Parallel Session 17: Scientists an science institutions as PCST agents: responsabilities?

SCIENTIFIC RESEARCH AND SOCIAL CULTURE. SOCIAL RESPONSIBILITY OF RESEARCH CENTRES

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Abstract

The scientific and technological knowledge are unable to form part of our popular culture.

Important historical marks, deficiencies in educational policy, and the mass media are frequently pointed at for being responsible of the divorce between *"both cultures"* giving rise to many severe evils in our society.

Who should be the driving force of this cultural change?

In our view, the leaders of that cultural revolution should be the science centres and universities.

For this to be possible, it is necessary to tear down the following myths that limit us when suggesting scientific communication.

Key Words: cultural revolution, social returns, tear down myths

Text

The relationship between science and society continues to be a cultural challenge yet to be solved. Immersed in this 21st century, identifying an economic or a simple daily activity, in which technological innovation is not decisive, is difficult. Science, technology and innovation constitute a fundamental chain in the nature of the modern citizen. However, and this is one of the paradoxes suffered in the world of science, scientific and technological knowledge are unable to form part of our popular culture. Moreover, the word "culture" is still reserved for traditional culture, the so-called artistic-literary one, in the same way that the scientist is still denied the condition of "intellectual."

Important historical marks, deficiencies in educational policy, and the mass media are frequently pointed at for being responsible of the divorce between *"both cultures"* giving rise to many severe evils in our society. It is pointless to look for culprits and to repeatedly discuss what we are already aware of if we do not find ways to change these things.

The "Encyclopaedia" compiled and made the knowledge of the time available to the bourgeoisie. It was a cultural initiative of great ideological importance. It is now our turn to create and develop efficient means to enlighten the great public with a scientific and technical understanding.

The question is: Who should be the driving force of this change? In our view, the leaders of that cultural revolution should be the science centres and universities. These centres are the deposits of the knowledge we are trying to transmit, and it is in these places where scientific advances take place. Expecting the public administration, businesses, or the media to begin this process is the same as asking one to share what one does not possess.

The cultural extension of science should be carried out with the deep conviction that knowledge is not an exclusive treasure belonging to the scientists that produce it, or the centres or the Universities they work at. Science is to be shared, making it accessible to all citizens.

In reality, how do we carry out this cultural revolution? The first step will be to make efficient systems available in the research nuclei in order to inform, in a feasible way, about what researchers do and to explain its importance for citizens. For this to be possible, it is necessary to tear down the following myths that limit us when suggesting scientific communication.

FIRST MYTH

"The communication of science demands exclusive approaches, very different than those of commercial communication."

It is certain that science, due to its abstraction and complexity is a *rara avis*, in terms of communication. However, besides knowledge, laws and formulae, filled with complexity and abstraction, science is also a "product" with great attraction offering unsuspected possibilities if we are able to apply techniques used in the world of commerce.

SECOND MYTH

"The mass media are the essence of communication"

The mass media are the transmitters, not the essence or the origin of scientific messages. It is in these facilities where these messages should be generated, based on new discoveries. Research entities need to create specialized departments for communicating the results and organizing outreach activities (visits to scientific institutions, exhibits, digital and printed publications, activities related to the week of science, outreach talks, courses for educating teachers, participation in radio and television programmes, etc.) directed to the public.

THIRD MYTH

"The challenges to the Department of Communication come from the outside"

False. The first great challenge that a Communications department must face is internal, and it begins with the complicated task of changing the Pythagorean philosophy of many scientists and winning them over to the cause of outreach, showing them that this is the best way to achieve the support that they claim from society.

FOURTH MYTH

"Scientists are busy enough doing quality science!"

This is certainly their best contribution to society. However, the scientific community cannot be a reservoir of knowledge, culturally futile to the great public. Scientists must understand that it is the citizens who pay their bills and that, for this reason, they have the right to obtain at least three "social returns" from science:

- **First return:** the right to take part, in some way, in the prioritisation of areas of research to be funded.
- **Second return:** the right to demand more outreach, which will allow them to increase their scientific and technological knowledge.
- **Third return:** the right to demand that the "science-technology" chain also benefit business and increase the well being of the citizens.

If the world of research were to take on this social challenge, its relationship with society would be much better.

FIFTH MYTH

"Our senses play no part in understanding science."

Science = concepts and laws = abstraction. This is true, but experience facilitates understanding. Conceptual coexistence generates strong emotions that should also be transmitted.

Putting it in a more philosophical way, we are trying not to forget the basis of that old adage, compiled by Locke*: Nihil est in intellectu quod prius non fuerit in sensu ('the intellect knows nothing that our senses have not known beforehand'*), which translates into favouring direct contact between the public and research centres, and their respective scientists and technologists, allowing for the citizens to have new experiences and, thus, mobilize their intelligence.

SIXTH MYTH

"Popularised science is no longer science"

This is as true as saying that flour isn't wheat. Science popularisation generates a new product to which it would be inappropriate to apply the conceptual precision of the original science, but that allows for a better understanding of science by the man on the street.

SEVENTH MYTH

"Communications do not need human or material resources"

More than a myth, this is nonsense. Communication requires management and communication professionals, journalists, graphic designers, computer services, and in short, funding. Around a 3% of the centre's annual budget and projects should be destined to these tasks.

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EXPERTISE FOR THE PUBLIC: THE SCIENCE-JOURNALISM INTERFACE IN GERMAN DISCOURSE ON GLOBAL CLIMATE CHANGE

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Abstract

Based on a mail survey of journalists and experts we analyzed the science-journalism interface in the German discourse on global climate change. The purpose was to better understand how scientific knowledge is integrated into public discourses and to explore what happens to the meaning of scientific knowledge when it enters the realm of the media. We found a strong co-orientation of experts and journalists. Furthermore, we identified some characteristics of "meaning production" in the journalistic processing of expertise. The survey is part of our project "Climate Change in the Public Sphere" and was funded within the German Climate Research Program.

Key words: Global climate change, science-journalism interface, experts

Text

Introduction

Global climate change is one of the major environmental challenges. In Germany, the expectation of raising sea levels and increased storm tides have led to concerns about coastal protection at the North Sea coast.

Scientists have been very active putting the climate change issue on the political agenda and still are important protagonists of that issue (cf. Weingart, Engels & Pansegrau 2000). The climate change issue provides an excellent opportunity to study the inclusion of scientific expertise in public discourses. This paper deals with the interface of science and journalism: How do experts and journalists interact? Is there cooperation or antagonism? Which semantic processes take place when scientific expertise is included in media reports?

