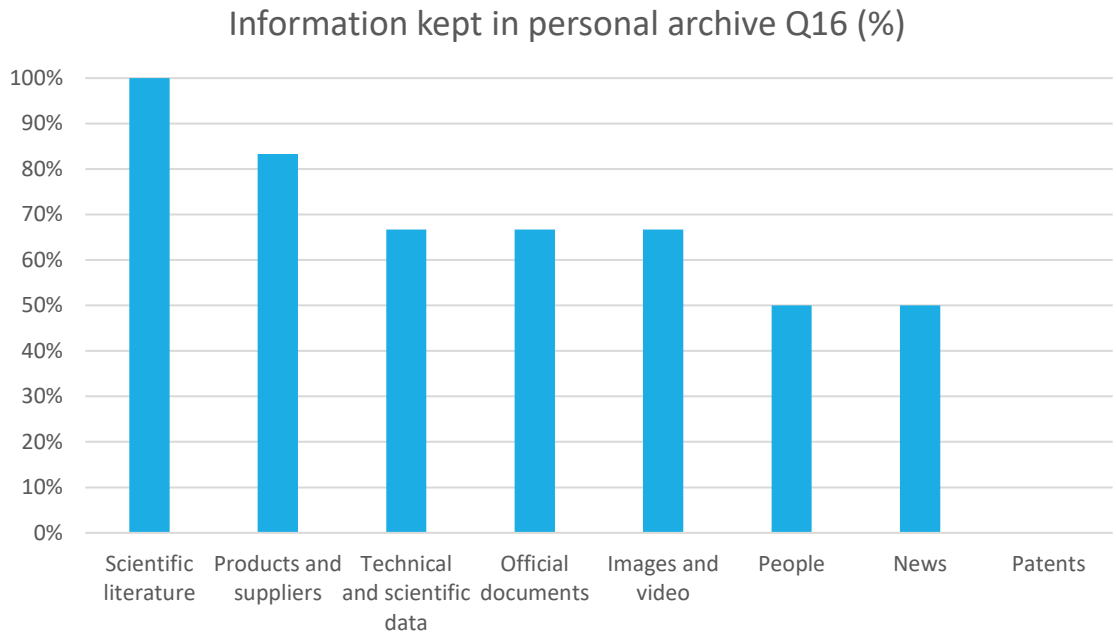
Figure 24: Information kept in a personal archive (%) - Question No. 16



Individually, there were some interesting differences in how the archive would be organized:

1. Filenames with tags (ex. “data”, “regulation”, “legislation”), every relevant article summarized, one document per topic with all summaries
2. Just a flat structure. Using the hierarchy or the search function to retrieve the documents.

There is a generous sharing of information inside of the company, using a range of tools: email (100%), digital tools (83%), corporate repository-intranet (83%), and Google Drive suite or similar (67%). This broad array of selected options is due to the simultaneous work with different companies or external groups (with varied preferences in terms of sharing technologies and approaches).

Much in contrast with the preferences of the rest of the participant to the survey, DIMECC staff would be only interested in paying for access to databases [see figure 25]. Even if there is a 33% of participants interested in improving the skill “Finding information”, none of them have payed or would consider paying for this kind of training.

