FET_TRACES

Tracing impacts of the FET programme

Project number. 665083
Programme: H2020-FETOPEN-2014-CSA
Contract type: CSA
Start date of project: July 15, 2015
Duration: 28 months

Deliverable D 7.1: Results from online survey I: Follow-up activities and career-building opportunities with FET projects

Authors: Ulrich Schmoch and Bernd Beckert (Fraunhofer ISI)
Dissemination level: public
Deliverable type: report
Version: 1.0
Due date: January 2017
Submission date: June 6, 2017

About FET_TRACES

FET_TRACES is a research project for the European Commission which analyses and measures the impacts of the research funding scheme “Future and Emerging Technologies Open” (FET Open and FET Proactive). Within the European research funding landscape, the FET scheme acts as a pathfinder for new ideas and themes for long-term research in the area of information and communication technologies and beyond. Its mission is to promote high risk research, offset by potential breakthrough with high technological or societal impact (see http://cordis.europa.eu/fp7/ict/fet-open/home_en.html).

In the FET_TRACES project we will investigate and measure direct and indirect impacts of these two schemes on the science and technology landscape and its perception by individual researchers who are potential proposers for FET Open and FET Proactive projects. Results from innovation research will be used to develop a targeted indicator set covering central aspects of the FET mission (novelty, trans-disciplinarity, innovation-ecosystem). For the data collection we use sophisticated impact assessment methods like bibliometrics, patent analysis and online surveys. In addition to the impact assessment we will analyze selected breakthrough-projects to find out about necessary components for “breakthrough”-research. The study will also include insights from FET-like funders on national levels in Europe.

Terms of use

This document was developed within the FET_TRACES project (see www.fet-traces.eu), funded by the European Commission within Horizon 2020, by a consortium consisting of two partners, the Fraunhofer ISI in Karlsruhe, Germany (coordinator) and AIT in Vienna, Austria.

Document history

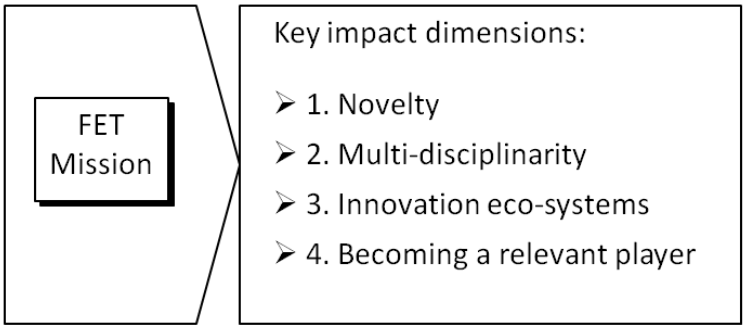
Version	Date	Changes
1.0	May 2017	
1.1	June 6, 2017	Made two versions, an internal, work-in-progress-version which includes project acronyms of specifically successful projects and an official version including only verified and anonymized information.

Contents

1 Introduction

Based on the mission of FET Open and FET Proactive as well as conceptual considerations concerning the characteristics of FET-like research, we have identified four key impact dimensions for the impact assessment (see figure 1).

Figure 1: Key impact dimensions of FET Open and FET Proactive



Source: D1, p. 6 and D3, p. 2

In Deliverable 3 we have developed a set of indicators suited to measure or describe in more detail the outcomes of FET-projects. For example, to examine outcomes in the third impact dimension “Innovation eco-systems”, we have defined nine indicators covering aspects like communicating results into academia and industry or building networks based on research results from the FET project (see table 1).

Table 1: Indicators for impact dimension “Innovation eco-systems”

Innovation eco-systems		
1	Relevance I: Publications coming out of a FET project	Bibliometrics
2	Relevance II: Publications with industrial partners	Bibliometrics and survey
3	Community building I: Transfer of new ideas into the scientific and industrial R&D community - number of citations of FET-project related publications	Bibliometrics
4	Community building II: Dissemination of a new ideas and the genesis of new scientific communities – number of FET-related publications co-authored by researchers who were not involved in the original FET project	Bibliometrics and survey

5	Dissemination of FET ideas into industry: number of publications that are co-authored by researchers from industrial R&D not involved in the original FET project	Bibliometrics and survey
6	Economic relevance of FET project results: patent applications which relate to concepts developed in FET projects	Survey
7	Project families analysis: Number of FET projects which triggered other research proposals	Project family analysis, bibliometrics and survey
8	Communicating FET results to industry: Number of contributions to proceedings of conferences with industry involvement	Bibliometrics & Survey
9	Industrial relevance: contacts to industry & cooperation with companies	Survey

Source: D3, p. 6

In D3, we have also assigned possible methods to each indicator so we could collect the respective indicators when starting the LDA analysis, bibliometrics or the surveys. In fact, we have tried to use bibliometrics as a method wherever possible because follow-up studies could profit from solutions found in this study the most.

However, bibliometrics have their limits, especially when it comes to the more complex indicators. While it is possible to trace FET-researcher´s publications in the different journals even though their work deals with interdisciplinary topics and publications may only cover one single aspect of the research done in a FET project, it is impossible to identify for example journal articles related to a specific FET project in which authors are present which have not been part of the project´s original consortium (see indicator 5 in table 1). In order to cover indicators like these, we have carried out a survey asking FET coordinators and participants directly to provide answers to the related questions.

The survey was designed to cover 11 indicators identified in D3 (p.31) plus the project families question which was originally assigned to bibliometrics, and a separate question asking for societal impacts which was suggested in the context of the midterm-review of our project (see Annex 2: Indicators covered by the survey).

Accordingly, the questionnaire of the survey was composed of four sections: “General information”, “Project impact”, “Follow-up activities” and “Social impact” (see annex 1: Questionnaire).

2 Method and field phase

After transforming indicators into single questions we copied the questions into the online survey tool Enterprise Feedback Suite (EFS), a software product provided by Questback.

As starting point, e-mail addresses of participants had to be identified. For this purpose, publications linked to FET projects were identified in the database Web of Science (WoS) and the E-mail addresses of the authors provided in this database were extracted. In addition, the Commission provided a large set of mail addresses of coordinators of early FET projects.

All in all, 5.757 e-mail addresses of FET project coordinators and participants were collected. However, not all e-mail addresses turned out to be valid due to spelling errors or because researchers have changed their affiliations in the meantime. In fact, 1.037 addresses could not be reached, thus the final sample comprised 4.720 researchers. Of these, several persons answered that they did not participate in a FET project and therefore did not participate in the questionnaire.

The survey encompassed 21 questions, it required an average time for answering of 10-15 minutes. Although we have designed a relatively short survey, requests to participate in online surveys are always seen as an interruption of other activities by the target group. Also, as the participation was not compulsory and participants were not rewarded for their participation, we did not expect a high response rate. The field phase of the started on December 8, 2016 and ended on January 30, 2017 with a reminder-mail just after the Christmas break to those not having answered until then.

At last, 278 participants completed the questionnaire or gave answers to most of the questions, which makes for a response rate of 5,9 percent. Although not very high, the number of answers is sufficiently high for a statistically meaningful examination.

3 Results

Concerning gender, 34 **females** and 245 **males** participated in the survey, thus in total 278 persons. Because 44 participants have not answered all questions the number of valid total answers varies slightly per question.

The respondents provided 267 project acronyms (question 2), thereof 71 duplicates, thus the participants came from 196 different FET projects. In the FET_TRACES sample, we look at a total sample of 224 projects. Thus, in our survey**, 87,5 percent of all projects in the FET-TRACES sample are covered** by at least one respondent (being coordinator or participant).

Among the respondents are 66 former FET project coordinators and 212 **participants**, thus the share of **coordinators** is 23 percent (total number of answers to this question: 278). The number of coordinators is sufficiently high for a meaningful differentiation between the answers of coordinators and participants.

Concerning the **stage of career** of the participating researchers, we find the majority of participants in the middle of their career (table 2).

Table 2: Stage of career of researchers participating in the survey

Stage of career	Cases in sample	Percent
young researcher	73	26
mid-career researcher	132	48
late career researchers	72	26

Source: Survey on FET impacts, n=227

To have the majority of respondents in their mid-career is important as it improves the validity of assessments of FET opening up new research directions (question 9) or new career opportunities (question 21).

3.1 Number of FET projects that were rejected before by other funding institutions

The fact that a research proposal was accepted by FET after it was rejected by another research funding organisation is an indicator for novelty of the research idea resp. for off-mainstream research (question 5). However, in our survey only **12 respondents (out of a total of 270), equivalent to 4 percent**, reported that their research **proposal was previously rejected** by another funding agency. We could assume that these specific proposals indeed show a high level of novelty. However, this does not automatically mean that the others do not.

One reason for the low number of previously rejected proposals may be that in our sample, 77% of respondents are participants and not coordinators of the respective FET project. It is quite reasonable to expect that participants often do not know whether or not the project was rejected by another funding organisation before it was funded by FET. In fact 14 % of our respondents said that they don´t know.

On the other hand, taking the low rejection rate as it is, one may speculate that FET research ideas were concisely tailored towards the criteria of the FET programme (novelty, interdisciplinarity, collaborative, technology-driven). This interpretation would support the statement that FET is a unique research funding instrument in Europe which researchers use to follow ground-breaking research ideas.

On the other hand, what we have not asked in the survey is the question whether the FET proposal was rejected itself and resubmitted in a new version. This is also a relevant question when characterizing the programme as such. However, we were confronted with this aspect only after the survey was already finished.[1]

The 12 respondents who reported that their proposal was rejected before were asked in the following question to speculate about the reasons for the rejection (question 6). The intention was to find out what the respondents considered to be the specific non-mainstream feature of their research idea, whether it was that the idea was too risky, too interdisciplinary or too unconventional to be funded by "regular" research funding agencies. Yet, of the 12 respondents, 8 refused to speculate by chosing the "Don´t know" answer. Thus we cannot provide valid answers to this question.