Method

Monitoring the coverage of climate change and coastal protection in 32 newspapers, magazines, radio and TV programs from February 2002 to February 2003 we identified experts quoted as sources. Experts and story authors received matching questionnaires by mail. Each questionnaire included a general module and one or more special modules referring to specific expert-journalist encounters.

169 experts returned questionnaires providing information about 186 encounters with the media (response rate 58%); 85 journalists returned

questionnaires with 103 completed special modules about encounters with experts (response rate 35%).

Results

The analysis of information channels shows that public relations as well as journalists' initiatives in contacting interview partners are important means to initiate contacts. About two third of the quotes are based on face-to-face or phone interviews.

The experts and journalists have remarkably similar beliefs about science, the media, the rights and duties of experts and journalists and the climate change risk. Selected items where there is some difference between experts and journalists are listed in Table 1. Sometimes the experts even take a more "journalistic" view than the journalists (I2) and journalists a more "scientific" view than the experts (I3). This is an indicator of co-orientation: Journalists respect expert norms and goals; experts on the other hand anticipate journalistic norms and goals.

There is only one item (I1) where experts and journalists outright disagree: Experts claim a say in the shaping of journalists' stories for which they have been interviewed, a demand that is clearly rejected by journalists.

Table 1: Beliefs and expectations of experts and journalists

	Experts (n=169)	**Journalists** (n=85)
I1: Experts have a say in the journalistic framing of the media product, for which they have been interviewed	1,09	-1,93
I2: Journalists can expect experts to express themselves in an understandable manner	2,10	1,27
I3: Environmental sciences should select their research questions based on purely scientific criteria	-0,02	0,47
I4: The media should always be critical regarding environmental experts and probe into their interests	1,31	2,32
I5: The media should dramatize the environmental situation a little to effectively warn the public	-1,19	-1,68
I6: Environmental experts should not only express their opinion on technical questions, but also criticize decisions and propose options for action	1,40	2,05
I7: Experts should warn the public, even if there is only a suspicion of possible dangers	1,12	1,62
I8: Environmental experts should contact journalists themselves and offer information	1,10	1,93

Mean values of a 7-step scale ranging from -3 ("strongly disagree") to +3 ("strongly agree");
all differences are statistically significant (t-test, $p<0,05$)

Experts and journalists assess climate risks very similarly: 90% of the experts and journalists are convinced that climate change will happen. Somewhat more than half of each group say that it is still possible to prevent climate change. And slightly more than half of the experts and journalists agree that Germany can cope with climate change. Although risk perception varies *within* the groups of experts and journalists, there is no great difference *between* the groups.

Guided by journalistic principles, "meaning production" takes place during the interactions. It is based on processes such as inquiring, selecting, emphasizing, re-contextualizing and evaluating. By means of qualitative content analysis of the answers to open questions we identified characteristics of journalistic processing of expert information:

Focus on a core message: Journalists rigorously reduce the complex expert information. They select a single aspect, omit details and apply an "angle".

Change of context: Journalists put research results into other contexts. They make connections to political processes and everyday experience.

Preference for concrete over abstract information: Experts tend to volunteer abstract information whereas journalists expect concrete information.

Preference for definite over vague information: Experts try to be cautious. They prefer to say "something could happen" rather than "will happen", for example. Journalists prefer definite statements and tend to omit qualifications.

Despite some criticism in detail – caused by discomfort because of semantic changes and factual errors – most experts in the climate change discourse have a lot of sympathy for the journalistic approach. Both groups express high satisfaction with the interaction partners (see Table 2). About 90% of the experts are at least "rather satisfied" how the journalists used their information.

Table 2: Evaluation of contacts

"How would you describe your contacts with journalists [experts] in general?"		
	Experts	**Journalists**
Mainly good	78,6%	91,7%
Good and bad experiences are balanced	20,8%	8,3%
Mainly bad	0,6%	0,0%
	100,0% (n=168)	100,0% (n=84)

Conclusion

The science-journalism interface in the climate change discourse is well-developed. The relevant scientific communities obviously include scientists who feel comfortable talking to the media and who are prepared to meet the

media's demand of not only facts but also interpretations. This expertise is processed according to journalistic rules. The resulting semantic changes only mildly irritate experts. We observe a strong co-orientation of experts and journalists, a situation that might be called "symbiotic".

Similar to other studies (cf. Peters 1995), there is strong disagreement between experts and journalists about how much control the experts should have over media coverage. Because of the strong co-orientation this control issue hardly leads to conflicts and frustrations: Journalists and experts seem to pull at different ends of a rope – but apparently they pull in the same direction.

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THE SCIENTIFIC COMMUNITY AS A SOURCE OF INFORMATION ABOUT THE *PRESTIGE*

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Abstract

The scientific community as a source for information on the *Prestige* oil spill in Galician journals is discussed. All environmental news were indexed in a database as a part of a wider study. This paper analyses the percentage of sources from he scientific community; the content of the scientists´statements, the support for their claims and their role in the media communication. The sources from the government outnumber the scientific voices, so the scientific community is not the main source of information. The transformations in the discourse are also analysed.

Keywords: Press communication, scientific community, transformation of discourse.

Context and objectives

The scientific discourse experiences transformations, from science reports to vulgarization in journals and other media (Jacobi, 1999). When the object is a catastrophe of great impact, the number of voices besides the scientific community increases. The case studied is one of such catastrophes: the *Prestige* oil spill which hit the Galician shoreline from November 2002, causing substantial ecological damages and social commotion. The oil spill had great impact on the Galician media: 2.671 from 8.084 environmental news in 2002 (Agraso, Eirexas e Jiménez, 2003).

The objectives of the study are:

1) To identify the proportion of sources from the scientific community in the press information about the *Prestige*.

2) To analyze the content of the scientists statements and the support for their claims.

3) To analyze some cases of transformations in the scientific discourse such as: reformulation, language changes or image use.

Methods

Data are drawn from a study about the coverage of environmental news in newspapers (Jiménez, Agraso e Eirexas, 2003). All news are indexed in a database. The object is the study of the *sources*, understood as individuals, institutions, documents or other media explicitly quoted. Four categories were established:

-Journals: including periodicals and bulletins.

-Press agencies and other media.

