PROJECT COMMIT/

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A bottom up program perspective on the five COMMIT/ Pillars

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Commissioned by COMMIT/

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Project COMMIT/ gives an overview of the results of COMMIT/. It takes the form of 160 two-page end-reports resulting from the COMMIT/Projects. They are in electronic form as an addendum to the report in paper to make them better accessible. The paper cover report was written by Tjerk de Greef on invitation of the Board and independent from them summarising the results of COMMIT/ bottom up.

We wish you a happy journey!

The COMMIT/Board

Introduction

As a general-purpose technology, ICT plays a vital role in society. Scientific research, technology transfer and development often go hand-in-hand and lead to an unprecedented commercial and societal success. In many cases the commercial and societal successes have had their roots in university labs.

COMMIT/ is the national program for ICT-Science in a public-private setting, which has run from 2011 to 2017 in the Netherlands. Although not started as such, as 'Big Data' were not in vogue at the time, it turned out to be a big-data project. The research of COMMIT/ is best covered by what is termed Big Data today. COMMIT/ focuses on the elements central in data science (see Figure 1, taken from the application in 2011).

For the backbone of future data handling, the COMMIT/Program took on ad-hoc infrastructure as one of its central themes to manage increasingly heavy computational requirements. Then, with more and more data on the input side, there is a growing need in the systems of the future to manage and to master the data explosion. And, as humans are on the output side, a deeper understanding is needed to be able to deal with tall these data in human understandable insights: human level semantic computing.

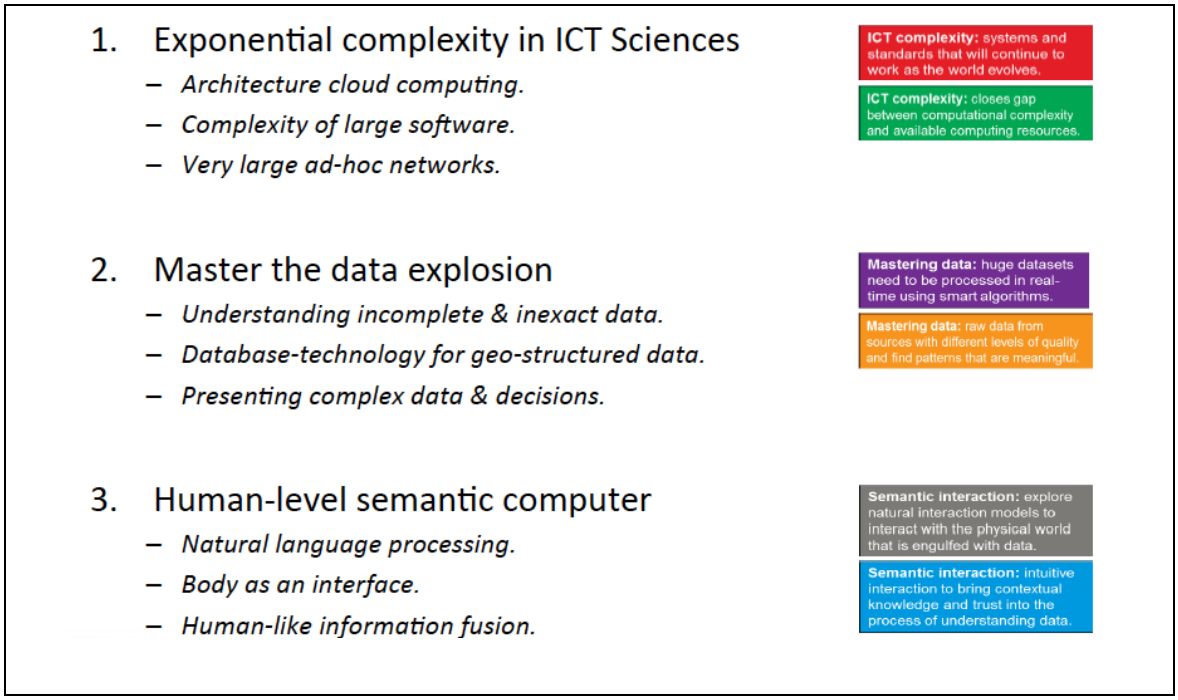

Figure 1 – COMMIT/ focuses on these elements central in data science

Along a different dimension, COMMIT/ does not stop at research. COMMIT/ took up the challenge to improve the transfer between public and private parties on ICT-research questions and results. The COMMIT/Program's goal was to stimulate the ICT-Science community to open the channel to the outside world to let inspiration for research or inspiration for business flow either way.