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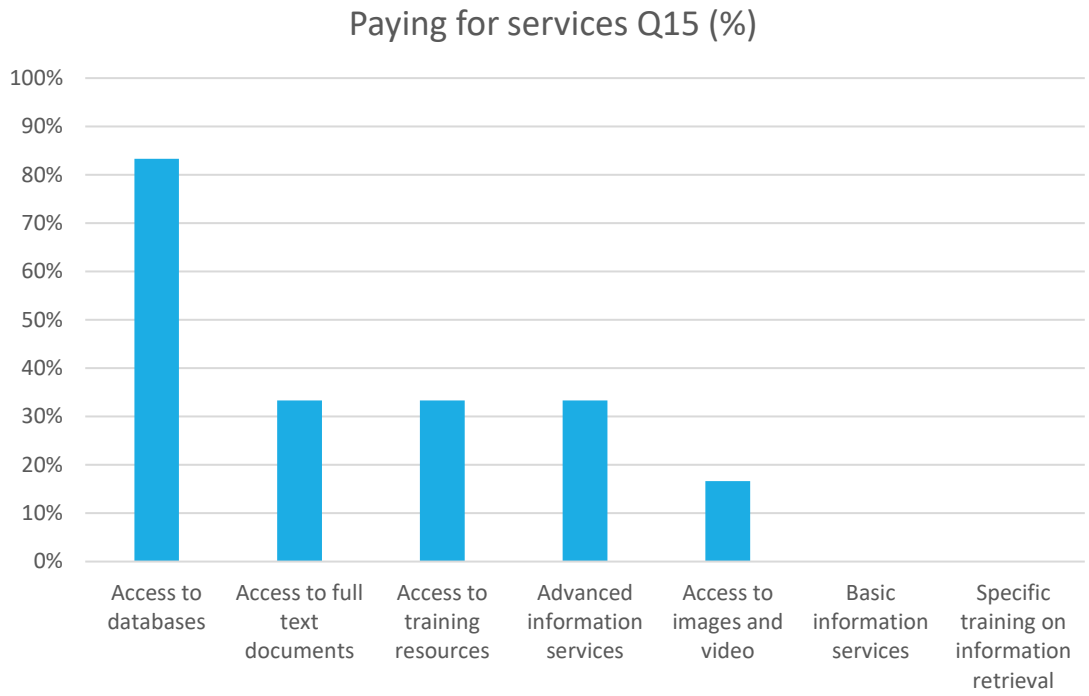
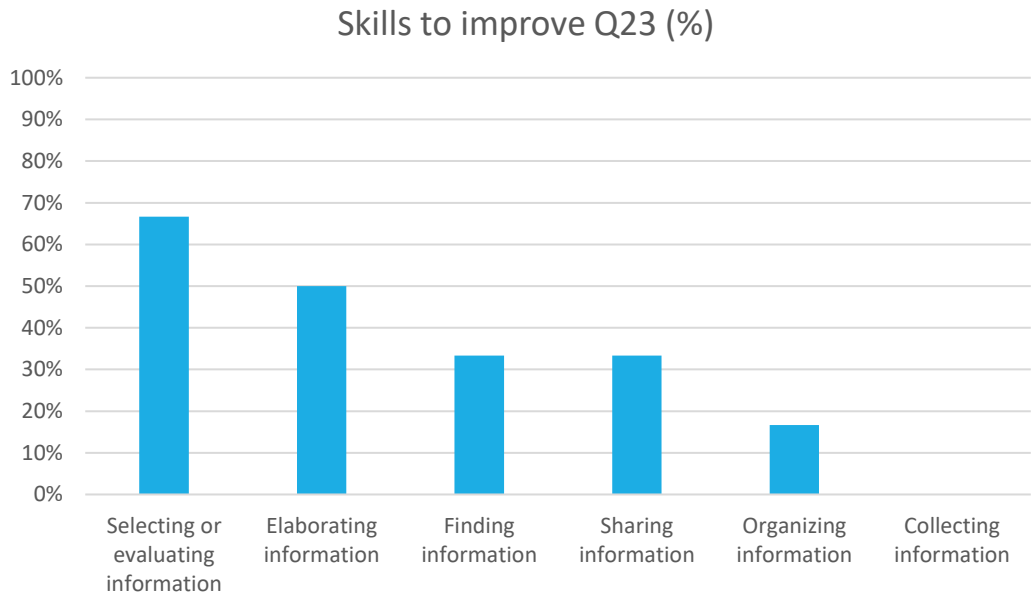
Figure 25: Paying for services (%) - Question No. 15



Participants marked as relevant the competences in selecting and evaluating information [see figure 26], and similarly chose mainly this skill as the one to improve (67%), followed by elaborating information (50%).