-Institutions: Government offices, research institutes, universities (as entities, not as individuals).

-Social actors and expert voices: either from scientific community, or from NGOs, associations or civical platforms.

For the first objective, the sources in each category were sorted according to their origin in the scientific community or not. For objectives two and three, 65 files related to he *Prestige* were selected, which reflected the scientist's voices. From these, six were chosen for in-depth analysis. Jacobi's (1999) frame was used for studying the transformations.

Results: weight of scientific sources

Two types of primary sources were analysed to explore the proportion from scientists: social actors & expert voices (73,4%) and institutions (14,8 %), because in press agencies (11,5%) there were none, and the journals (0,3%) were not significant.

From the *expert voices*, the majority (55%) correspond to political or government sources, then sailors and other directly damaged by the spill (17%), and only a 11,5% from the scientific community.

From the *institutions* also the government offices are the most quoted (74,5%). It is worth nothing that the foreign (Portuguese or French) research centres are quoted three more times (11,2%) than the Spanish Oceanographic and Marine Research Institutes (3,6%). The sources from Universities (1,9%) are very scarce.

Results: content and support of the statements

The experts´ statements and supports revolve around four issues:

a) The decision about sending the ship off the coast: some criticizing it because because of the spreading angle ("fan effect") affecting a longest coastline (V. Urgorri), some supporting it, based on the difficulties of transferring the oil.

b) The situation of the sunken hull: the risk of oil coming out or not from the ship; turning or not solid, or the risk of corrosion. Some scientists predicted that the oil will not leak because its state will turn solid at this temperature and because the hull will not suffer corrosion due to the lack of oxygen. Others predicted that it would leak, based on empirical data from other sunken hulls.

c) The consequences of the spill in the environment: the degree of damages in the ecosystems and food webs. It seems to be an agreement on ecological damages, but one of the experts claims that oil is not as toxic when spilled on the sea as would be on the air.

d) The recovery of damaged areas: differences about recovery time from 6 months (Ministry of Environment) to more than ten years, and methods.

Results: transformations of the discourse

The transformation include:

Lexical reformulations: two types (Jacobi, 1999), paraphrases and substitutions of specific terms. Some instances: explaining tar (Spanish "fuel") as a "thick and viscous oil" (Spanish 'petróleo'), referring to concrete as a lasting solution for the hull, because it does not "rot", instead of "disaggregate"; or to damaged animals as "sand hoppers" instead of amphipods.

Analogies and metaphors: some current metaphors used in scientific communication can be misleading when the "label" function of language takes over interpretation (Sutton, 1992), for instance "food chains". Other clarify the meaning, as "fan effect" or "to asphalt beaches". An original analogy is the comparison of the coast recovery to wood fires.

Discussion: features of scientific discourse in the media

The first issue arising from the data is the scarce frequency of sources from the scientific community, compared to institutional and government sources, despite the great involvement of Galician research institutions since the first days of the spill.

There are great differences among the statements: some seem supported on available empirical evidence or theoretical knowledge, while other ignore it, as shown in the controversies about the oil freezing point.

About the transformations of the discourse, there are different types of it that seem to serve the purpose of a better understanding for the public.

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COLOMBIAN SCIENCE NEWS WIRE SERVICE, NOTICYT

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Abstract

The Colombian Science News Wire Service, NOTICyT, created in January, 2003, has become one of the most effective instruments of the National policy on science communication. It consists on a weekly bulletin, with three articles on average, that reaches more than 700 journalists from Colombia and Latinamerica.

Cosponsored by the Colombian Institute for the Development of Science and Technology, Colciencias, and the National Academy of Medicine, NOTICyT is an initiative of the Colombian Association of Science Journalism, acpc. As an independent program, it has conquered spaces in the written media, specially newspapers and magazines, and in some Internet academic and press pages.

Key words: Science journalism, science news wire service, Noticyt

Text

Designed to popularize the Colombian science research and technology innovations, NOTICyT has been alife since January, 2003

Based in Bogotá, Colombia, and cosponsored by the Colombian Institute for the Development of Science and Technology, Colciencias, and the National Academy of Medicine, NOTICyT is an initiative of the Colombian Association of Science Journalism, acpc.

The idea became a programme as a response to different facts that science journalism was showing in Colombia, and became identified through different studies[1] done by the acpc between 1999 and 2002:

1. Mass media scarcely informed about science
2. When they did, news referred to stories of the developed countries – Seldom they referred to research done in Colombia
3. Science community activities were not visible to Colombian society

4. Lack of science journalists in the media – When there is a science journalist, he (she) had to cover other sources as well
5. Science journalists did not have enough time to report, nor they had enough space to publish their articles.

Members of the acpc thought that if it was imperative to do something in order that Colombian society would have access to knowledge, the best way was to create an effective and easy-to-use instrument for journalists and editorial branches of the mass media industries. At that point, we started to shape a news wire service, thinking that it would be neccessary to emphasize in the science research and technology innovations produced in Colombia, or produced by Colombians living abroad.

NOTICyT, 2003

NOTICyT has had two seasons, the first one being from January to September, 2003, and the second one that started in January, 2004, and is still running: in eight months during 2003, NOTICyT sent 106 Colombian science and technology stories, and 28 sections describing science and technology events held within the country. Of those, we have figures of the response of the Colombian newspapers, as they are presented in the following chart:

NOTICyT, February – October, 2003

Newspaper	City	Number of published articles
Diario del Sur	**Pasto**	**60**
Diario Occidente	**Cali**	**51**
Portafolio	**Bogotá**	**20**
El Universal	**Cartagena**	**12**
El Heraldo	**Barranquilla**	**12**
El Colombiano	**Medellin**	**12**
La Tarde	**Pereira**	**10**
Diario del Huila	**Neiva**	**9**
El Tiempo	**Nacional**	**9**
El País	**Cali**	**6**
Vanguardia Liberal	**Bucaramanga**	**2**

El Nuevo Día	**Ibagué**	**1**
El Espectador	**Bogotá**	**1**
El Informador	**Santa Marta**	**1**
14	**11**	**206**

Achievements, 2003

- NOTICyT stories started to reach the written media because they were reliable, consulted more that two sources in most cases, were current, were news, and were nicely written.
- NOTICyT was also present in radio programs and Internet news and academic pages, such as terra.com and universia.com
- We consulted about 200 human sources, among scientists, policy makers, engineers and science communicators. Scientists became more confident when speaking to the press.
- Thanks to NOTICyT service, four newspapers reopened their science and technology sections
- NOTICyT trained 5 journalism senior students from four universities.
- NOTICyT promoted the idea of covering Colombian science in the newspapers -- The science stories published in the newspapers, not only the ones produced by NOTICyT, started to speak about Colombian achievements.
- We have a database of Spanish speaking journalists with almost 300 entries

NOTICyT, 2004

In September 2003 we had to stop the service due to lack of funds. However in January 2004 we came back with some changes, being the most powerful, that we are sending the news along with pictures and illustrations that refer exactly to the story being told. Since February, we have written 58 stories. The newspapers have published them in 65 ocassions, and they have appear 74 times in Internet pages.