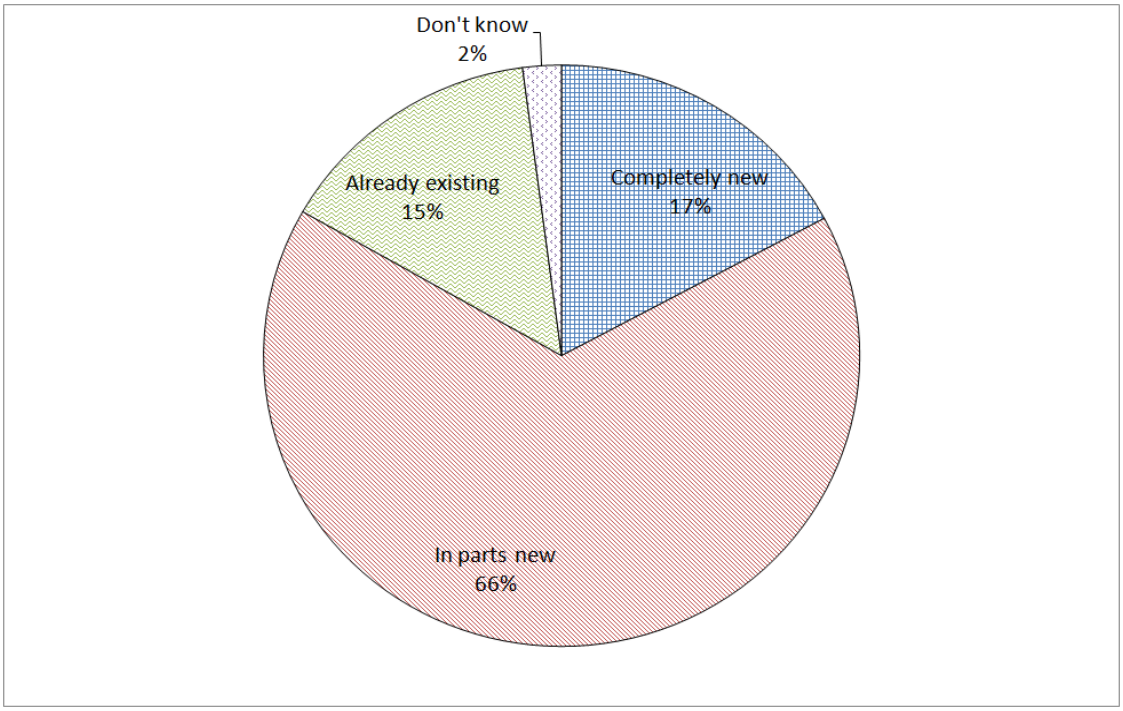
1 By the report „Horizon 2020 FET Open in 2014-2016: State of Play" of the Research Executive Agency in March 2017, see https://ec.europa.eu/digital-single-market/en/news/horizon-2020-fet-open-2014-2016-state-play.

3.2 Composition of the project consortia

Another indicator for novelty is the new or partly new combination of the consortium brought together in a FET project. We assume that research questions being developed in consortia which have been worked together before may not be as innovative as research questions developed in new or party new configurations of research consortia. In our question 8, respondents had the option to characterize their FET consortium as being “completely new”, “in parts new” or “All partners knew each other before”.

Altogether, 239 people have answered question 8. The answers given are shown in figure 2. The survey results clearly show that the **vast majority of the projects induced the formation of completely or partly new consortia (83 percent).**

Figure 2: Novelty of consortium of FET projects



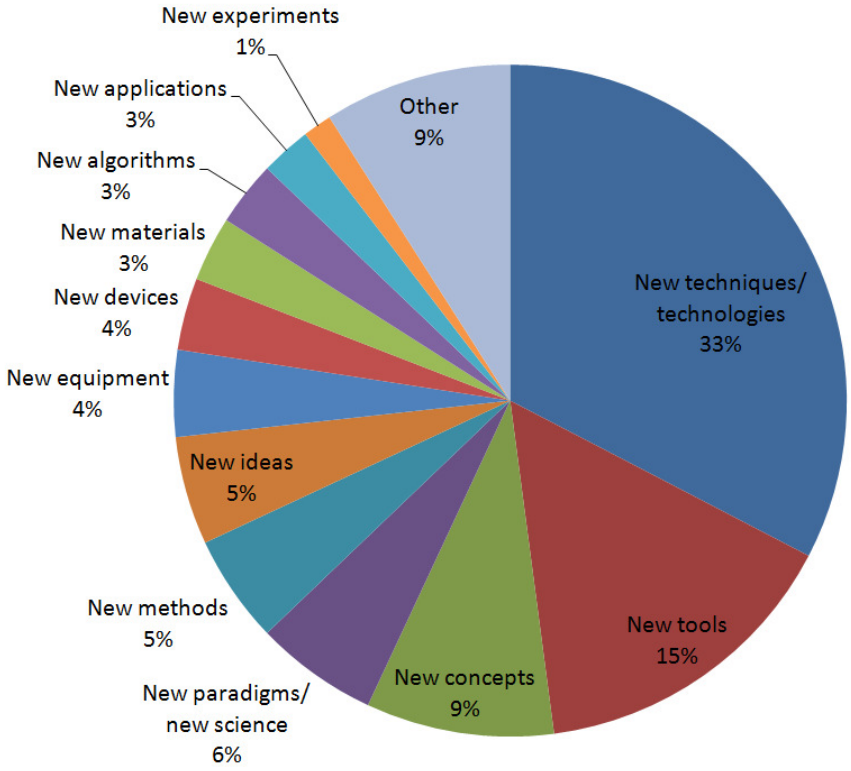
Source: Survey on FET impacts (sample of n=239)

3.3 Novelty of outcome: Answers of researchers about the novelty of their results

Although the survey is not an adequate instrument to find out about the degree of novelty of research carried out in FET projects (for this we use bibliometrics and LDA analysis) it is a good instrument to find out about the nature of novelty in the projects. Thus, we asked in question 7: "Concerning the idea followed in your FET project: What was it that you considered as new in the project (new tools, new techniques, new equipment...)? Please specify."

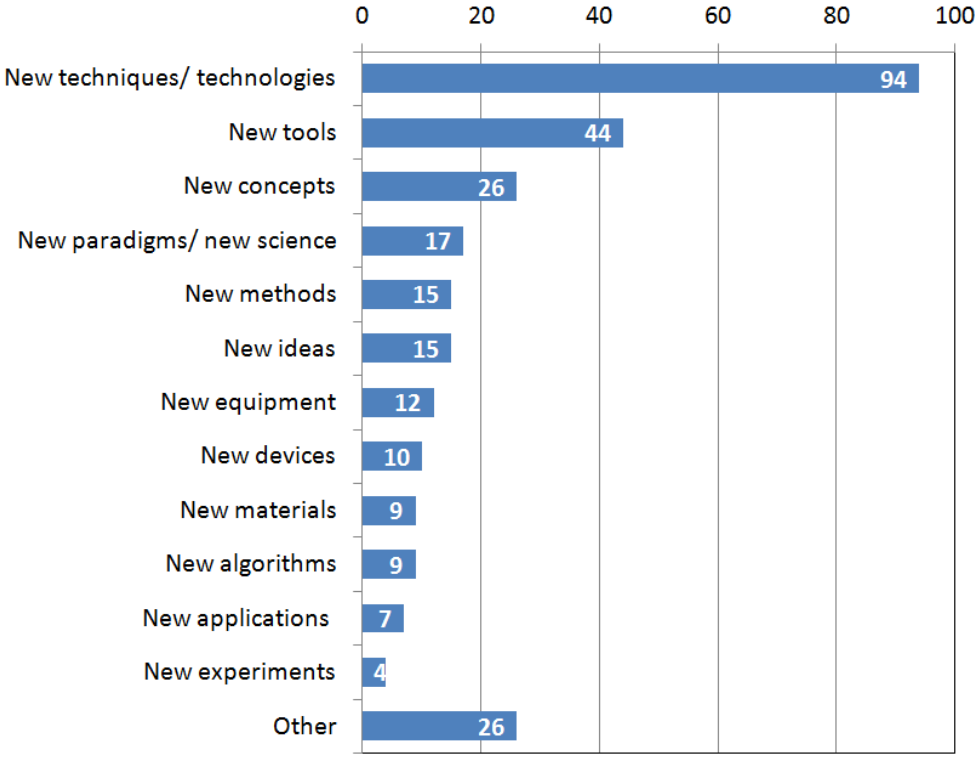
Altogether, 52% of the respondents pointed to the development of new technologies/techniques, new tools or new devices as the most notable novelty dimension in their project (see figure 3). Other novelty dimensions were new concepts (9%), new paradigms, new science and new foundational research (6%) new methods (5%) and new ideas (5%).

Figure 3: Novelty dimensions in FET projects (question 7): Percentages



N=288 answers, multiple answers possible, 223 persons have answered this question.
Source: FET survey, 2007

Figure 4: Novelty dimensions in FET projects (question 7): Absolute numbers



N=288 answers, multiple answers possible, 223 persons have answered this question.
Source: FET survey, 2007

Some of the answers point at potentially ground-breaking research or at new combinations which had not been tried before. Table 3 lists the most remarkable comments related to the novelty dimension.

Table 3: Novelty dimensions of FET projects (question 7)

"A paradigm shift in how in-vitro neuroscience should be done. For realization of this, new tools, techniques, and equipment."
"The combined impact of the consortium, which was truly cross disciplinary."
"New device type made possible by combination of different top-level techniques."
"New techniques, new dynamics/computations arising out of interfacing biological with

electronic neural processing systems."

"The application of diverse techniques to solve a common problem."

"New technologies, new integration of existing technologies, new theoretical formalisms, new basic research."

"New ambition: to reach fundamental limits in energy dissipation."

"Radically new concept, requiring design and fabriction of novel devices and processes and new analysis techniques."

"New topic of Soft Robotics and new methods for carrying on a Coordination Action." (Robosoft, not in our sample because CSA, how about CSAs anyway, separate analysis, who does it?)

"Disruptively new technology (soft robotics)."

"Novel computational paradigm."

"New techniques and merging new concepts coming from different fields of research like maching learning (reservoir computing) and nonlinear dynamics."

"The novelty was in the idea that a chip can replace simple learning task." (RENACHIP)

"A new physical mechanism (Gunn effect in GaN diodes)."

"New device that has fundamental interest in many frontier research currently limited by instrumentations."

"Biological methods and tools in communication networks."

"Stimulating the brain in order to transmit thoughts."

"New paradigm in data analysis, instead of building a suitable model, perform a query for all models that conform to specifications."

"New device concept, although based on existing technologies."

"New theory with high impact on applications: Paradigm change for constructing opti-

mized basis functions in signal/image processing.”
“New modeling ideas: We developed an alternative approach to Machine Learning, i.e., validation of algorithms as posterior distributions.”
“Techniques and interdisciplinary combination.”
“Informatics applied to medical data interrogation.”
“We were bringing an innovative technology to Commercial Off The Shelve (COST) devices.”
“It is a highly multidimensional project aiming at providing new concepts in computer science and nanotechnologies inspired by biology.”
“Everything was new: ideas in quantum information and interferometry, new theoretical tools, etc.”
“The use of a wide set of advanced technologies to obtain a highly advanced result.”
“New combination of software technologies with global systems science.”
“Unique interdisciplinarity in the consortium making it possible to tackle an innovative scientific and technological challenge.”
“New techniques combining into a new piece of equipment.”
“New calculation technique based on model not used for this purpose before.”
“Partially, a new combination of methods was used.”
“New methodologies (inter & multidisciplinary).”

Source: FET survey, 2007

3.4 Most remarkable outcome of the project according to participants

In question 11, FET participants or coordinators were asked: “What was the most remarkable scientific or technological outcome of the FET-project for you? Was a portion of this outcome unplanned? Please specify”. Altogether, we found 177 usable comments after having deleted 16 answers like „too early to tell“ or “impossible to say in one sentence”.

Asked for the main outputs of their FET projects most respondends started their comments with “new” or “novel”, like in “A new algorithm for acoustic simultanious localization and mappping” or “New event-based bio-signal interfacing circuits”. This is not surprising as novelty is a main requirement for FET projects. The spectrum of scientific topics dealt with is wide and includes basic science topics as well as more application oriented research.

All comments were linked to some kind of “technology”, which also includes new programming languages or algorithms or the combination of concepts which results in improvements of existing devices. Table 4 lists some of the outputs mentioned by the respondents to illustrate the wide spectrum of topics covered.