Figure 26: Skills to improve (%) - Question No. 23



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The topic of identifying relevant information was equally underlined during the interviews:

> *"Is this important? Is there something for me or is like nonsense in a way that there isn't anything important for me?"*
>
> *Finding relevant information and going through the information and finding relevant points is quite time-consuming [...]*

Participants share a set of common trusted sources and do not feel they are lacking skills to use them or the need to find new ones.

They have a similar method for searching for information:

1. General browsing starting from Google. Picking some ideas from Google Scholar. Selecting keywords.
2. Refine the search.
3. Consulting databases / tech reports.
4. Skimming articles and documents.
5. Getting in contact with experts, if needed (sometimes at the beginning, other times later in the search).

DIMECC employees could identify the steps of their searching process in a more defined way than the interviewees from Italy and Spain, as well as its adaptation to the level of previous knowledge about the topic or the purpose of the research. One of the employees even expressed his advocacy for open science.

The difficulties in these activities that were expressed could be summarized in the following points:

1. Not being able to quickly discern the relevant from the unimportant, during the first steps of the research (before reading the documents). / Filtering through important volumes of documents of different kind (including, for example, video talks).
2. Having the need to use many different sources (source selection).
3. Missing a structured way of sharing information (and especially knowledge).
4. Deciphering and understanding technical papers from different fields.

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6.2 Conclusions

DIMECC is an innovation platform and, as such, the backbone of its staff's responsibilities is the ability to keep up with the latest news and developments in the industry sectors relevant for the company. Being able to select and evaluate information becomes necessarily a fundamental part of their day-to-day activities, and the future inclusion of a new foresight service will increase its importance.

Unlike what has been identified earlier in the survey, DIMECC's staff works mostly with already elaborated information (tech reports) from top consulting firms.

There was no specific interest in receiving training on information retrieval since the interviewees voiced that any eventual lack of skills could be complemented when working with the rest of the team, and the confidence in their own abilities is high:

> *Googling is not as bad as it sounds, but you need to know how to use the search results.*
>
> *Answering the questions what are the things I would like to have that it works better. I know how to do it better.*
>
> *They are the same general issues: "make these keywords, do-do-do…" I know all of them [...].*

Their time disponibility is also very limited:

> *[...] as short as possible, but not shorter.*

This is an ever-present concern for the participants in the survey. The problem of allocating time to training activities remains a key point for DIMMEC employees, as for professionals in general, and for this reason a highly focused training with high added value for daily activities is favored.

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Conclusion

The fact that the questionnaire was answered mainly by professional figures (61% of the respondents) other than by R&D Managers (39% of the respondents) points to the difficulty of involving the specific target of CARONTE project on a cross-cutting theme such as research and management of scientific information, but also highlights the interest for these topics from a wider audience, consisting of professionals that work in or collaborate with the SMEs in various ways.

Such challenges were particularly apparent in the Finnish context, where a lack of responses affected the results of the survey and redirected the study to the inclusion of a small case study.

Professionals need scientific information

Scientific literature and technical and scientific data are among the information most frequently searched by professionals (searched daily or weekly with percentages of 55% and 52% respectively), after news and images and video.Technical and scientific data are also considered the most important type of information for their work (marked as "very important" or "the most important one" from 85% of respondents); and, moreover, scientific literature (80%) and technical and scientific data (77%) are the information most frequently kept in personal archives.

A higher value is attributed to people (68%) -and therefore also to researchers, teams and institutions-, as also emerged from the interviews. Information about people is needed when they search for experts in the field, possible partners, creators or implementers of a technology, potential competitors, or future contacts.

Scientific information should respect some attributes deemed important by the respondents: data should be well founded, reliable, updated, verified and usable, and literature and documents should be preferably open and immediately accessible and readable.

In general, professionals look for information at the beginning of a new project or industrial activity or at the end of these projects and activities, for the purposes of keeping-up-date (91%), deepening the knowledge of a specific topic (89%) and preparing presentations (61%).

They do not use any strategy to organize their personal archive of information (70% use a personal approach) neither any specific digital tool to manage information (like digital content management services, bibliographic management software, digital mapping tools, etc). They usually share information using email (95%) or a corporate repository intranet (44%).