As achievements of this second season we can highlight the following:

- NOTICyT conquered front page in five ocassions
- NOTICyT stories have been published also in newspapers from Ecuador
- NOTICyT trained other four students as science reporters
- NOTICyT has stringers in Cali and Medellin
- NOTICyT is preparing to start sending a short bulletin in English

- NOTICyT has a database of Spanish speaking journalists with almost 700 entries
- NOTICyT is not sending only its weekly bulletin. It is now prepared to send information in the moment it occurs.
- NOTICyT has conquered other media: Revista Javeriana and Portafolio have commissioned NOTICyT specific articles, as exclusive stories for them.

Conclusions

NOTICyT has become an effective instrument for socializing Colombian science and technology activity, through the written and electronic media. Radio and TV are still media that it has to conquer, but that means more funds to invest.

Through its articles, NOTICyT is improving the quality of the science stories published in the Colombian media. It is also promoting that within the media editors and journalists put more attention to science stories running in the country.

Although NOTICyT is independent, the science community is starting to realize that this science news wire service is helping make visible the science activity in the country, which, in the end, is good for them.

NOTICyT is also training science journalists that in the future can find jobs as such in other media.

Finally, NOTICyT has become one of the most important communication instruments Colombia has currently to democratize science and technology. It has been a novel experience with some impact in the written media, that is now crossing the countries frontiers.

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NO ONE IS AN ISLAND: BIOTECHNOLOGY RESEARCHERS TALK ABOUT COMMUNICATING

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Abstract

This paper reports work-in-progress: a pilot study of biotechnologists communicating their work, with the aim of developing a research instrument to map communication attitudes and activities of researchers at the National Institute for Cellular Biotechnology in Ireland. The research has also enabled a limited exploration of communication models. A series of semi-structured interviews were conducted, producing data that was analyzed descriptively. Each question was re-assessed using the pilot responses and respondent-identified problems. The results show a willingness and responsible attitude manifested by biotechnologists in communicating their research and has led to a stronger emphasis on mixed methods in the re-development of the research instrument.

Key words: Biotechnology; research scientist; communication; semi-structured interviews

Text

Context

Increasingly, research scientists are encouraged to communicate their work to specialists and non-specialists, and nowhere more so than in the diverse and sometimes controversial fields of biotechnology. Yet, a mapping of biotechnology researchers' current communication activities and an understanding of their attitudes towards communication has been neglected. The aim of this research is to explore these issues with biotechnology researchers employed at the National Institute for Cellular Biotechnology (NICB) in Ireland.

The NICB has adopted a novel approach to biotechnology in Ireland: its research themes incorporate the entire value chain of activities from discovery to clinical treatment, including communication and educational considerations.

Objective

The long-range objectives of this research are to explore the following questions:

- What beliefs about and attitudes to communication of their own work do biotechnology researchers at the NICB hold?

- How do biotechnology researchers at the NICB communicate with each other, with other biotechnology researchers, other scientists and/or non-scientists?

- How do these compare with the beliefs/attitudes of scientists in general from a similar cultural milieu?

- What constraints on or encouragement for communication exists for biotechnology researchers?

Scientists are often accused of practicing the Shannon and Weaver 'injection' model of communication. This model emphasises a difference in status/expertise between sender and recipient, and assumes that the audience is passive. An unnecessary dichotomy has been created between the way scientists are accused of communicating and the emergent emphasis on a more egalitarian 'dialogue' model in science communication (i.e. interaction and debate between individuals and groups, treating science as simply another facet of life). If it is assumed that scientists use the injection model by default (and preference), a corollary is that the communication complexity afforded to other professional groups is not acknowledged for the science community.

In order to explore these seemingly simplistic assumptions and gain an empirical understanding of communication by scientists, the present pilot study gathered data about the communication attitudes and activities of a sample population of biotechnology research scientists. This information is being used as feedback in the development of a research instrument to gather census data about the communication attitudes and activities of the biotechnology research scientists at the NICB.

Methods

A series of face-to-face semi-structured interviews was carried out in April 2003. The interview instrument used the Wellcome Trust-commissioned MORI survey *The Role of Scientists in Public Debate* (MORI 2001) as a starting point, but evolved into an exploration of specific instances of communication by scientists in formal and informal contexts and with specialist and non-specialist audiences.

A database of the interview responses was constructed. Descriptive statistics were generated and the database was interrogated using the text tool WORDSMITH. Some interesting trends were identified using these methods, although these were limited in scope due to the small size of the pilot population. More importantly, each question in the pilot interview instrument was re-assessed for relevance and appropriateness using both the responses *and* respondent-identified problems associated with the questions.

Results

The descriptive statistics and WORDSMITH identified a positive association between 'years since receiving a PhD' and a range of activities and achievements (e.g. membership of professional organisations, applications for or ownership of patents), which is both obvious and expected, given the longer working life of respondents who have held PhDs for longer. These respondents also tended to spend less time in the laboratory than respondents either working towards a PhD or in post-doctoral research. In addition, they had more often practiced across the spectrum of least- to most-interactive communication activities. All respondents believe that there are real personal and professional benefits accrued in speaking with others and listening to feedback about their work.

In general, results have indicated a willingness and a sense of obligation in scientists doing biotechnology research to communicate their work, a belief in the social benefits of their work with a concurrent responsibility to demonstrate these benefits to others, and a positive attitude to face-to-face questioning/debate in informal situations, despite personal fears of being ill-equipped to deal with such situations.