Table 4: Spectrum of topics mentioned as main outputs of FET projects (question 11)

"A novel atom interferometer beating the standard quantum limit, which could be used to improve electromagnetic field measurements."
"Development of the first robot in the world inspired by plants."
"First hardware implementation of a photonic reservoir computer."
"Nano-scale optical addressing by surface plasmons and single electron charge control."
"The advancement of sentiment analysis for big data and to put together psychologists, computer scientists, and physicists."

"The CGAL library and the structuring of the EU community in computational geometry thanks to several FET projects, during FP7 and before."

"The creation of new neuromorphic chips (computational devices inspired by brain circuits)."

Source: FET Survey 2017

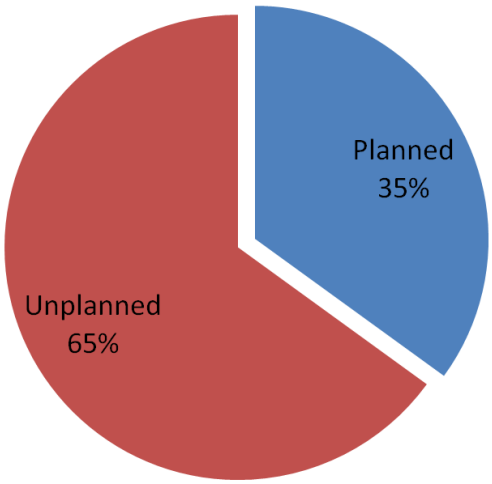
In addition, some respondents highlighted new methods and a deeper understanding as main outcomes of their projects. Examples of comments are:

- “A solid theoretical basis for 'uncertainty principles for constructing optimized function systems', opened new avenues for future applications in hyperspectral imaging.”
- “A model and a methodology for pervasive systems engineering.”
- “Ability to accurately describe effect of time activity patterns on charging of EV.”
- “Methods we developed thinking about robustness of system can be directly transferred to cyber security, so we got a new project with extensive funding based on just one paper from our task”.

The second part of question 11 was related to unplanned outcomes. We asked FET participants and coordinators “What part of this outcome was unplanned?” in order to get an indication on the possibility to follow unplanned insights and results. In general, research funding schemes shall provide such possibilities, especially when focussing on novel scientific research and technologies.

Question 11 was designed as an open question. Of all usable 177 responses to this question, 72 explicitly responded to the “Was a portion of the outcome unplanned”-question. Of those, 25 (or 35%, with 72 being 100%) said that outcomes were as planned in the workplan or mostly planned and realized as expected.

Figure 5: Percentage of planned and unplanned outcomes of FET projects



N=72, source: FET survey 2017

However, this does not mean that the there were no surprises in the project. Some respondents said the outcome was as expected but that they were surprised it worked so well, or that they were not sure whether it would indeed be feasible what was foreseen in the workplan. “Outcome as planned” also includes outcomes which were literally “breakthroughs”: Envisioned and planned for in the proposal and which – sometimes to the surprise of all - in fact could be realized in the course of the project.

On the other hand, 47 (or 65%) researchers reported of outcomes which were not planned or expected or partly not planned or to some extent different than expected, or even “beyond our expectations”. Some of the comments reporting of unplanned outcomes give deeper insights into the project context and the way scientific results are being generated in FET projects (see table 5).

Table 5: Selected comments on main outputs and the portion of unplanned outcomes (question 11)

“Achievement of a new optical memory. Part of it was unplanned. The ideas were developed within the project, but new fabrication technologies by external partner emerged during the active involvement in the development process.”

“Artifical chemical muscles. We were aiming for neurons, but when we discoverd motion in artifical neurons we started a line optimizing for that.”

“New method for entangling many ultracold atoms, with application to metrology (published in Science). This result was well in the spirit of the proposal, but the method itself was not foreseen in the work plan.”

“New signal processing techniques combining sparsity, the uncertainty principle and graph theory. This was unplanned.”

“Novel languages for logic-based knowledge representation and techniques for efficiently and flexibly accessing data. A part of this was unplanned.”

“Pushed the state of the art in unprecedented levels for low-power autonomous miniaturised sensors, nanowire PV efficiency and sensitivity of nanowire-based sensing. Some parts were beyond our expectations.”

“Scientific networking with a different area of research, at a very high level of research. I had not foreseen that it could influence so much the rest of my career.”

“Scientifical outcome: I discovered relations to disciplines I have never thought about earlier.”

“Single-photon detectors in deep submicron technologies. Implementation as large arrays (for R&D) or smaller ones as industrial products (unplanned as such).”

“That it was actually possible to federate the efforts of research groups on such diverse expertise fields.”

“The development of a new schema language for XML. Unfortunately, this outcome was not unplanned. We felt that the contact with EU did not have that much freedom. The more exciting results came after the project, when we had more freedom in research again.”

“The 'golden heart' of FET projects has been that novel basic concepts could be tried without pressure to deliver applicability - and then often did just that. In two cases, major results lead to industrial collaborations, after the project.”

“The main outcome of our project consisted of scientific results. A part of these were not envisioned.”
“The main outcome was a middleware for pervasive computing. The concept was in the proposal but how to implement it was found out over the course of the project. It is not possible to say a percetage here.”
“We did not expect we could actually publish several research papers on the topics of the FET as they were extremely innovative.”
“We discovered that a long time believed fundamental limit was not there. This was to some extent unplanned.”
“Yes, with a large team, we met very new people allowing unexpected new collaboration.”

Source: FET Survey 2017

In addition to mentioning scientific or technological outputs, 7 out of 177 (4%) respondents highlighted rather formal outputs like:

- “A few good publications.”
- “A new ERC proposal submitted by a member of my group.”
- “Conference and journal publications, PhD thesis.”
- “Colloquium paper in EPJB (>500 reads within 3 days on Researchgate).”
- “Link with new people and broader perspective.”

In sum, the comments concerning outcomes show that a large part of the major results were unplanned and that FET projects offer the opportunity of unplanned, open research. Only one respondent felt that FET was not giving this opportunity, saying that “unfortunately, this outcome was not unplanned [meaning the outcome of the project being a new programming language, B.B.]. We felt that the contract with EU did not have that much freedom. The more exciting results came after the project, when we had more freedom in research again”.

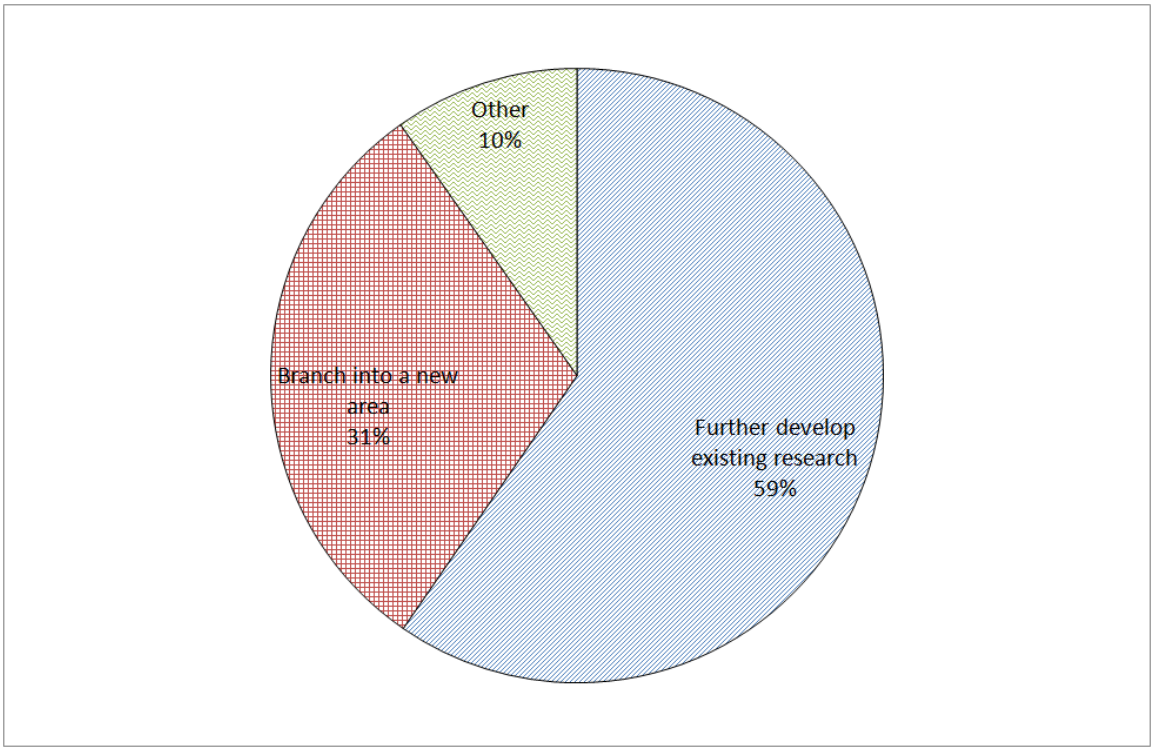
Another respondent noted that he/she does not understand the question because any research programme encouraging innovation shall be prepared for unplanned outcomes and shall even encourage this.

3.5 Pursuing new research directions in FET projects

The FET programme is designed to support researchers with novel ideas pursuing interdisciplinary approaches and new combinations of knowledge. Especially mid-career researchers with a proven scientific track record may use FET-funding to take their research into new directions and pursue exceptionally innovative or high-risk projects.

Thus, we would expect that many researchers use FET projects to branch into new avenues of research. An indeed, asked whether their FET project has helped branch into a new area of research (question 9), 31% of our respondents checked “yes”. On the other hand, 59 % said that they used their FET project to further develop their existing line of research (see figure 6).

Figure 6: Impact of FET projects on individual research agendas



Source: Survey on FET impacts (sample of n=297)

Looking specifically at the answers given by mid-career-researchers, we find an even higher number of researchers (39%) saying that the FET project allowed them to branch into new areas. Respectively, the percentage of mid-career researchers saying that they used the FET project to further develop existing research areas is lower with 53 %.

When looking into the comments in the “other, please specify”-category, it seems that for many researchers this is not a fundamental differentiation, as they commented that the FET project was good for both. Typical comments were: “Both options above”, “a combination of both”, “Both further my line of experience in dynamical systems and branch into new areas (pure maths, computer science)” or “Both further develop my line of experience and branch into a new area of research.” Thus, our results merely indicate the overall direction, FET projects were used for by participating researchers.

As the “Other”-category is quite large (10%) it is worth looking in detail at the comments. Table 6 lists the most interesting responses.

Table 6: Other uses of the FET project according to the researchers surveyed (question 9, other)

“To learn how an existing innovative technology could be applied in new ecosystems and use cases.”
“Further develop my line of experience but through a drastically new advancement of the technique.”
“The projects allowed to both deepen research into a topic that each partner already had a very visible track record, as well as establishing new collaborations, in particular bridging basic science and applied science.”
“The FET project was useful as a local source of funding but the interactions with partners were very disappointing for the most part.”
“Rethink some of my research goals.”
“Research an area of existing interest that was too adventurous to get funded any other way.”
“Jump into a related career in industry, trying to make those innovations happen (it is VERY slow:), though).”