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Professionals need to improve their information competences

For all types of information under consideration, excepting news, it was noted a significative division between those who find information frequently and those who find it occasionally or rarely. The ability to find information is the competence that professionals would like to develop the most among those proposed (46%). In general, 56% of them declare their interest in improving two or more information skills.

Participants have stated their willingness to pay for accessing training resources or receiving specific training on information retrieval (66%), but only a small percentage of R&D Managers (33%) showed an inclination to pay for training activities, and Finnish respondents, none at all. Interviews made explicit participants' interest, mostly among Spanish professionals, in receiving training about archiving information. A third of interviewees in fact stated that finding information from their own personal archives does not come easily.

Italian and Spanish interviewees also expressed their interest for participating in training activities on the topics of searching and managing information, but simultaneously the lack of time to devote to these activities was underlined. They distinguished between the possibility of following elearning courses for receiving a first approach or general information of the topic and the opportunity to work face-to-face for allowing an efficient and deep learning.

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Appendix A: Questionnaire

GENERAL INFORMATION

1. Gender * *Mark only one oval.*
    a. F
    b. M
2. Age * *Mark only one oval.*
    a. < 25
    b. 25 - 30
    c. 31 - 40
    d. 41 - 50
    e. 51 - 60
    f. > 60
3. Country * *Mark only one oval.*
    a. Italy
    b. Finland
    c. Spain
4. Your area of study * *Mark only one oval.*
    a. Chemistry
    b. Computer sciences
    c. Engineering
    d. Economics
    e. Humanities
    f. Material sciences
    g. Physics
    h. Social sciences
    i. Other:
5. Sector of your company * *Mark only one oval.*
    a. ICT (Information and communications technology)
    b. Energy supply
    c. Machinery & equipment
    d. Mobility
    e. Other
6. Your role in the company * *Mark only one oval.*
    a. R&D Manager (internal)
    b. R&D Manager (external consultant)
    c. Other

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7. If other, define your role * *Mark only one oval.*
    a. CEO
    b. Project Manager
    c. Researcher
    d. Intellectual property expert
    e. Communication manager-Social Media expert
    f. Other:
8. Do you work in a team? * *Mark only one oval.*
    a. Yes, only one team
    b. Yes, more than one team
    c. No
9. Usually which is your role in a team? * *Mark only one oval.*
    a. Manager
    b. Collaborator
    c. Both
10. Your working team is usually composed by * *Mark only one oval.*
    a. 2-3 components
    b. 4-8 components
    c. 9-20 components
    d. More than 20 components
11. How often do you search for information related to your job? * *Mark only one oval per row (NEVER / ONCE A YEAR / ONCE A MONTH / ONCE A WEEK / EVERY DAY).*
    a. Scientific literature (papers, books, research results, etc)
    b. Technical and scientific data
    c. Official documents and information (standards and norms, funding opportunities, publications by European Commission, Eurostat, etc.)
    d. Products and suppliers
    e. Images and video
    f. People (partners, research institutes or groups, competitors, etc.)
    g. News (specifically related to your field of activity)

SEARCHING ACTIVITIES

12. How much do you think the following information is important for your job? * *Mark only one oval per row (*IT'S NOT SO IMPORTANT / IT'S QUITE IMPORTANT / IT'S VERY IMPORTANT / IT'S THE MOST IMPORTANT THING).
    a. Scientific literature (papers, books, research results, etc)
    b. Technical and scientific data
    c. Official documents and information (standards and norms, funding opportunities, publications by European Commission, Eurostat, etc.)