Some methodological observations have been possible regarding the appropriateness of different approaches in large-scale multi-interviewer questionnaires compared to small-scale census (whole population) single-interviewer instruments. For example, large sample questionnaires are usually designed such that inferences may be made to a larger (untested) population. However, emphasis in the present research on a sub-group (biotechnologists at the NICB) calls for the use of more qualitative open questions. In addition, the population is 'captured' and may be re-tested at the will of the researcher. Set against this is the assumption that the respondents place a high value on quantitative methods because they are trained research scientists (as I was) – this has created a tension in the current re-development of the research instrument.

Conclusions

These results illustrate that biotechnology researchers do communicate about their work with others. At this stage it is safe to conclude that just as much complexity exists in communication by biotechnologists as it does in other professional groups. I would argue that there is a place for each model of communication (dissemination, engagement, consultation, dialogue etc.) depending on the communicative context.

The communication complexity practiced by these biotechnology researchers, coupled with tensions between divergent approaches to its exploration, is prompting a theoretical and methodological reappraisal, but is also leading to a more difficult and potentially more rewarding project.

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Parallel Section 17: Scientists and science institutions as PCST agents: responsibilities.

NANOTECHNOLOGISTS' SELF-CONSIDERATIONS ABOUT THEIR SOCIAL VIEW

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Abstract

This paper analyses the responses of 29 nanotechnologists to a survey about their profession's social view. The researchers of the London Centre for Nanotechnology consider British public is not aware of the discipline and place the academic background as the most influential factor of awareness. Nanotechnologists think their discipline is dominantly associated with computing and has a slightly negative image. The investigators' perceptions square with the awareness of the discipline detected in general public-based surveys and are too pessimistic about nanotechnology's social assessment.

Key words: Nanotechnology, attitudes, survey.

Text

Introduction:

In the last five years, nanotechnology has become a priority for the European and United States scientific authorities, due to its significant research potential. Either the European Commission and the National Science Foundation have fostered studies about the discipline which frequently include general public-based surveys (A). The curiosity for knowing laymen's perceptions contrasts, however, with the absence of similar polls among investigators[1]. The present paper aims to address that gap presenting the results of a survey performed in March 2004 among a group of researchers of the London Centre for Nanotechnology (B)[2].

[1] One of the few initiatives in this direction is a workshop with scientists and engineers held by the British Royal Society within a project for exploring nanotechnology (see http://www.nanotec.org.uk/)

[2] This institution hosts 53 investigators from two British universities (Imperial College and University College of London) in the fields of physics and astronomy, chemistry, electrical and electronic engineering, materials, geology and medical research (see http://www.london-nano.ucl.ac.uk/)

Methodology

A questionnaire with eight statements was distributed to the nanotechnologists. The questions referred to British general public's level of awareness of nanotechnology, the factors which determine it (age and studies), the fields with which the discipline is dominantly associated (computers, materials or biomedicine) and its positive or negative assessment (figures 1, 2 and 3). The investigators had to express their agreement or disagreement with the statements through a Likert Scale (C). The questionnaire was submitted to all the researchers and answered by 29 (55%)[3]. Many of the scientists who did not co-operate alleged knowing nothing about the discipline's social view.

Results

The surveyed nanotechnoligsts perceive the social awareness of their profession is near to zero. According to their responses, the factor which determines the level of knowledge about the discipline is the academic background instead of the age. Physicists are the researchers who more strongly support the influence of the education and are more moderately against the significance of the age (figure 1).

Computing is the first field with which investigators consider general public links nanotechnology, followed by biomedicine. On the contrary, the materials area is seen socially farther away to the discipline. Curiously, the most negativistic researchers about the materials association are the engineers (figure 2).

Nanotechnologists are pessimistic about the social assessment of their profession and cautious about the public perception of its consequences. In the responses, they consider Britons have a slightly negative opinion of nanotechnology and are almost indifferent about the effects of the discipline in their lives. Physicists and chemists are respectively the most optimistic and pessimistic researchers in these issues (figure 3).

Conclusions

When compared with general public-based surveys (D), the opinions of the investigators correspond with the reflected awareness of nanotechnology and are more pessimistic about its social assessment. The inaccuracies nanotechnologists perceive in the public knowledge of their discipline square with the results of a Royal Society survey performed in January 2004 among 1000 Britons. According to this poll, the social class is a more influential factor of awareness than the age[4], as nanotechnologists consider (figure 4).

The Royal Society's survey also shows that, as nanotechnologists perceive, the majority of the respondents link the discipline with electronics (computers,

[3] This sample includes 10 physicists, 12 chemists, four electrical and materials engineers, one geologist and two medical researchers

[4] However, the Royal Society's survey points to gender as the most influential factor of awareness

microchips, circuits and robotics), as well as medical applications (devices circulating through the blood stream). On the contrary, Britons' references to materials are scarce.

Nanotechnologists' negative consideration about the social image of the discipline does not correspond with the results of the Royal Society's survey. According to it, 68% of the Britons consider nanotechnology will make future better[5] and only 4% are explicitly against this discipline.

The researchers of the London Centre for Nanotechnology are, hence, aware of the low public knowledge about their discipline and wrongly believe this slight account corresponds with a negative opinion[6]. This perception leads them to a pessimistic position which sometimes derives in disinterest about the public dimension of their job. The correction of this view would become them more actively involved in Public Communication of Science and Technology.

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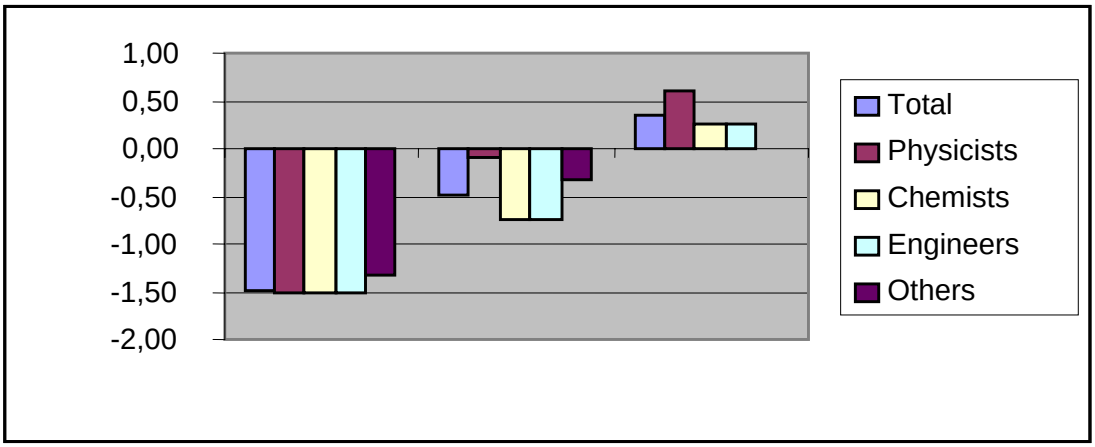
[5] According to a United States survey, people favourable to nanotechnology are older than 45, university educated and politically conservative, also supporting the space program, nuclear power and research on cloning (see Sims Bainbridge, 2002)

[6] In this belief, they are probably influenced by the especially high activism of anti-nanotechnology groups in the UK and by the unfavourable claims of some British celebrities

Figures

Figure 1: Nanotechnologists' perception about public awareness of their profession.