“It offered me a tremendous postdoctoral experience, branching into a completely new area of research and boosting my career for a follow-up research fellowship and recently lectureship.”
“Improve international collaborations, and strengthen my expertise.”
“Further develop my line of experience and learn new areas and people.”
“Develop my network.”
“Build a network of researchers working in the field.”
“As an outside partner (non-cost non-EU), the opportunity to stay in touch with my European colleagues.”

Source: Survey on FET impacts (question 9, “other”, n=29)

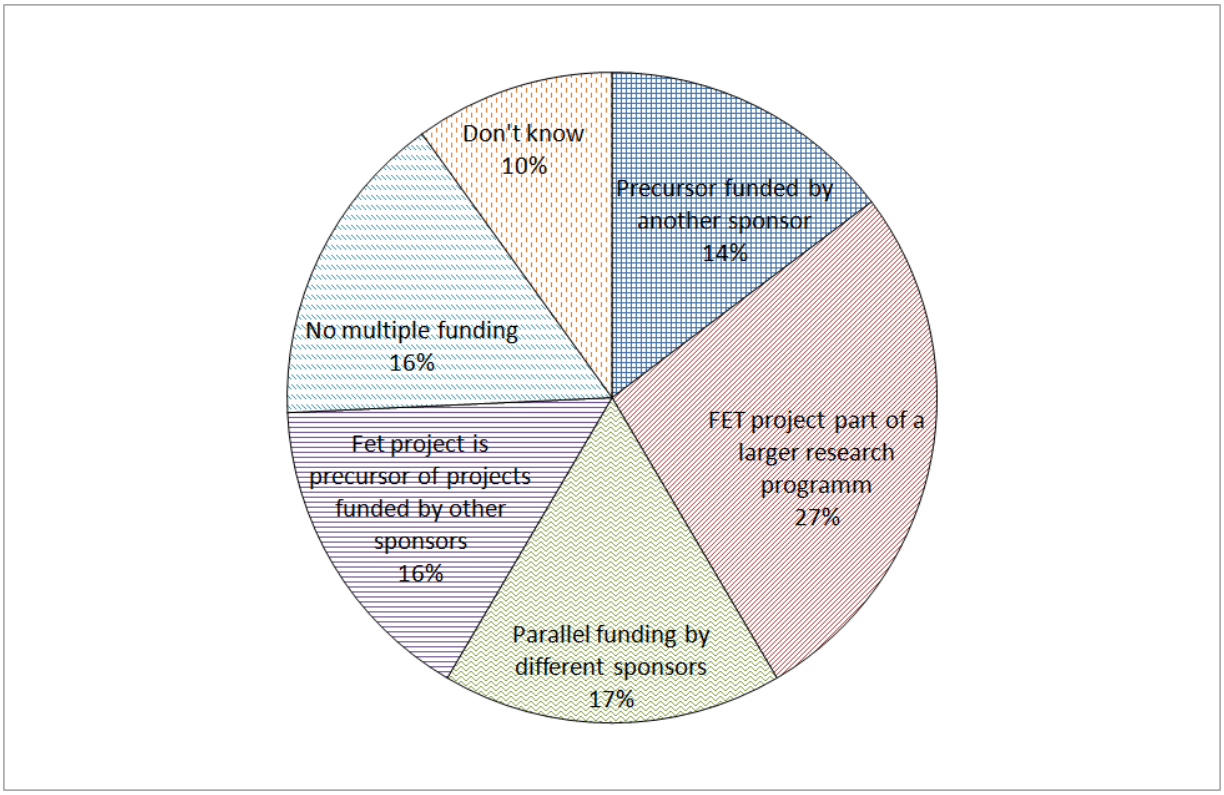
Other uses mentioned were “To develop my managerial skills” or “Manage international consortia, develop my line of experience, learn EC practices, and master funding applications, project finances, reporting, and other communications.” Also, some more practical uses were given like “Fund a student” or “Do my PhD”.

3.6 Multiple funding

When identifying FET-publications in the Web of Science database, we often found that not only FET was mentioned as the sponsor of the research, but **other funding organisations** as well. Therefore we asked the participants of the survey how this phenomenon can be explained (question 10).

It turned out that researchers mentioned several sponsors in their publication because the results presented are linked to more than one project: Figure 7 shows that 14% said that the FET project was preceded by another project which was sponsored by a different funding organisation. And 16% said that after the FET project was finished, the topic was further developed in a project sponsored by a different funding organisation. Taken together it can be said that often it takes a FET project plus another project (or vice versa) to be able to achieve results publishable in a scientific journal (30%).

Figure 7: Reasons of multiple organisations in acknowledgement



Source: Survey on FET impacts (272 answers, 191 respondents, multiple answers possible)

Another reason for mentioning additional funding organisations together with FET is that the topic dealt with was part of a larger research programme. This was the case in 27 percent of the cases, thus FET funded only a part of the programme.

An interesting result is that in 17 percent of the cases, the respondents conceded a multiple funding of the project. In this context, the comments in the open answer field give additional explanations (table 7):

Table 7: Multiple funding explanations by respondents (question 10)

"As is typically the case, the funding provided was not nearly enough, so I had to rely on other sources of funding, too."
"Constraints over budget forces us to apply for several fundings."
"In our community (AMO physics), an experiment is typically too expensive to be funded from the FET contribution alone."

“Scientific research is not tied to specific funding, and some important works transcend single projects. Also, simply, sometimes researchers are paid by multiple sources.“
“Specific tools and methods developed for other projects were found useful and used also for the FET project.”

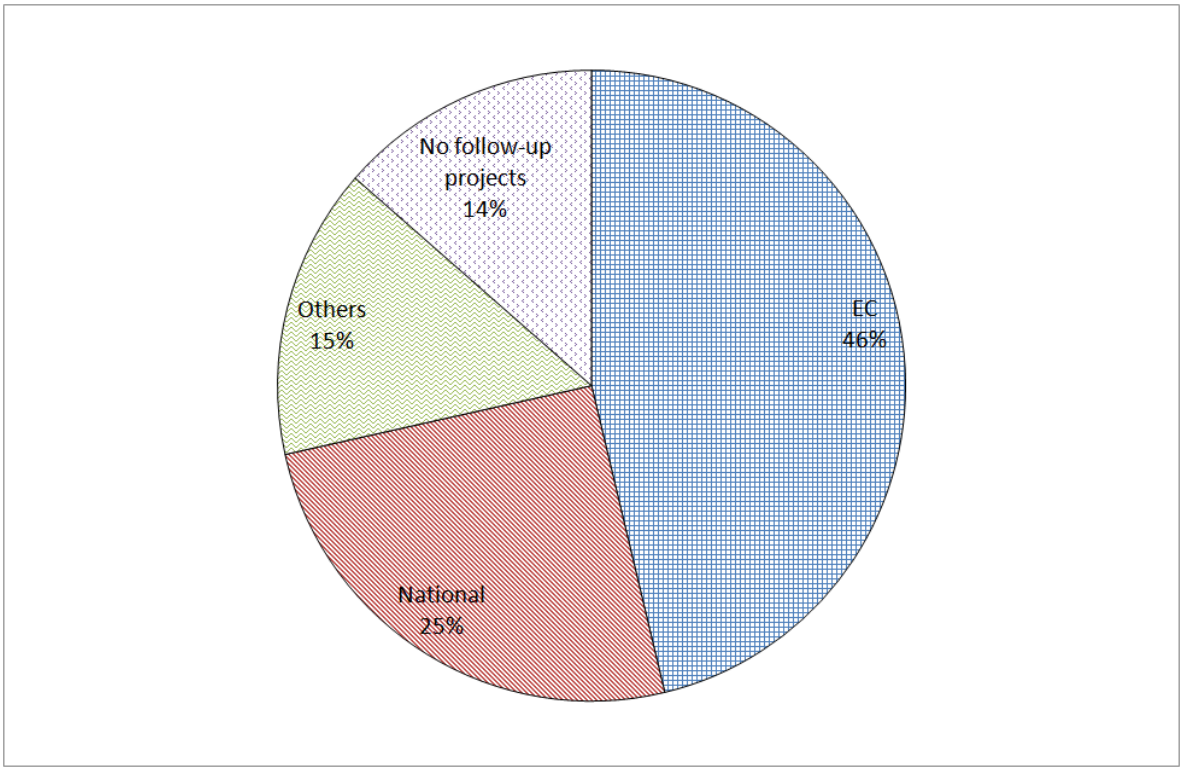
Source: Survey on FET impacts, 2017

The main aim of this question was to understand why researchers often mention several sponsors in the acknowledgement field in the Web of Science database which makes it difficult to assign specific research results to specific FET projects. We wanted to know how researchers use FET projects in their funding mix and what role FET projects play in their individual line of research. Question 10 provided an extensive list of possibilities to chose from (7 options plus one open field). By taking together answers "FET project is precursor for other projects", "parallel funding", and "FET project is part of a larger research programme", we could indirectly calculate the percentage of FET projects which have triggered other research projects in general (about 60%). However, since the question covered a different topic, we shall not take this number to be the correct follow-up number but only use it as a magnitude. In fact, we have asked a separate question aiming explicitly at follow-up projects (question 18).

3.7 Follow-up proposals or projects triggered by FET projects

Question 18 asked for follow-up proposals or projects which extend the work of the individual FET projects in specific ways. It turned out that most of the FET projects (86 percent, see figure 8) triggered **follow-up proposals or projects**, thus it is reasonable to conclude that a large portion of FET projects has initiated successful lines of research.

Figure 8: FET project triggered follow-up projects



Source: Survey on FET impacts (sample n=214)

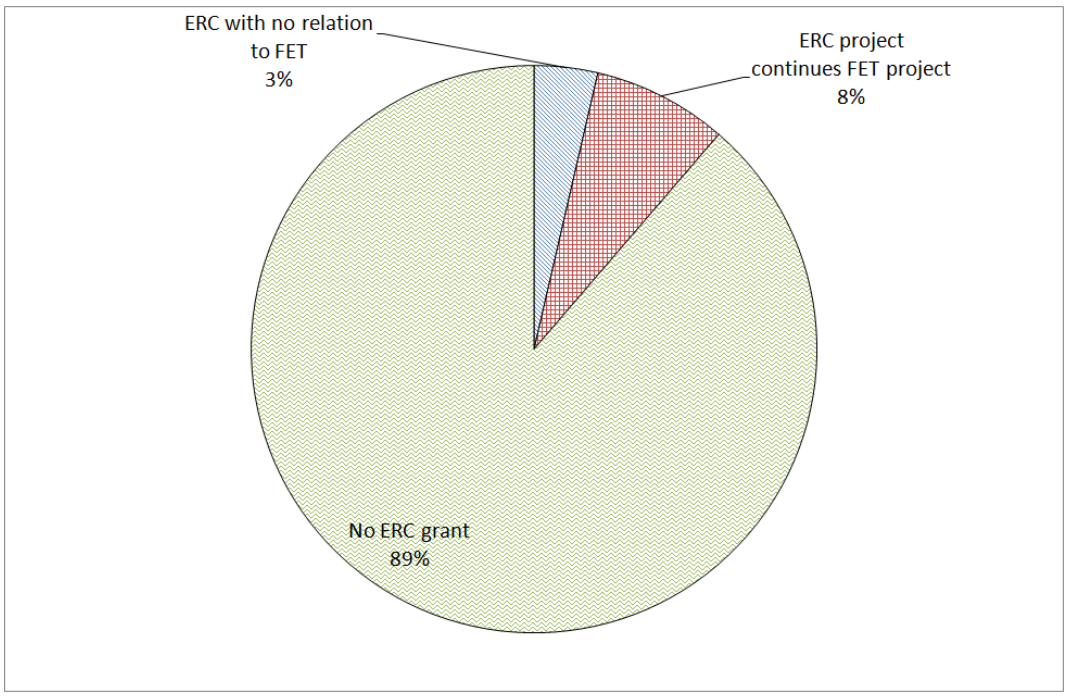
The majority of follow-up projects were conducted with support from the EC (46 percent) and 25 percent were supported by national sponsors. The 15 percent "others" refer to both EC and national funders and sometimes even include international funders.