The connection between ICT-Science and societal and commercial inspiration is achieved by active collaboration at the work-floor. Active steering of the program aimed to achieve both top-level research in ICT-Science *and* well connected to the societal and commercial reality.

Five pillars have been formulated, functioning as the five pillars of the COMMIT/Program. They are:

Pillar 1 - ICT-Science
Pillar 2 - Valorisation
Pillar 3 - Dissemination
Pillar 4 - Internationalisation
Pillar 5 - Synergy

This report explores the achievements along each of these five axes from a sample of 103 workpackage end-reports out of a total of 171 The workpackage leaders of the COMMIT/Program have written two-page end-reports. This bottom-up view was compiled independently of the COMMIT/Office and the COMMIT/Board. The top-down view of COMMIT/ is available in the COMMIT/ the program report written by the COMMIT/Board.

Motivation to participate

At the start of COMMIT/, all workpackages were required to seek inspiration from the societal or commercial parties by active collaborating around the *worktable*. Such a form of active collaboration requested from ICT-scientists to consider real problems in real potential applications beyond the scientific challenge. And at the same time, the worktable-concept allowed societal or commercial parties to absorb the possibilities and limitations, if possible the early adaptation of the research as it is developing.

In preparation for this report, COMMIT/ commercial partners have been asked to spell out the motivation to participate in COMMIT/ in a one-liner. *Figure 2* shows the word cloud generated from these statements indicative for the most frequent words used in these statements. The figure shows that the motivation to participate mostly was based on the shared interest to collaborate (with academia), to research and to develop a solution, a service, a product or a shared technology.

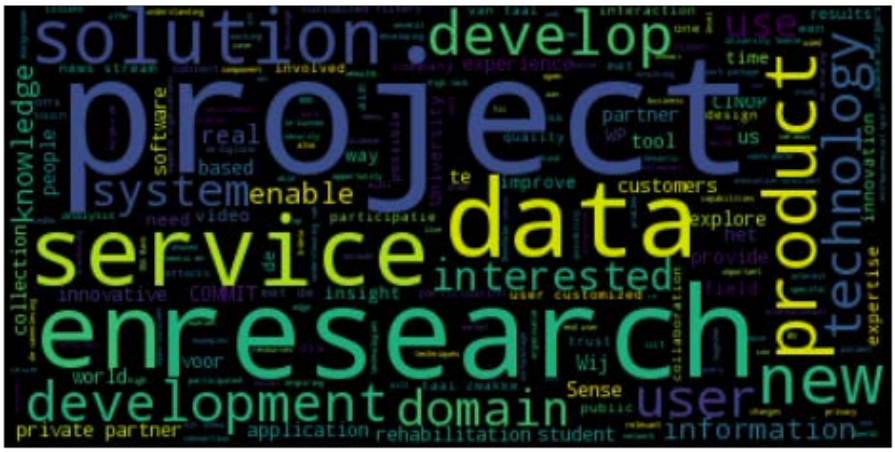

Figure 2 – Word cloud based on the motivational statements of commercial partners

Motivational statements frequently express the following:

- '*…..not have the time, nor the funds to do all kind of 'out of the box' R&D*'
- '*This was a great opportunity to collaborate in an international cross cultural environment to build and leverage on each other's domain expertise.*'
- *'Enabled us – in collaboration with the other partners – to develop innovative solutions & possibility contribute with a multidisciplinary consortium on innovative solutions*'

The statements clearly show that the motivation of private partners to participate in COMMIT/ lies in filling the gap between the company and the frontiers of what is possible. By requiring workpackages to collaborate at the worktable, a significant impact for both parties has been achieved.

Conclusion

The concept of a worktable thus works very well in public-private partnerships for research: starting from the science and moving forward in a direction discussed at a round table, exploring and collaborative building is a successful approach.

Pillar 1 – ICT-Science

The COMMIT/Program starts from the idea that high-quality ICT-Science is an enabler to dissemination, valorisation and further scientific collaboration with novel partners. Good science is international, no matter what, as it is focused on publications submitted to the best knowledgeable person on the planet. Whether in journals or at conferences, always an active debate is sought on the validity, the generality and the robustness of academic idea.

As COMMIT/ is a data science project covering a broad range of topics, it is clear that the projects in COMMIT/ have different levels of scientific production. They adhere to the publishing style of the respective subfields of computer science they operate in. System-oriented research typically produces smaller amounts of papers than data interpretation projects do.