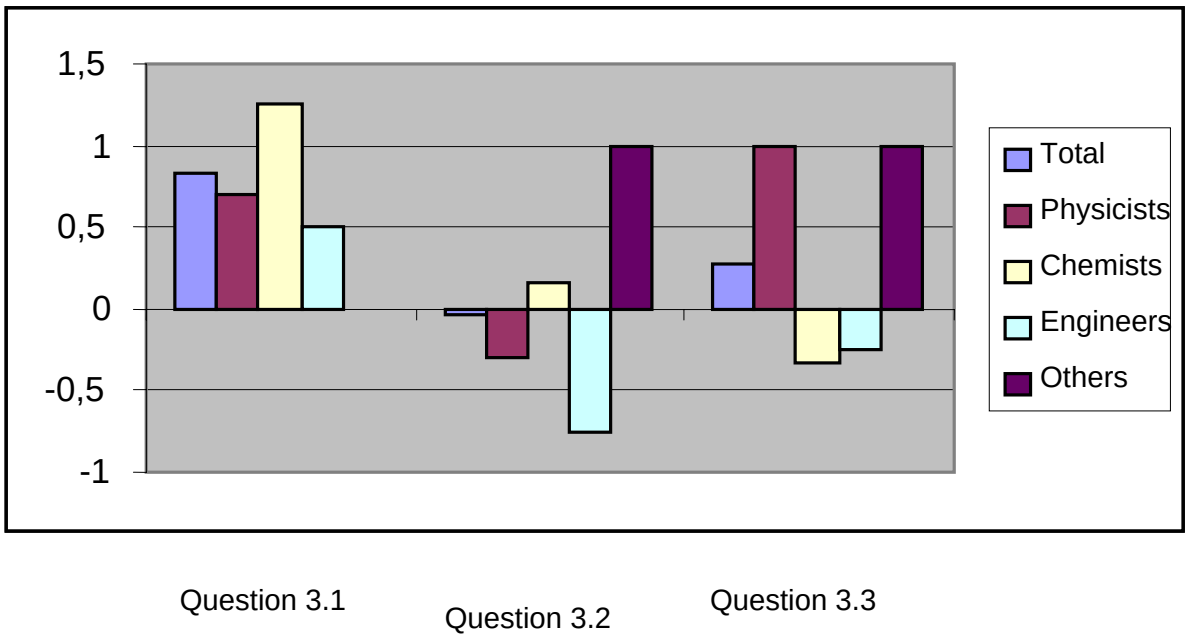


-Question 1: General public accurately knows the meaning of nanotechnology *(+2 complete agreement, -2 complete disagreement)*.

-Question 2.1: Younger public has a wider knowledge about nanotechnology.

-Question 2.2: People with a university degree have a wider knowledge about nanotechnology.

Figure 2: Nanotechnologists' perception about the applications of the discipline.

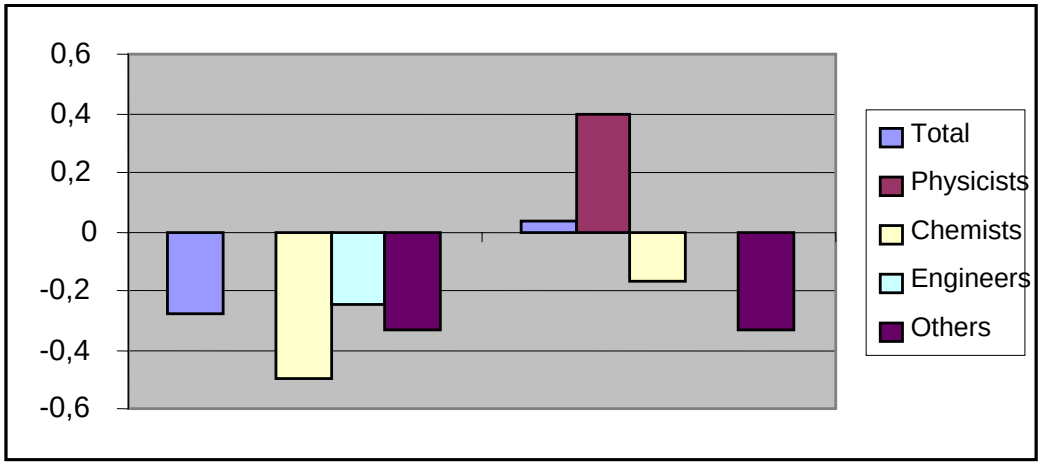


-Question 3.1: Nanotechnology is more often associated with electronics (computers) *(+2 complete agreement, -2 complete disagreement).*

-Question 3.2: Nanotechnology is more often associated with engineering (materials).

-Question 3.3: Nanotechnology is more often associated with health (biomedicine).

Figure 4: Nanotechnologists' perception about the social assessment of the discipline.



-Question 4.1: General public's opinion about nanotechnology is mainly positive *(+2 complete agreement, -2 complete disagreement).*

-Question 4.2: General public considers nanotechnology affects its life.

Figure 5: Comparison between the nanotechnologists' survey and other general public-based surveys.