3.8 Follow-up ERC grant as an indicator for excellence

It is difficult to achieve an **ERC grant**. Thus it would be a specific honour, if an ERC grant can be achieved after finishing a FET project. Thus, we have asked FET project participants and coordinators in question 14 whether or not they have received an ERC grant anytime after the FET project and if yes in which way the ERC grant allowed them to continue the work done in FET.

According to the survey, altogether 11 percent of the respondents achieved an ERC grant after the FET project which is a clear indicator for excellence. What is more, in 8% of all cases, the research being done with ERC funding was initiated or at least supported by a FET project (see figure x). This share can be considered as high, as the funding schemes of FET and ERC are quite different. The FET projects are granted for large interdisciplinary consortia, the ERC projects for individuals in disciplinary projects.

Figure 9: Achievement of ERC grants after the FET project



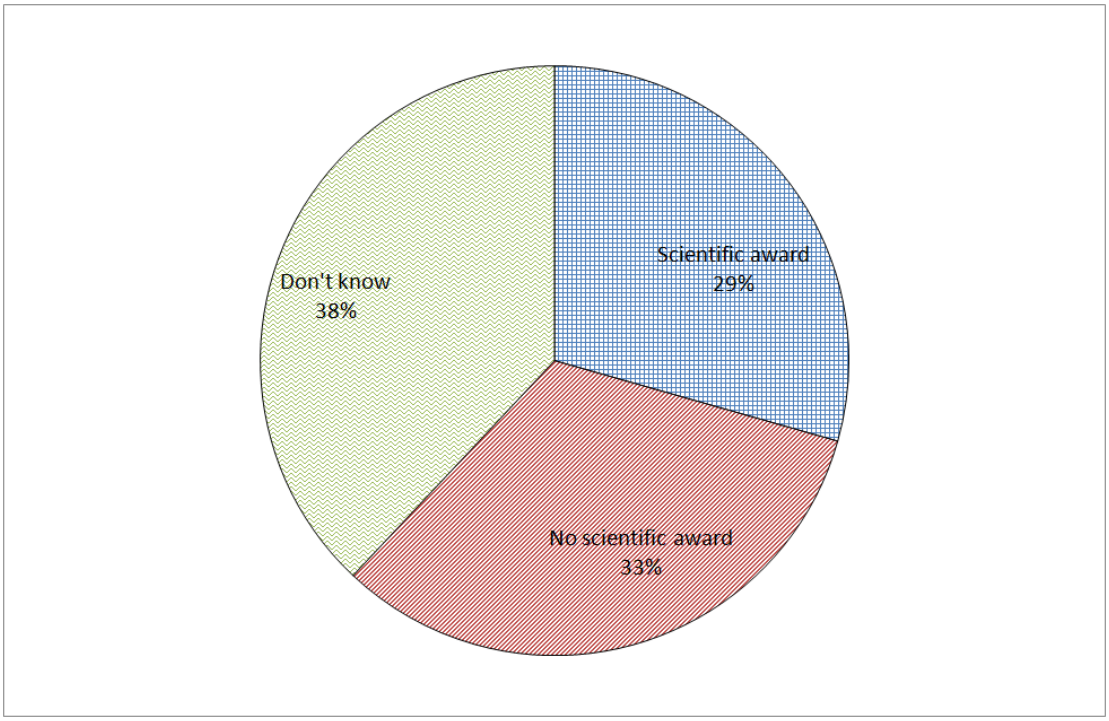
Source: Survey on FET impacts (sample of n=221)

3.9 Major scientific awards received for FET-related research

Scientific awards are indicators for research excellence. We assume a close relationship between excellence and novelty of the research and have asked in question 12 whether or not FET project participants have received any scientific awards for their research carried out in the respective FET projects.

The results show that almost one third of the respondents report of **scientific awards** for work carried out in their FET project (figure 10). This share is impressive in the area of high risk research where failure is also a possible outcome.

Figure 10: Scientific awards for results connected to FET projects



Source: Survey on FET impacts (sample of n=221)

3.10 Patent applications which relate to concepts developed in FET projects

An indicator for economic relevance and especially for starting an innovation ecosystem is when researchers apply for patents related to their work. Thus, in question 13 we have asked FET participants whether or not they have applied for one or more patents based on the results of the FET research.

It turned out that **25 percent** of the respondents reported of at least one **patent application**, thus the applied impact of the projects as scientific projects is considerable (sample of n=220).

Differentiating by the end date of the projects (projects finished in 2010 or in previous year versus projects finished after 2010), it may be expected that the antecedent projects achieved more patent applications due to the longer delay. However, a higher share of patent applications was achieved by recent projects (40 percent). Obviously, the programme put more attention to patent applications in recent years.

3.11 Industrial relevance of FET projects: Spin-off enterprises

In 12 percent of the cases, the respondents reported of the foundation of a **spin-off enterprise** based on the results of the FET project (sample n=212, question 16). This share is quite high compared to experiences in academia and public research institutes in general. Thus, this figure reflects the orientation of the FET programme on emerging technologies. This share is independent of the time when the project was finished.

3.12 Dissemination of FET results into academic and industrial R&D communities

An important aspect in the impact assessment of the FET programme is whether or not the ideas or parts of the research results developed in a FET project have spread into the academic and industrial R&D communities, respectively in how far the ideas generated there were taken up by researchers who were not originally involved in the FET project.

One of the indicators which can be used here are citation rates which is being done in the bibliometrics workpackage. Citation rates give indications on how successful ideas based on FET projects were disseminated within the academic and industrial R&D communities and thus have lead to new innovation eco-systems (see indicator report D3 sections 3.2.3 to 3.2.5, p. 20f).

Another, more specific indicator for dissemination of new ideas and the genesis of new scientific communities is the number of publications that are co-authored by researchers not originally involved in the FET project - be they from academia or from industrial R&D. Originally we planned to gather this information in the bibliometrics workpackage. However, it turned out that this is not feasible because of the high number of involved researchers in FET projects. In fact, FET projects in our sample involve many researchers who sometimes come from as many as 26 partner organizations. Bibliometric analyses of co-publications thus become very complex. In principle, relevant follow-up articles need to be selected and to be checked whether or not new researchers who were not belonging to the original consortium were involved. Since this was not possible for all projects in our sample we decided to include the responding question in the survey and directly ask the fesearchers.

In question 15, the respondents were asked with whom they have published project related articles in journals or proceedings. Possible answers were:

- with partners in academia not originally involved in the FET project

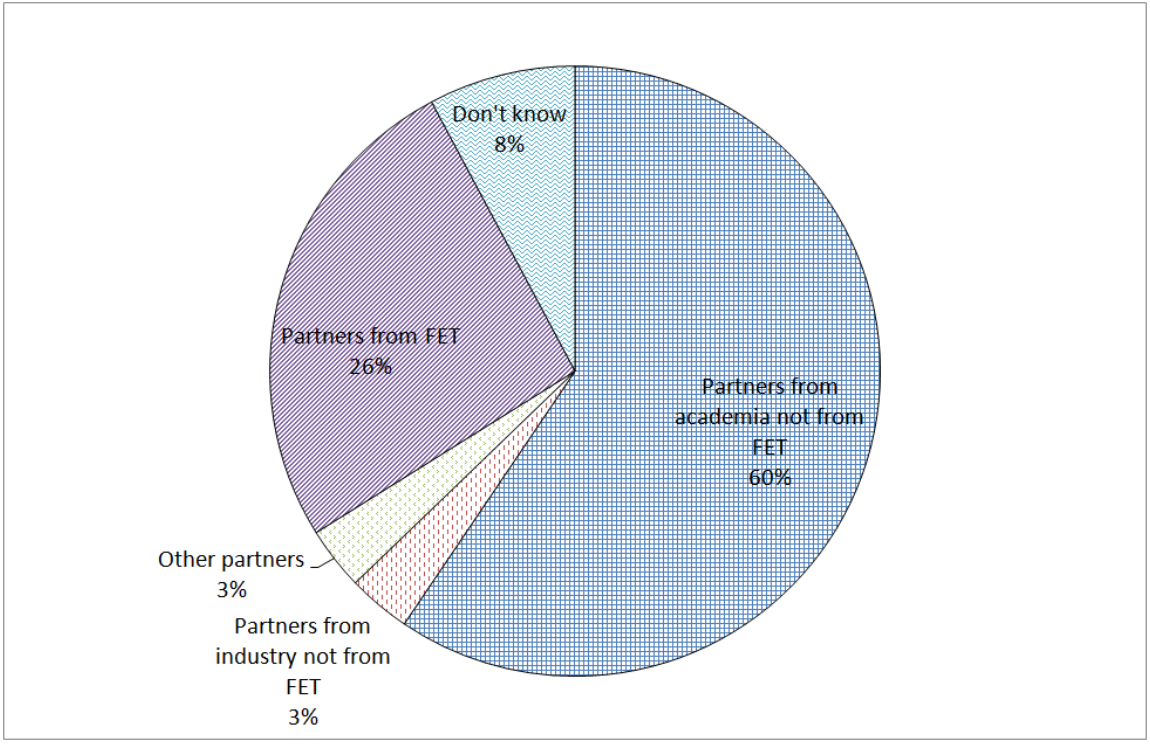
- with partners in industry not originally involved in the FET project

- with other partners not originally involved in the FET project, namely..., and

- only internal (partners of the FET project consortium)

Figure 11 shows the results concerning the dissemination of FET results into the academic and industrial R&D communities.

Figure 11: Follow-up co-publications with different partners



Source: Survey on FET impacts, n=180, multiple answers possible

The most important channel to diffuse the knowledge gained in the FET context is the academic communitiy: In 60 percent of the cases, the co-publications were performed with academic partners outside the FET context.

On the other hand, only 6 percent of co-publications were done with industry partners not from the original FET consortium. We added the 3 percent "other partners" to the total share because most answers there mentioned that they published with exteral partners *both* from academia and industry.

At first glance, the industry share of 6% appears low. Especially when comparing it to the high share of overall industry participation in our project sample (40% of projects having at least one partner from industry, see D4.2, p. 7ff), the high percentage of projects which have applied for patents (25%) or the high rate of spin-off foundations as a results of a FET project (12%). However, the low co-publication rate may reflect the fact that industry in general is not so much interested in publishing results in scientific journals or proceedings but in applying and practically enhancing scientific results. In this context it would be interesting to know the percentage of industry co-publications which emerged *within* the FET consortium. However, we cannot specify the 23% any

further because we have not asked respondents to say whether this was a publication with an academic vs. an industrial partner. Originally we expected to get this information from bibliometrics. As it turned out that this is not possible for all projects in the sample, we have checked selected cases and found that the percentage of joint publications of academia and industry within the FET consortium is much higher than 6 percent. This shows that industry relevance of FET projects is generally high. However, when it comes to publishing results or further developments with industry partners outside the original FET consortium, we find fewer activities.