This COMMIT/ report takes several views when considering the scientific component of the program. Science results have been ordered into 6 categories where a higher level (presumably) signifies a higher order potential or impact. The science output is also measured by the production: the number of contributions to conferences and journals. And, science is measured by the qualities of the scientists involved by their career citation pattern (to which the h-index is the most often used standard).

Measuring science by classification

All workpackages have been evaluated on their scientific contribution by classifying their scientific impact into one of 6 levels. A higher level is considered a higher impact. At the highest level, level 6, the ICT-Science received an award indicative for peer appreciation and likely future science impact. Level 5 describes that ICT-Science complemented with a prototype to demonstrate the scientific innovation. Level 4 requires publications in journals or the delivery of a PhD thesis. Level 3 describes publication at international conferences, workshops or contribution in scientific books. At level 2, scientific work is related to the generation of a dataset, which is open for the community to use. And the lowest level is reports of scientific activity in general.

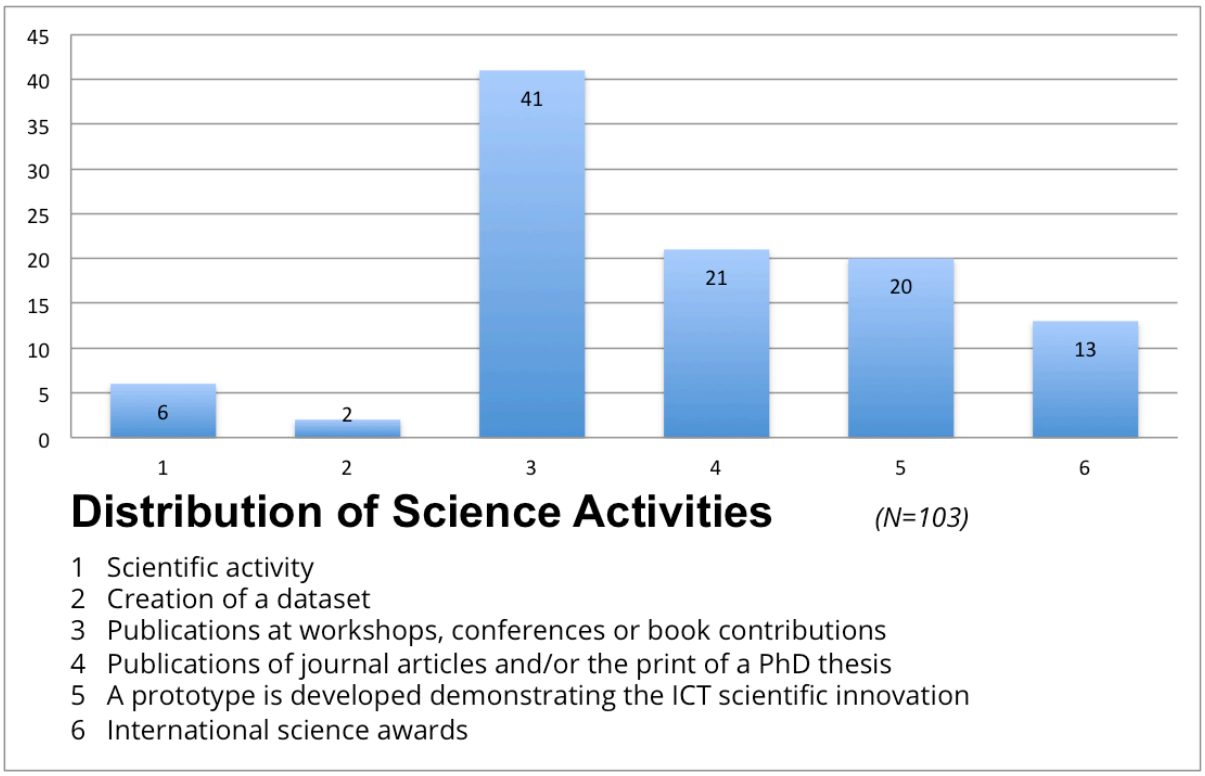

Figure 3 – Distribution of science reports over workpackages.

The 103 end-reports are classified in Figure 3. The most frequent contributions are at conferences, 41 in total, followed by 21 workpackages reports in journals. In addition to these more or less traditional accomplishments, the COMMIT/ funded work also yields prototypes, which is rarely a requirement in other science programs. Likewise, there is great international appreciation for COMMIT/ researchers since at least 13 workpackages report international appreciation via awards. A list of scientific international awards given to COMMIT/ researchers is in Table 1.