Topic	**Nanotechnologists**	**General public**
Public awareness of nanotechnology	General public's notion of nanotechnology is severely inaccurate	71% of the Britons have never heard about nanotechnology
Influence of socio-demographical factors	Academic background is considerably more influential than age	Gender (male) and social grade (high) are the most influential factors

Most popular applications	Nanotechnology is more often associated with electronics and health than with engineering	The most popular images of nanotechnology are linked to computing, robotics and medical devices
Social assessment	Britons have a slightly negative opinion of nanotechnology	68% of the Britons think nanotechnology will make future better

Parallel Session 17: Scientists and science institutions as PCST agents: responsibilities

PERSONAL, PROFESSIONAL PROFILE, AND MOTIVATIONS OF SCIENTISTS INVOLVED IN PCST ACTIVITIES: THE CASE OF THE MADRID SCIENCE FAIR

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Abstract

The project `*Scientific Culture and Communication of Science in the Community of Madrid: A study to encourage scientists to participate in PCST activities*`, is here presented, together with some of the preliminary results obtained. The objective of this study is to define the profile of scientists who participate in the Madrid Science Fair, as well as to identify the motivations that prompted them to take part in the Fair, with the purpose of proposing strategies and actions directed towards promoting and improving their participation in this and other PCST events. The study has been carried out through personal interview with scientists.

Key words: Public Communication of Science and Technology, Researchers, Motivations, Science Fairs

Text

Context

The project `*Scientific Culture and Communication of Science in the Community of Madrid: A study to encourage scientists to participate in PCST activities*`[1], is here presented, together with some of the preliminary results obtained.

Objectives

The objective of this study is to define the profile of scientists who participate in the Madrid Science Fair (MSF), as well as to identify the motivations that

prompted them to take part in the Fair, with the purpose of proposing strategies and actions directed towards promoting and improving their participation in this and other PCST events.

Methods

The analysed sample is constituted by the staff of the Spanish Council for Scientific Research (CSIC), participating in the three latest editions (2001 to 2003) of the MSF.

The study has been carried out through personal interviews with the participants, who where asked about the following aspects:

1. Professional and personal profile: professional status, scientific field, size and composition of their research teams, age, gender, family, involvement in other participatory activities, hobbies.

2. What made them take part? (own initiative, told to, obligation due to its professional position); What was their task? (coordinator, collaborator, expositor)

3. Motivations that prompted them to participate.

4. Its perception of whether activities presented aroused public interest, and their utility (for the public, for themselves, for their centres, etc.)

5. Benefits gained from their participation.

6. Main limitations and problems they encountered.

7. Participation in other PCST activities.

8. Proposals for promoting scientists' participation in PCST activities.

Results

Table 1 shows some data relating to the professional and personal profile of interviewees.

Figure 1 shows motivations that prompted scientists interviewed to participate in the Fair, showing differences based on the professional status (PST)."Economic Reward" is the motivation that most discriminate among individuals in relation to their PST, followed by the "Sense of Duty". The former shows a negative correlation with PST, while the later shows a positive one (see Figure 2).

In general, interviewees faced few limitations at the time of participating in the Fair. Economic, time and space are, by this order, the most significant limitations for Senior Researchers, although they were no more than moderately important limitations (valued below 3 in a "1-to-5" scale). Space and time, followed by economic, were also the main limitations encountered by Technicians and Support Staff. Finally, the most important limitation for

Fellows was the time, over the space. The rest of problems on which interviewees were asked, were valued, in average, as of little importance or not important at all (technical limitations, problems with other colleagues, no recognition, problems with the public, administrative, personal problems, stand short staffed, staff attending stand scarcely trained, transport).

Conclusions

The results obtained show that, although motivation vary with the professional status, CSIC staff appear to be motivated more by a desire to communicate science and increase the public's understanding of science and scientific culture, than by personal, professional or economic motivations.

In what respect the profile of scientists, stands out the relatively high participation of fellows, group that is characterized by the low percentage of individuals having dependent relatives and by its unexpected reduced implication in other participatory activities, probably derived from its little availability of time. On the other hand, it is worth noting the reduced participation of scientists from the Social Sciences and Humanities, probably due to its less experimental character.

Results are expected to allow to promote initiatives aimed at encouraging and improving the participation of the scientific community in future editions of the MSF and, in general, to increase their interest in PCST activities, as a way of increasing public's awareness of science and technology and the scientific culture of our society.

Figures and Tables

Legends to Figures:

Professional Status (PST):

RS= senior ReSearchers; TE: TEchnicians and support staff; FE: FEllows

Motivations:

PI: increasing Public's Interest and enthusiasm for science

SC: increasing Scientific Culture

PA: increasing Public's Acknowledgment of scientist's work

SD: Sense of Duty

VI: to give VIsibility to my institution

SS: Self-Satisfaction

EN: ENjoyment

TT: Told To by other person

PC: Personal Commitment

PR: Professional Relationships

PP: Professional Promotion

ER: Economic Reward

DL: Days' Leave reward

Table 1: Personal and professional profile

	Professional status			***Total***
	RS	**TE**	**FE**	
Population				
N	42	35	88	165
%	25.5%	21.2%	53.3%	100.0
Distribution by field				
BB+NR+AG				47.3%
PHY+MST				39.4%
HS				10.9%
Support Units				2.4%
Sample interviewed				
N	38	25	56	119
%	31.9%	21.0%	47.1%	100.0
Population interviewed (%)	90.5%	71.4%	29.5%	72.1%
Distribution by field				
BB+NR+AG				52.9%
PHY+MST				36.1%
HS				8.4%
Support Units				2.5%
Gender				

- Male	76.3%	68.0%	33.9%	54.6%
- Female	23.7%	32.0%	66.1%	45.4%
Age (average)	51.6	47.2	30.4	40.3%
Have dependent relatives	78.9%	68.0%	12.5%	45.4%
Carry out other participatory activities	57.9%	56.0%	33.9%	46.2%

BB=Biology and Biomedicine; NR=Natural Resources; AG=AGronomy; PHY= Physics science and technology; MST=Materials Science and Technology; HS=Humanities and Social sciences

Figure 1: Motivations of scientists to participate in the Madrid Science Fair, by Professional Status