The fact that there are not many publication activities of FET researchers with other industrial R&D collegues who were not originally part of the FET consortium might also be understood as a deficit of researchers in spreading their idea into the industrial realm. However, in question 17 we have explicitly asked for industry contacts and found that there are quite many activities to get in contact with industrial R&D (see section “Communicating FET results into industry”).

3.13 Communicating FET results to industry

In order to start an innovation ecosystem based on FET research we would expect FET researchers not only to wait for their idea to become known by publishing it in scientific journals. Instead, we would expect communication and diffusion activities to make their idea known in the engineering and technology development communities, and that they partner with industry R&D to further develop, refine or apply the idea of the FET project (see also section “Innovation eco-systems” in D1, p. 51f). Our assumption is that FET researchers resp. FET projects who are active in this direction are more successful in starting new innovation ecosystems than others.

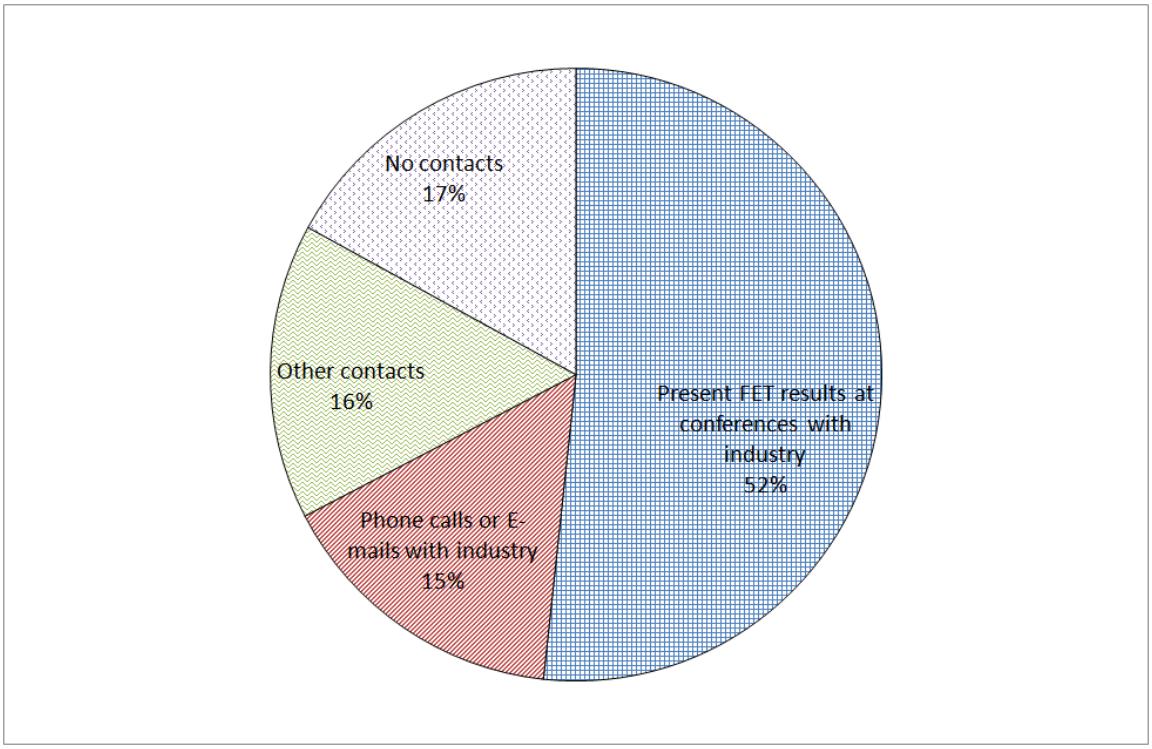
Thus, in question 17 we have asked: “Did you or any of your project partners...

- present FET results at a conference with participants from industry?
- get any phone call or e-mails from companies or offers for cooperation in the FET context?
- have any other contacts with industry? Please specify:...
- No contacts to industry that I know of.”

The answers to this question show that the majority (83 percent) of respondents was actively seeking contact with industry to communicate FET results: 52 percent said that

they have presented FET projects at conferences with industry participation, 15 percent said that they have used informal channels such as phone calls or E-mails to contact industry R&D collegues (see figure 12).

Figure 12: Communicating FET results to industry



Source: Survey on FET impacts 2017, question 17, 294 answers, 170 respondents, multiple answers possible

The remaining 16 percent “other contacts” comprise other channels such as contract research, employment of former students at industry, informal meetings, etc. Table 8 documents some of the most interesting comments of researchers concerning other activities to get in contact with industry.

Table 8: Other contacts with industry (question 17)

“We received an Industry-Academia Partnerships and Pathways project (IAPP) project.”
“We contacted companies for informing them about the project results.”
“We called them to offer some ideas.”

“The follow up of the project was another project with many other participants from industry.”
“Some companies founded or owned by our students and ex-students are currently using partial results of our research in their products and services.”
“Solve an industrial application.”
“Significant case study with industry of the automotive field.”
“Several industries were interested in our research lines, being several researchers very well known to the industry before the project.”
“Policy making bodies: central banks, OECD, UNEP, EIB”
“Our mission is to industrialize research through the spinoff.”
One partner of the project was a SME. We are now considering the possibility to found a spin-off company, potentially with the help of other companies
“Multiple industries have been interested in our technology.”
“Meetings have happened or are planned.”
“Many industrial researchers received the project newsletter.”
“Long-term collaborations with leading industry.”
“Joint conference with industrial counterparts.”
“Joint appointment with an applied institute.”
“I have presented our results to several electric utilities.”
“I collaborate with industry in other areas, but the results we have from the FET project project would need further development before it could turn into technology.”
“Focused events.”
“Direct presentation of project results to industry collaborators.”

“Currently in conversations with a pharmaceutical company to develop a new research project on related topic.”
“Continued collaboration with industry partner on project related topics.”
“Contacts with device manufacturers related to the FET project topic.”
“Contact with SMEs to value the results of the project.”
“Close contacts with 3 spin-off companies resulting from our research in other areas.”

Source: Survey on FET impacts, 2017, Selection out of a total of 43 comments.

The share of 17 percent of respondents reporting of no contacts to industry is very low. The results show that most FET researchers are actively seeking industry contacts which also means that a large part of FET projects have an assumed potential for industry application or are expected to be able to start new innovation eco-systems.

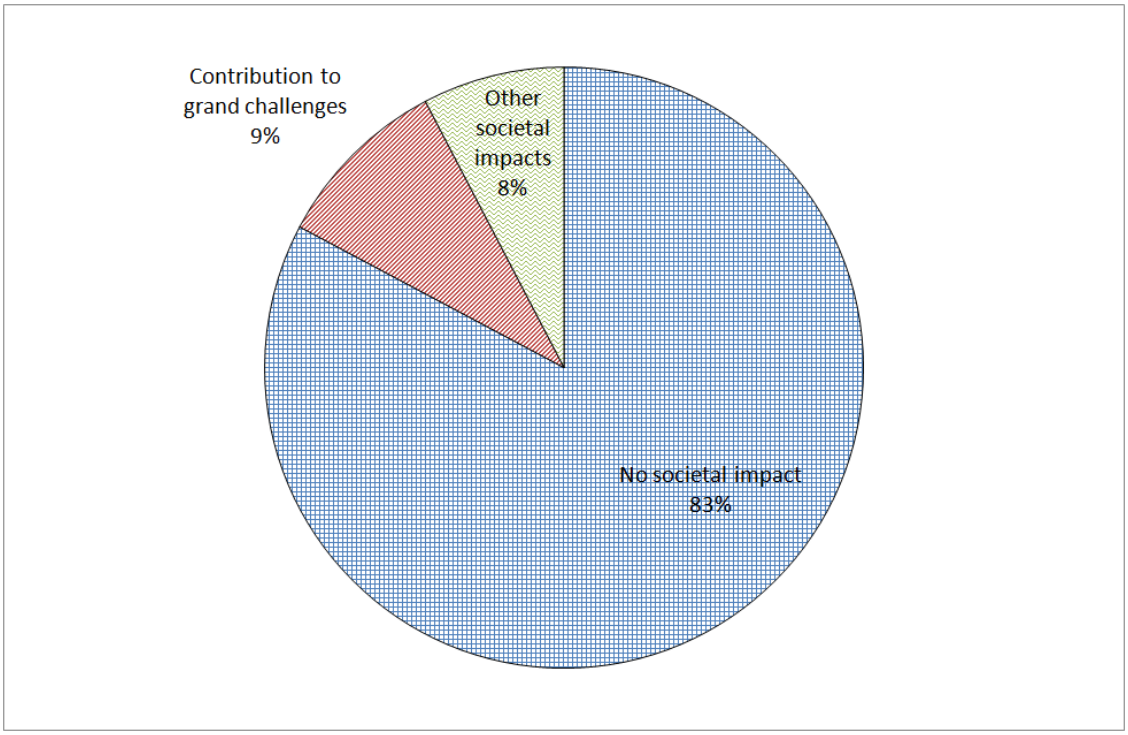
3.14 Societal impacts

In the survey we also asked for societal impacts of FET projects, a question which was discussed in the FET_TRACES review meeting. The aim of the question was to find out about the level of awareness of grand social challenges and the contribution of FET projects. As the focus of research policy towards solving grand social challenges (instead of a mere technological focus) is relatively new and researchers still define themselves as being part of a technology development community rather than a community solving societal challenges, we expected a low level of awareness of societal impacts. Also, in order to get more out of this question than a confirmation of officially targeted fields of social impacts (climate change, inclusion, security, health, food, energy, transport) we included an open question asking for “Other social impacts”.

Question 20 was formulated in the following way: “If you critically reflect on the outputs of your project: Apart from scientific and technological impacts, did your project trigger any social or political changes (for example new kinds of user support, change of

medical guidelines, new computer security guidelines and regulation, etc.)? Figure 13 shows the results.

Figure 13: Social or political impacts of FET projects



Source: Survey on FET impacts 2017, n=209, question 20

Contrary to our expectations, we found a relatively high share (17 percent) of the answers reporting societal impacts of FET projects: 9 percent said that their research in FET contributed to the grand challenges of the European Commission and 8 percent reported of "other societal impacts". Table x lists some "other societal impacts" mentioned by the respondents.

Table 14: Other societal impacts of FET as seen by respontends of the survey

"Yes, it contributed to the understanding of the feasibility (and ecological sensibility) of massive EV introduction and differences between different member states."
"Some partners apply the research in the transportation field."
"Our paper was rewritten as executive abstract and was considered as a ground for new banking laws by EU commission."

“New health policies in several countries.”

“It helped to look at the problem of energy consumption during computation with new perspective.”

“It had contributed to the decision on Quantum Flagship.”