When looking at these data, the COMMIT/Program delivered significant scientific output with more than enough potential to achieve impact on the short term and on the long term. COMMIT/ yielded significant effect at conferences and journals. In addition, the list of awards demonstrates a high international standard, far beyond what can be expected from a country of the size of the Netherlands.

Intermezzo

'COMMIT/ heeft voor mij een snelle start mogelijk gemaakt in de wereld van data rond sport en bewegen. Dit heeft de kiem gelegd voor het nationale Sport Data Center,' Joost Kok

Table 1 - List of awards to COMMIT/ funded researchers

Awards COMMIT/				
Individual Achievements				
2014	P19	SIGMOD Edgar F. Codd Innovations Award	Martin Kersten	Most prestigious prize for researchers who made innovative and significant contributions to DB-systems and DB's
2014	P20	Euro-Par Achievement Award, Porto, Portugal, 2014	Henri Bal	In appreciation of outstanding and sustained contrib. to parallel processing NLs and beyond & work on the DAS infrastructure.
2014	P20	Honorable mention for Christiaan Huygens Award	Jacopo Urbani	Researcher that has made a innovative contribution to science
2015	P02	Dutch Prize for ICT Research 2014	Birna van Riemsdijk	Young, promising researcher in innovative research / responsible for a scientific breakthrough in ICT
Best Journal Papers				
2012	P06	IEEE Transactions on Multimedia Prize Paper Award	Xirong Li, Cees Snoek, and Marcel Worring	Article "Learning Social Tag Relevance by Neighbor Voting"
Best Conference Papers				
2012	P06	Best Paper Award at the ACM Recommender System Conference	M. Larson & A. Hanjalic	" CLiMF: Learning to Maximize Reciprocal Rank with Collaborative Less-is-More Filtering"
2013	P01	Best paper award European Conference on Information Retrieval (ECIR'13)	M.-H. Peetz and M. de Rijke.	"Cognitive Temporal Document Priors"
2013	P01	Best paper award at the 5th International Conference on Social Informatics (Japan '13)	Daan Odijk, Bjorn Burscher, Rens Vliegenthart, Maarten de Rijke	Automatic Thematic Content Analysis: Finding Frames in News
2013	P02	Best Paper Award 4th IEEE International CogInfoCom 2013	op den Akker, H.J.A. & Bruijnes, M.	"The Recognition of Acted Interpersonal Stance in Police Interrogations"
2013	P19	2nd place with Norvig Web Data Science Award	Hannes Mühleisen	"Babel 2012 - Web Language Connections"
2014	P06	Best paper award in ACM International Conference on Multimedia 2014	Amirhossein Habibian, Thomas Mensink, Cees Snoek	"VideoStory: A New Multimedia Embedding for Few-Example Recognition and Translation of Events"
2014	P07	John Wiley Best JASIST Paper award 2014	Suzan Verberne, Saskia Koldijk, Eduard Hoenkamp and Wessel Kraaij	"The paper Reliability and Validity of Query Intent Assessments"
2015	P01	Best paper award Soc Info 2013	Daan Odijk, Björn Burscher, Rens Vliegenthart and Maarten de Rijke	"Automatic Thematic Content Analysis: Finding Frames in News"
2014	P08	Best paper award 11th MobiWis, Barcelona 2014	Paul Havinga, Hans Scholten	"Online Change Detection for Energy-Efficient Mobile Crowdsensing"
Other "Best Products" International				
2012	P23	Open Science Award at ECML/PKDD 2013	Gerben de Vries	"A Fast Approximation of the Weisfeiler-Lehman Graph Kernel for RDF Data" and website
2012	P06	ACM SIGMM best phd thesis award	Xirong Li	"Content-based visual search learned from social media"
2013	P19	Best poster video at IDA 2013	Roel Bertens	The above mentioned video won the prize for the best PhD poster video at IDA 2013.
2014	P12	Best demo award at the BNAIC conference in Nijmegen	Steffen Michels, Marina Velikova, Bas Huijbrechts, Peter Novak, Jesper Hoeksma, Roeland Scheepens, Jan Laarhuis, and André Bonhof	"Enhancing operational work in maritime safety-and-security tasks"
2014	P24	NVMS Award Flash Presentation	Ron M. A. Heeren	"Combined mass spectrometry and multivariate data analysis image accumulation of fatty acids in the hindbrain of mouse models with impaired peroxisomal oxidation"
2014	P15	Best Student Paper Award DBSec 2014	Sokratis Vavilis, Milan Petkovic, Nicola Zannone	"Data Leakage Quantification"
2013	P07	Neelie Kroes has awarded prizes to eHealth SMEs eHealth Week 2013 in Dublin	Sense Observation Systems	"Goalie", a context-aware, personal health assistant to improve cognitive behavioural therapy for mental care
International Competitions				
2013	P06	RECVID Workshop 2013 in Gaithersburg, USA	WP01	Winning approach Semantic Indexing in Videos with No Annotation task
2013	P01 / P19	MSM2013 challenge, 1st 1500$ prize	TimeTrails (Zhemin and Maurice) & Infiniti (Mena)	Novel method (two-step method) for extracting the named entities over tweets
2013	P01	2nd position for visual classification International PASCAL VOC challange	Collaboration University of Amsterdam, Barcelona& Trento	n.v.t.
2013	P20	Winner SCALE challenge at CCGrid 2014	Alexandru Iosup	Scaling Complex Big Data Workflows
2012	P01	3rd position for object detection International PASCAL VOC challange	Collaboration University of Amsterdam, Barcelona& Trento	n.v.t.
Best "Local" Products				
2013	P04	NGI Informatie Scriptieprijs (5000 euro) Koninklijke Hollandsche Maatschappij der Wetenschappen	Arne Hillebrand	Hillebrand ontwikkelde een succesvol algoritme ter ondersteuning van realistische simulaties van groepen mensen in een bepaalde ruimte of omgeving
2013	P01	ICT.OPEN 2013 3rd Prize Poster Award	Sezer Karaoglu	"Con-Text : Text Detection Using Background Connectivity for Fine-Grained Object Classification"
2013	P08	Award for best imaging presentation at ASCI.Open 2013	Francesco Comaschi	"RASW: a Run-time Adaptive Sliding Window to Improve Viola-Jones Object Detection"
2015	P01	Best student Project Award 4th ESWC Summer School, 2014, Greece	Kim Schouten	Outstanding contribution to group project work
2015	P04	Best Flash Presentation ICT.OPEN 2015	Roland Geraerts	Towards Believable Crowds: A Generic Multi-Level Framework for Agent Navigation
2015	P04	Best Poster Award ICT.OPEN 2015	Roland Geraerts	Towards Believable Crowds: A Generic Multi-Level Framework for Agent Navigation
2015	P19	Best demo award at ICT Open Conference 2015	Hannes Mühleisen	"Rapidly visualizing Wikipedia page views"
2012	P20	2012 Most Promising Young Researcher award of the VU Network Institute	Jacopo Urbani	n.v.t.