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d. Products and suppliers
e. Images and video
f. People (partners, research institutes or groups, competitors, etc.)
g. News (specifically related to your field of activity)

13. For which activities do you search information for? * *Tick all that apply.*
    a. Keeping up-to-date
    b. Preparing presentations (internal project meetings, public speeches, etc)
    c. Deepening knowledge about specific topic (state of art)
    d. Analysis of competitors' activities
    e. Preparing of proposals (grant application, internal project, etc)
    f. Retrieving specific answers to a specific information problem
    g. Supporting adopted decisions
    h. Other:
14. Do you usually find what you search for? * *Mark only one oval per row (VERY RARELY / RARELY / OCCASIONALLY / FREQUENTLY / VERY FREQUENTLY).*
    a. Scientific literature (papers, books, research results, etc)
    b. Technical and scientific data
    c. Official documents and information (standards and norms, funding opportunities, publications by European Commission, Eurostat, etc.)
    d. Products and suppliers
    e. Images and video
    f. People (partners, research institutes or groups, competitors, etc.)
    g. News (specifically related to your field of activity)
15. For which of the following sources or services did you pay or would you consider to pay? * *Tick all that apply.*
    a. Access to databases (bibliographic, materials, professionals, etc.)
    b. Access to full text documents
    c. Access to images and video
    d. Access to training resources
    e. Basic information services (bibliographic search, list of technical and scientific documentation, document retrieval)
    f. Advanced information services (literature review, synthesis of technical and scientific documentation, technological state of art, panorama of expert/suppliers/key players, funding opportunities, patent analysis)
    g. Specific training on information retrieval and management

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INFORMATION MANAGEMENT

16. Which information do you keep in your personal archive/storage system? ** Mark only one oval per row (YES / NO).*
    a. Scientific literature (papers, books, research results, etc)
    b. Technical and scientific data
    c. Official documents and information (standards and norms, funding opportunities, publications by European Commission, Eurostat, etc.)
    d. Products and suppliers
    e. Images and video
    f. People (partners, research institutes or groups, competitors, etc.)
    g. News (specifically related to your field of activity)
17. Which tool do you use to organize the information you have found? ** Tick all that apply.*
    a. I use digital folders and subfolders
    b. I use digital content management tools (Diigo, Evernote, Scoop.it, etc.)
    c. I use bibliographic management software (EndNote, Mendeley, Zotero, etc.)
    d. I use digital mind mapping tools (Cmap, mindmap, Mindomo, etc.)
    e. I use tags, keywords or a classification system
    f. I use physical folders and shelves
    g. I don't organize my information Other:
18. Do you share the information you have found with a team? ** Mark only one oval.*
    a. Yes
    b. No
19. Which information do you share with your team? ** Tick all that apply.*
    a. Technical and scientific information
    b. Planning - Organizational information
    c. News
    d. Other:
20. How do you organize your personal information management? ** Mark only one oval.*
    a. I use a specific well recognized methodology (specify in Other).
    b. I use a personal approach
    c. I don't use any organizational system
    d. Other:
21. Which tools do you use to share information in your teamwork? ** Tick all that apply.*
    a. E-mail
    b. Digital tools
    c. Google Drive suite or similar
    d. Digital information management tools
    e. Corporate repository-intranet
    f. Knowledge management system
22. Please select the sentence you identify the most with ** Mark only one oval.*

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a. Competences in selecting and managing information are fundamental for my career
b. An effective information management system is essential to the team improvement
c. Capability in evaluating information is essential for undertaking effective choices
d. Learning an effective method for selecting relevant information would help me to save time
e. Competence in finding and manage information is not relevant for my professional results

23. Which of the following skills would you like to improve? * Tick all that apply.
    a. Finding information
    b. Collecting information
    c. Selecting or evaluating information
    d. Organizing information
    e. Sharing information
    f. Elaborating information
24. Do you have an example of a situation in your working experience where finding/not finding the right information has been crucial for you or your business? ** Mark only one oval.*
    a. Yes
    b. No
25. Would you be available for a brief interview about the topics addressed in this questionnaire? ** Mark only one oval.*
    a. Yes
    b. No
26. If yes, please add your contact information

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Appendix B: Interview structure

Interview for general survey

Greetings

Introduction

- Brief introduction to CARONTE Project.
- May I record our conversation?

Core interview

General information

1. Key data about your company. Market sector, main activities, etc.
2. Tell me briefly about your role in the company and what kind of work you are engaged in.
3. What are the main stages of your activity?
4. [If he/she has answered that works in a team] How is the work in your team organized?