“Follow-up projects in the energy area, the security area and climate change applications would not have been possible without the ground-breaking work of our FET project.”

“Education (we applied the approach in the way work is organized within a university as social community, from many points of view, e.g. organizational).”

“Data protection regulation and medical science derogations reinstated before approval.”

“As you can note machine learning is now heavily used everywhere, especially for net-worked systems. Our FET project proposed this years before but of course we do not claim that this result would be achieved without our project.”

“We were among various movements talking about data publishing, better support for open access, better credit for peer review and in general - beyond paper writing. It all happens now. We were ONE of the triggers, not THE trigger.

“Too early to say.”

“New approach to economic growth.”

“Local action on air quality studies in London that we continue to do.”

“It's too early to tell. In fact, we are still working on the aftermath and it is quite possible that this will have a significant impact.”

“It triggered wide interest in the media and patients associations.”

“It is a security related project, we are sure it would have a wide impact on security of mobile devices.”

“It arose concerns on the reliability of multimedia forensic tools.”

“Hope it will help therapeutic management of spinal cord injury.”
“'Future and Emerging' excludes direct impact - if such impact is measurable during or shortly after the project, the project has not been about novel significant concepts but has been incremental or insignificant. Some results look very promising.”
“A strong unifying foucs of the quantum physics community on Europe - this also has significant international impact.”
“A new attitude to sound design among practitioners.”

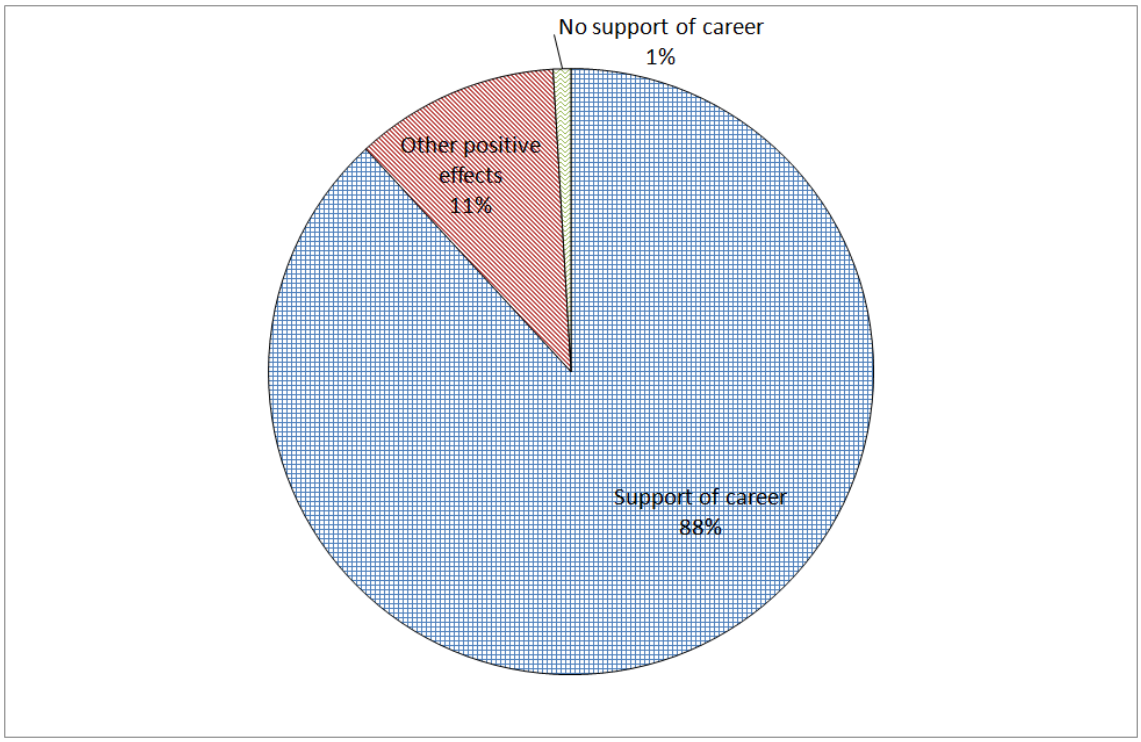
Source: Survey on FET impacts, 2017, Selection out of a total of 16 comments.

In the case of the societal question, we examined whether the answers of the coordinators were different to those of the participants. We found an almost equal distribution, so that we did not distinguish between coordinators and participants in this question.

3.15 Number of researchers expecting career impacts of FET projects (FET-participants)

In order to attract the best researchers, the FET programme needs to be attractive not only in the sense that it offers an opportunity to follow scientifically interesting topics but also in terms of career building in a scientific context. Thus, in the final question of our questionnaire (question 21) we have asked FET project participants and coordinators whether or not the respective FET project supported their career or what other positive effects they have experienced. Figure 14 shows the results.

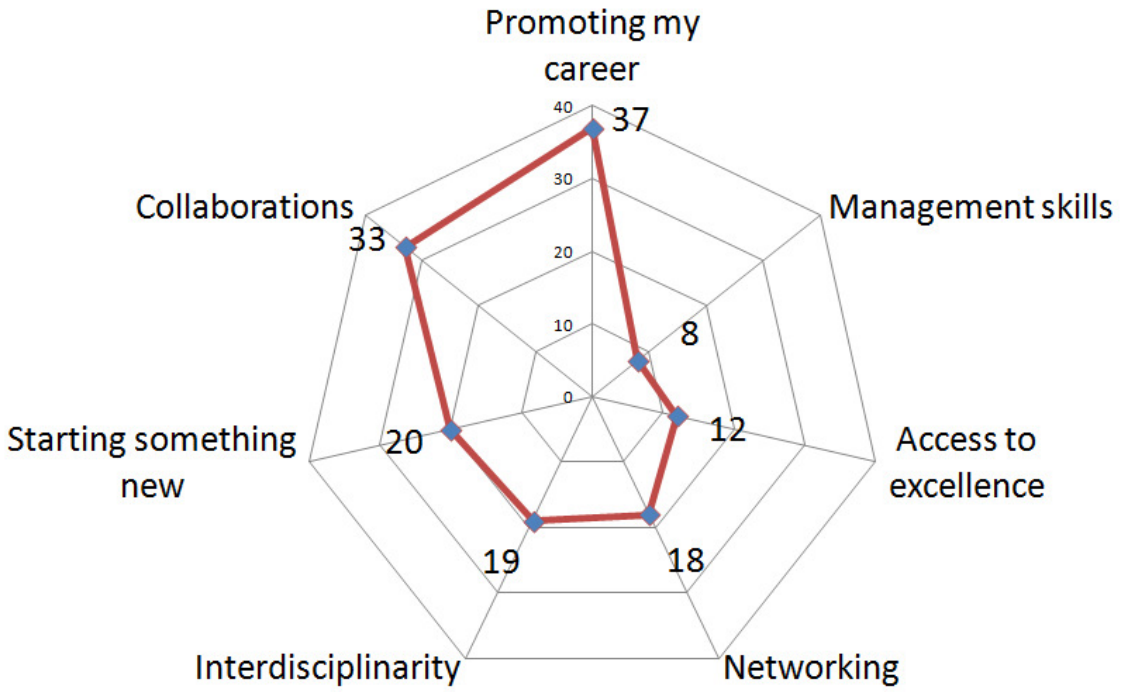
Figure 14: Impact of FET project on the career of the researcher



Source: Survey on FET impacts (sample n=211)

Altogether, the overwhelming majority (88%) of respondents reported of positive effects of the FET project for their career. Only 1% denied a positive effect. Other effects were mentioned by 11% of the respondents. Looking closer at what respondents answered in the “other” category, we can assume an even higher percentage of positive career effects of FET projects: Clustering the comments in the “other” categotry, we find that “Promoting my career” is mentioned most often with 37 statements (n=132, coded as multiple answers, see figure 15.

Figure 15: Other effects of FET projects according to respondents of the survey



Source: Survey on FET impacts 2017, question 21, altogether 132 comments in the "other effects" category were clustered in seven topics

Table 10 documents the most interesting statements in the seven clusters.

Table 10: Other positive effects of FET projects according to the respondents

Promoting my career in science
"Visibility, reputation, partnership."
"Training in leadership, creating a new specification paradigm which more and more widely used, boosting my visibility and citations, led to interesting invitations."
"Supported my career (became full professor), helped me for further projects."
"Several invitations from prestigious Institutions to present the results of my FET pro-

ject; awards; invitations to edit special issues in ISI Journals, etc.”
“Securing a 3-year research fellowship, which in turn helped in getting appointed as a Lecturer (in a different EU country).”
“Recognition as a leader in the field, increased my network, provided valuable insights about FET expectations.”
“Promotion to full professor.”
“Professorship and a good network and standing in the community.”
“Participating to the project helped me to get promoted as research director.”
“It started my career and my current position is a post-doc place with a researcher of the project that got an ERC advanced grant.”
“Introduced me to new partners and helped my group build reputation.”
“Increasing my international visibility.”
“Helped to demonstrate the potential of new approach which we are now developing in ERC consolidator grant award to myself, and a MC visiting fellowship to my university.”
“Growing my research group, collaborations, scientific output, and career.”
“Great publications.”
“Increasing my visibility, allow me to be taken seriously in communicating with industry (this is probably the largest benefit). Strangely the flaw was that my research productivity was a bit reduced because some low hanging fruits was not to be considered.”
“Establishing a work group and become full professor. Several permanent (now nationally funded) university positions stem from this which would not exist without this and prior FET projects.”
“Broadening my expertise, which ultimately lead to a permanent academic position.”
“Better formation of my research profile, more visibility, bigger working group.”

“Attracted different industrial players, attraction from private and institutional investors.”

International and peer group collaboration
“Strengthened and tightened a European network of collaborators on a then emerging research topic.”
“Stimulate collaboration and exchange between the project partners. This definitely ac-celerated the progress towards our goals in quantum metrology.”
“Starting new collaborations with other European research groups.”
“Sharing knowledge and expertise on this topic with other researchers involved in the field, prompting further collaboration/networking.”
“Reinforced contacts with other experts, funded promising young scientists.”
“Introduced me to research areas, people and organizations with which I would like to continue collaboration.”
“International cooperation vital to building a consortium of interested parties in emerging field of research.”
“Giving me the platform to collaborate beyond my institution and discipline.”
“Giving me some experience of larger scale collaborations; strengthening my scientific background; taking a critical approach, notably through the very constructive European review process.”
“Getting to know and publish with other researchers in Europe.”
“Favouring my collaborations with many important European researchers in my research area.”
“Establishing lasting collaborations outside of the EU (USA) due to the demonstrated timelines and excellence of the research carried out within the FET project.”
“Establishing collaborations with researchers around the globe beyond the time frame of the FET project.”

“Creating a network of researchers in my area, allowing me to have new collaborators.”
“Collaboration with different international high level groups.”
“Broadening the scope of our research team and calling attention to the benefits of international partnership.”
“Allowing me to focus on academic research and to collaborate with industrial partners.”