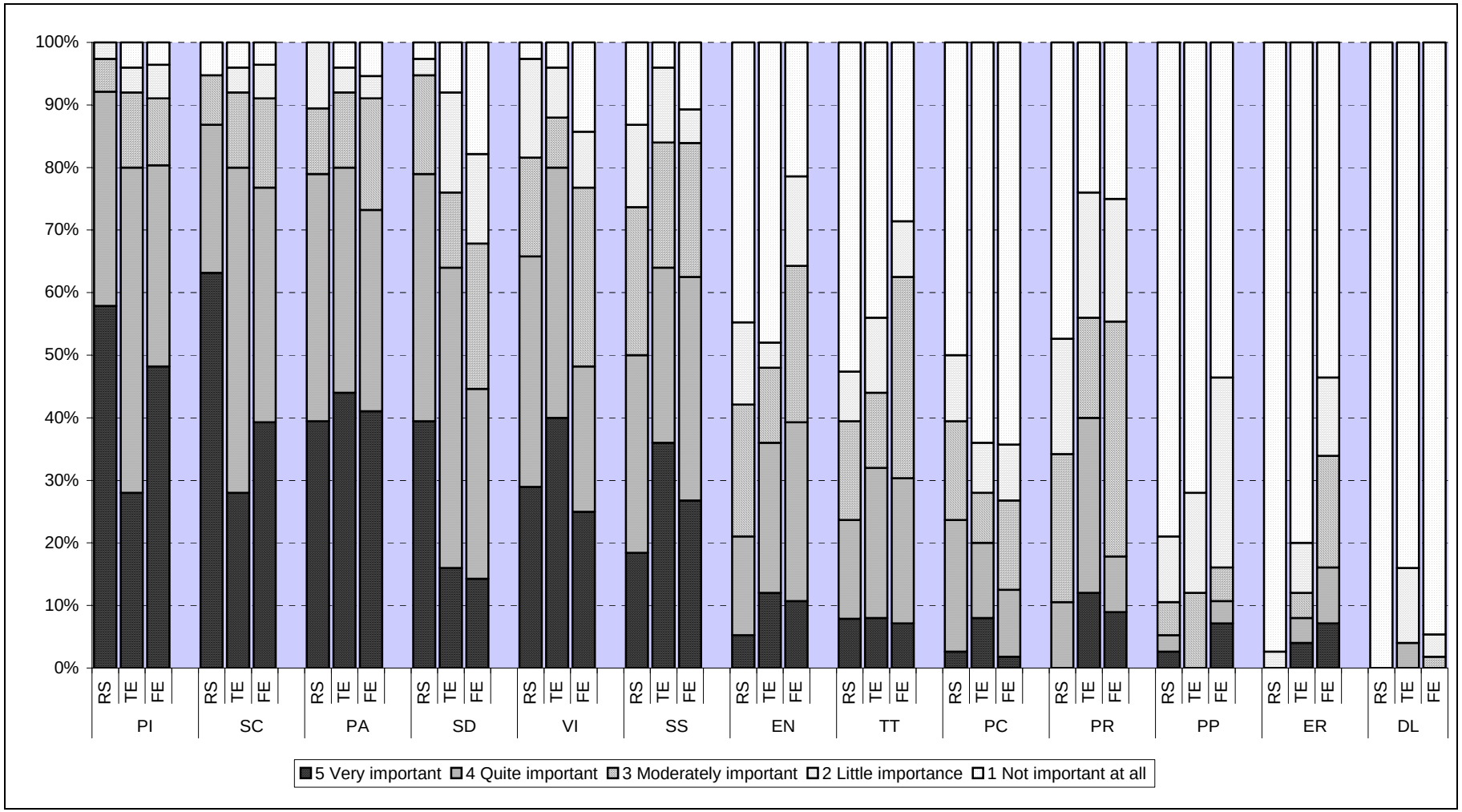
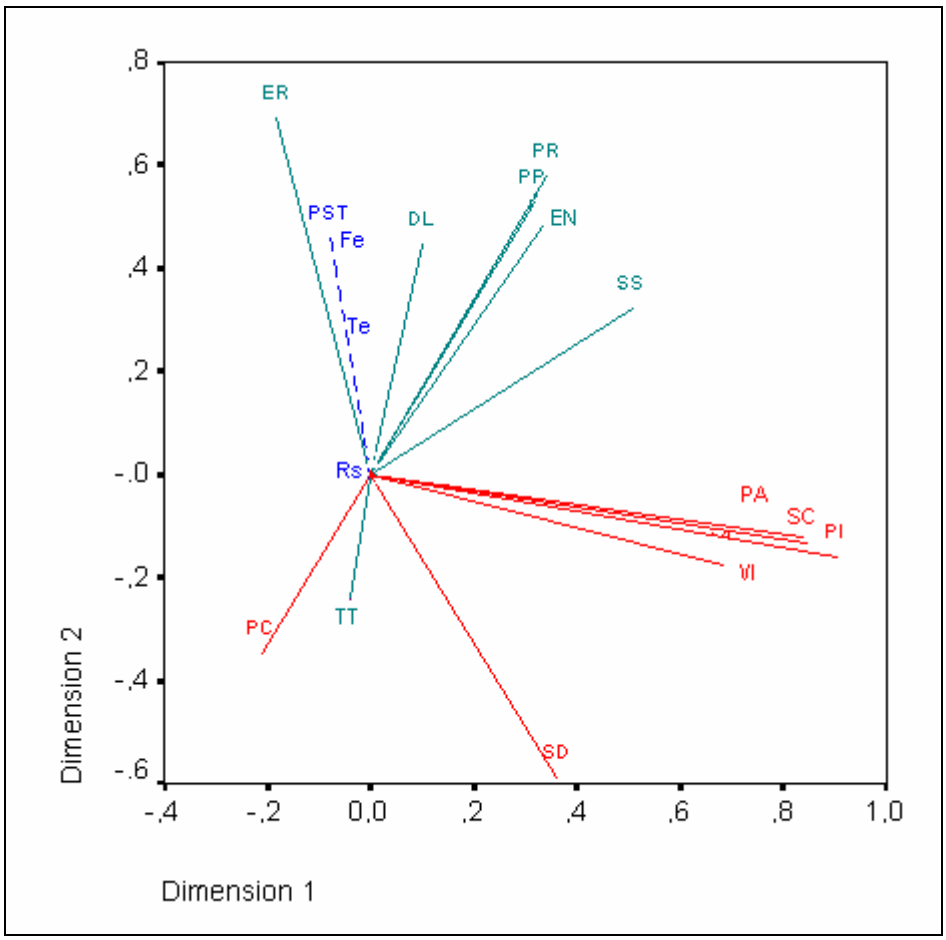


Figure 2: Principal Components Analysis for Categorical Data (CATPCA) of Motivations and Professional Status.



PC, SD, VI, SC, PA and PI show a positive correlation with PST (the higher the PST, the higher the value assigned to the corresponding variable). ER, DL, PR, PP,EN,TT and SS are negatively correlated with PST.

[i] Project funded by the Directorate of Research of the Autonomous Region of Madrid