Habits in researching and managing information

5. In relation to the stages of your activity that you have just described, in which of them do you feel the need to search for technical or scientific information (articles, patents, data, reviews, etc.)? Can you give an example of a recent or past activity in which the search for technical or scientific information was fundamental for the success of the activity?
6. You have indicated as important the following types of information: [bring questionnaire data]. Among these, are there some that you deem decisive for reaching your goals? Are there any characteristics that according to you are more fundamental than others? For example: free, from certified/controlled sources, easily accessible, instant accessibility…
7. Which channels/tools do you use for searching the information you need? Do you use different channels for different types of information or do you always use the same channel/tool? If yes, which ones?
8. Do you find difficulties in finding information in Internet? If yes, which difficulties?
9. Could you tell me about one episode/case of your activity in which it has been impossible to find information?
10. Do you know any expert to whom you entrust or would you entrust the searching of information?
11. Would you deem useful a methodological-training support for improving your searching and managing information capabilities? [If yes, try to understand how much time would he/she be willing to dedicate, in what form (e.g. face-to-face, e-learning, blended learning, etc.), if on site or in another place, etc.]

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12. You have indicated that your personal archive is organized like this: [bring questionnaire data]. Can you tell me more in detail? What do you archive and how? Do you use a tool in particular or some specific technique?
13. Do you manage to find the information that you have archived when you need it in a quick and easy way? If not, could you give me some real example of the difficulties you face / have faced?
14. Regarding the team or the people you collaborate with, which kind of information do you usually share? How do you share it (do you use any tool or strategy in particular)? Do you face any difficulties in doing so? [Ask for examples.]
15. Would you deem useful a methodological-training support for improving your archiving and sharing information capabilities? [If yes, try to understand how much time would he/she be willing to dedicate, in what form (e.g. face-to-face, e-learning, blended learning, etc.), if on site or in another place, etc..]

Feedback

16. Would you like to add any other information about this topic?
17. Are you interested in receiving the transcript of the interview for conservation or review?
18. Are you interested in being updated about the final product?
19. Thank you very much for taking the time to answer my questions!

Interview for case study

Greetings

Introduction

- Brief introduction to CARONTE Project, if needed.
- May I record our conversation?

Core interview

General information

1. Tell me briefly about your role in the company and what kind of work you are engaged in.

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Habits in researching and managing information

2. How do you usually behave when you need to look for the information you need? Could you briefly describe how do you proceed / what do you do? How do you organize your searches?
3. You have indicated in the questionnaire that you search information for the following activities: [bring questionnaire data]. Which channels and sources do you use to achieve your goals?
4. You have marked as important the following types of information: [bring questionnaire data]. Is there any other type of information that is important for you and that I have not listed?
5. Which are the main difficulties that you face in finding information?
6. How do you organize the information that you find? In the questionnaire you have indicated that the tools that you use are these: [bring questionnaire data]. Can you tell me more in detail? How do you use the folders? [if marked in the questionnaire]. How do you use the tags and which tags? [if marked in the questionnaire], etc.
7. You have indicated that you use the following strategy for your personal information management: [bring questionnaire data]. Could you briefly tell me what it consists of?
8. You have indicated that you would like to improve the following skills: [bring questionnaire data]. What would you expect to learn or to better? How much time would you be able to dedicate to this type of training?
9. Regarding the team or the people you collaborate with, which kind of information do you usually share? How do you share it (do you use any tool or strategy in particular)? Do you face any difficulties in doing so? [Ask for examples.]
10. You indicated in the questionnaire that you have an example of a situation in your working experience where finding / not finding the right information has been crucial for you or your business. Could you tell me your example?

Feedback

11. Would you like to add any other information about this topic?
12. Are you interested in receiving the transcript of the interview for conservation or review?
13. Thank you very much for taking the time to answer my questions!

Place: Bologna (Italy)

Date: 27 febbraio 2019

CARONTE Coordinator

.....Paolo Dondi.....

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