Starting something new
“This was one of the few sources for funding true research.”
“The FET framework provides a lot of freedom to do exploratory far-reaching research.”
“Starting new lines of research and new co-operations with other researchers.”
“Started a novel line of research that I still continue with collegues (with one PhD student and several MSc projects).”
“Participation in further research projects, with strong industrial impact. The results in the FET project lay the foundations for this further more applied work.”
“Opening a new field of research, mixing communities of researchers.”
“New research ideas emerged from it and were pursued subsequently.”
“New ideas and new partners.”
“Enter a new field, work with good partners where we have tried to continue collaboration both informally and by applying for new projects.”
“Continued output, and a somewhat new direction for the research, which enhanced my perspectives on different condensed matter subfields.”
“Allowing me to develop a new research line and to establish contacts with pharmaceutical companies.”

“Allowed to develop the idea of the new field of soft robotics.”
“Allowed me to do research that would have been otherwise impossible to fund.”

Interdisciplinary work or widening the scientific scope
“Interdisciplinary learning from other scientists/communities.”
“Greater interdisciplinary, mutual understanding and ability to communicate, raised the level of publications, met extremely interesting scientists from the other projects in our cluster, some of whom I hope to collaborate with in the future.”
“Widened my scientific contacts.”
“Understood complexity of international cooperation; understood complexity of inter-dis-ciplinary cooperation.”
“Started to bring informatics into the life sciences and medicine worlds in a serious manner.”
“Put me in touch with complementary researchers.”
“Exposure to innovative ideas, collaboration with other researchers (from other disci-plines as well), strengthen my network of contacts.”
“Exposure to a wider interdiciplinary projects.”
“Build a research network on complementary areas.”
“Extend my scientific cooperation network.”
“To get new knowledge to another area of neuroscience and brain research.”

Networking
“Workshops we could organize to meet new people and strengthen relationships among the partners, it provided funding that allowed fantastic new researchers to enter the field.”

“To have fun to closer work with other groups in the same field.”
“Significantly increased networking on a European level.”
“Networking, expansion of know-how, starting new lines of research.”
“Improving my skills, experience, building network.”
“I met many people who were interested in the ideas we worked on.”
“Growth of network, leadership opportunities.”
“Great network, which is alive on the academic side (2 further successfull EU-projects), helped to shape a spin-off company.”

Access to excellence
“Enabling me to hire good researchers with relevant experience in order to gain a critical mass of know-how in the area of the FET, and so lead on to new and further scientific research.”
“Strengthen links with top researchers in the field.”
“Networking. I got to know stellar European scientists that I did not know before.”
“Increased number of publications and increased facility to obtain funding from national entities.”
“Increased mobility opportunity, as well as for my students. Also receiving the visit of young foreign researcher, future candidates.”
“Get in touch with top-level groups and share new ideas.”
“Stay in touch with the development in Europe, especially in the transition from quantum technology from research to applications.”
“Meet other researchers and discover new problems.”

Project Management
“Learning to coordinate a highly scientific project and cope with bureaucracy in order to foster science.”
“Learning project management, experience with EU projects, I could continue my PhD topic. In general it was a great experience.”
“Improving my skill in coordinating a team.”
“Gaining experience with working in a multi-national project.”
“Funding researchers, building experience in EU projects.”
“Clearly it was good to build my team. I found the coordination management very chal-lenging, but I learned a lot from the process.”

Source: Survey on FET impacts 2017, question 21, altogether 132 comments in the “other effects” category were clustered in seven topics

Concerning career impact, respondents also provided some negative comments. The negative comments relate to management issues: Coordination and reporting duties are criticised as tasks stealing time which could better be used for scientific tasks (table 11).

Table 11: Negative comments (question 21)

“I had a lot of experience as coordinator and I got my personal funds. The drawback is that I also lost a lot of time with coordination I may have devoted to basic research”.
“Great networking opportunities, several good job proposals after the project. I wish I had more time for research, though, and spent less time on gathering publications and other stuff for reports, Form C, etc.”
“Positive effect: help me to pursue my scientific objectives in collaboration with the best groups in the field. Negative for my career as a researcher: Waste of time in co-ordinating but moderate impact on my publication list. ERC would have been a plus plus.”

> “On the scientific side, very positive. But not for my career, some people judging my work consider that coordination of a FET Project is too much work and that I should have applied for an ERC grant instead.”

Source: Survey on FET impacts, 2017, selection of negative comments out of a total of 132 comments.

Interestingly, researchers did not criticise the FET approach as such, which promotes interdisciplinarity, requires partners from different institutions and expects some link to technology. Contrary to what we assumed in the beginning, this specific mode of doing research does not seem to be a career-stopper at all. In our sample of researchers, interdisciplinarity, collaboration and technology-orientation are seen as important aspects of their research which helped them in establishing a career within science. And if time was spent for management issues instead of actual research, this was made up for by other aspects of FET, for example access to excellence or collaboration with interesting partners.

Possilbly, in the light of our results the impression needs to be revised that science careers are usually made within disciplinary borders working on “mainstream” topics while avoiding application-oriented lines of research.

Annex 1: Questionnaire of the survey on impacts of the FET programme

Welcome to the survey on impacts of the FET programme of the European Commission. Your input is important for us.

The partcipation in this suryey is voluntary. Your information will be traeted confidentially, all data will be anonymized. No piece of information that you may give in the course of this survey will be linked to you as a person. This notification is part of our concept for anonymity and data protection which we have committed ourselves to. In case you have any question concerning confidentiality and anonymity, please contact Dr. Beckert at Fraunhofer ISI (bernd.beckert@isi.fraunhofer.de).

□ I agree, please take me to the survey

□ I do not agree

General Information

1 What is your gender?

Please mark the appropriate answer

□ Female

□ Male

2 Please give us the acronym of your FET project. All following questions relate to this specific project.

Please fill in the following text box

3 What was your role in the FET project?

Please mark the appropriate answer

□ Coordinator

□ Participant

4 What was your stage of career at the time of the FET project?

Please mark the appropriate answer

□ Young researcher

□ Mid-career researcher

□ Late-career researcher

5 Was your project rejected by another funding agency before it was granted by FET?

Please mark the appropriate answer

□ No, I have not tried to get funding otherwise

□ Yes.

□ Don't know

6 If your project idea was previously rejected, please speculate about the reasons why the idea was rejected.

Multiple answers are possible

□ Because the proposed research idea was too 'high risk' or too new in the view of the review panel;

□ Because the proposed research idea required interdisciplinarity work which the review panel did not appreciate;

□ Because the proposed research idea countered a conventional pardigm.

□ Don't know

7 Concerning the idea followed in your FET project: What was it that you considered as new in the project (new tools, new techniques, new equipment ...) ?

Please specify

8 Was the FET consortium a completely new combination or was it put together of partners who were in contact before?

Please mark the appropriate answer

□ Completely new

□ In parts

□ All partners knew each other before

□ Don't know

9 The FET-project helped me as a researcher to

Please mark the appropriate answer

□ further develop my line of experience

□ branch into a new area of research

□ Other, please specify

10 When identifying FET-publications in the Web of Science database, we often found that not only FET was mentioned as the sponsor of the research, but several funding organisations as well. What are the reasons for this observation?

Please mark the appropriate answer

□ The FET-project emerged from a precursor project funded by another sponsor.

□ The FET-project is part of a larger research programme where other sponsors are also involved additionally.

□ The FET-project is about a topic which was funded funded by several sponsors in parallel.

□ The FET-project is the precursor to follow-up projects funded by other sponsors.

□ The situation is different, rather the following applies ...

□ The multiple funding does not apply to our FET-project.

□ Don't know

Project impact

11 What was the most remarkable scientific or technological outcome of the FET-project for you? Was a portion of this outcome unplanned?

please specify

12 Have you or other researchers in the project consortium received any scientific awards for their results of the FET-related research?

Please mark the appropriate answer.

□ Yes

□ No, not yet.

□ Don't know

13 Have you or have any of the project partners applied for one or more patents based on the results of the FET-research?

Please mark the appropriate answer.

□ Yes

□ No, not that I know of

14 Did you receive an ERC grant anytime after the FET project? How did or does the ERC project relate to the FET project?

Please mark the appropriate question.

□ Yes, but no relation to the FET project.

□ Yes, it continues or deepens the FET project.

□ No, I did not receive an ERC grant

Follow-up activities

15 Concerning project-related publications: Have you or your project partners published project-related results (in journals or proceedings) in cooperation with

Please mark the appropriate answer.

□ partners in academia not originally involved in the FET project

□ partners in industry not originally involved in the FET project

□ other partners not originally involved in the FET project, namely ...

□ only with partners of the FET consortium

□ Don't know

16 Did you or other participants in your FET project found a spin-off company based on outcomes of the project?

Please mark the appropriate answer

□ Yes

□ No, not that I know of

17 Communicating FET results to industry: Did you or any of your project partners ...

Please mark the appropriate answer

□ present FET results at a conference with participants from industry?

□ get any phone call or e-mails from companies or offers for cooperation in the FET context?

□ have any other contacts with industry? Please specify :

□ No contacts to industry that I know of.

18 Did your FET project trigger other research activities like new proposals or projects?

Please mark the appropriate answer

□ No

□ Yes

19 If yes, did it trigger ...

Please mark appropriate answer

□ EU research framework proposals (FP7, H2020)?

□ proposals to national funders?

□ Other, please specify

Societal impact

20 If you critically reflect on the outputs of your project: Apart from scientific and technological impacts, did your project trigger any social or political changes (for example new kinds of user support, change of medical guidelines, new computer security guidelines and regulation, etc.)?

Multiple answers are possible

□ No

□ Yes

□ Yes, it triggered social or political changes in the field(s) of health, food, energy, transport, climate change, inclusion, security (Grand Challenges of the EU).

□ Other, please specify

21 Concerning your career as researcher, participating in a FET project ...

□ was a good thing, because it supported my career or had other positive effects like ...

□ was not an experience which I would recommend to other researchers, because ...

□ was neither good nor bad for my scientific career, but helped me to ...

You have reached the end of the survey.
By clicking the next buttom your personalised link to the questionaire will be deactivated.
Please submit your completed questionnaire by clicking on "continue".
Thank you for your valuable contribution.

Annex 2: Indicators covered by the survey

Project families (lead: AIT)	Project families analysis: Number of FET projects which triggered other research proposals (bibliometrics and survey) 327
Online-survey asking FET project coordinators (lead: ISI)	Off-mainstream research ideas: Number of FET projects that were rejected before by other funding institutions 3012
	Outstanding excellence: Major scientific awards received for FET-related research 3014
	Novel combination of approaches: Novel composition of the interdisciplinary consortia 3015
	New research avenues for established researchers: Number of researchers pursuing new research directions 3016
	Novelty of outcome: Answers of researchers about the novelty of their results 3017
	Economic relevance of FET project results: patent applications which relate to concepts developed in FET projects 326
	Community building II: Dissemination of a new ideas and the genesis of new scientific communities (see also bibliometrics) 324
	Dissemination of FET ideas into industry: number of publications that are co-authored by researchers from industrial R&D not involved in the original FET project (see also bibliometrics) 325

	Communicating FET results to industry: Number of contributions to proceedings of conferences with industry involvement (see also bibliometrics) 328
	Industrial relevance: contacts from industry & cooperation with companies 329
	Number of researchers expecting career impact of FET projects (FET-participants) 332

Source: D 3, p. 31f. In addition, the survey covered a question on spin-offs and an question concerning possible social impacts (see questionnaire)