Measuring science by volume

The number of papers (i.e., volume) is a clear indicator of science activity. Producing a journal or a conference publication is a condition to participate in the scientific debate. Writing one simply cannot do without in science.

Intermezzo

Where volume is a necessary condition, by itself it does not indicate quality. Given an extensive debate about indicators of scientific quality, it is observed that single choice will be without controversy. As one of 3 indicators, volume itself is considered a relevant indicator since it follows the approach of science quality as measured in relation to personal grants (e.g. ERC, VENI/VIDI/VICI) and national research evaluations.

The COMMIT/Program has funded some 75 full-period PhD-students and 25 postdocs supplemented with problem owners, engineers and senior research staff to reach well over 200 fte's over 4 years. The standard for a PhDs and postdocs is 4 papers over the full period including staff and engineering support. Given the 100 junior staff, 400 papers can be considered a healthy volume.

Publications in computer science are focused mostly on conferences as the short turn-around of conference contributions matches better with the rapid developments in computer science. To illustrate, the only conference in the Google top-100 list of science sources is a computer science conference. Journals serve to document consolidated knowledge and typically require at least a year and a half before actual publication.

Given the expected 400 publications, in reality the output of COMMIT/ is far bigger. COMMIT/ produced some 50 journal and 50 conference publications per quarter, totalling to the number of 2330 publications covering the 4th quarter of 2011 up to the first quarter of 2017.

For the COMMIT/Program, the volume is gratifying. It shows a more than solid output for a program even when taking its size into account. The actual volume of output surpasses the expectation almost by a factor 6.

Measuring science by measuring the quality of scientists

In addition to measuring science by the volume, the Hirsch index - commonly known as the h-index - is another good indicator of science quality. The h-index is the person-specific number of papers each of which has been cited at least h-times. As the h-index favours older scientists over younger (the h-index can only increase with age), the h-index is to be related for academic age. The start date of a PhD is taken as a reference point, and the cites are derived from Google Scholar.

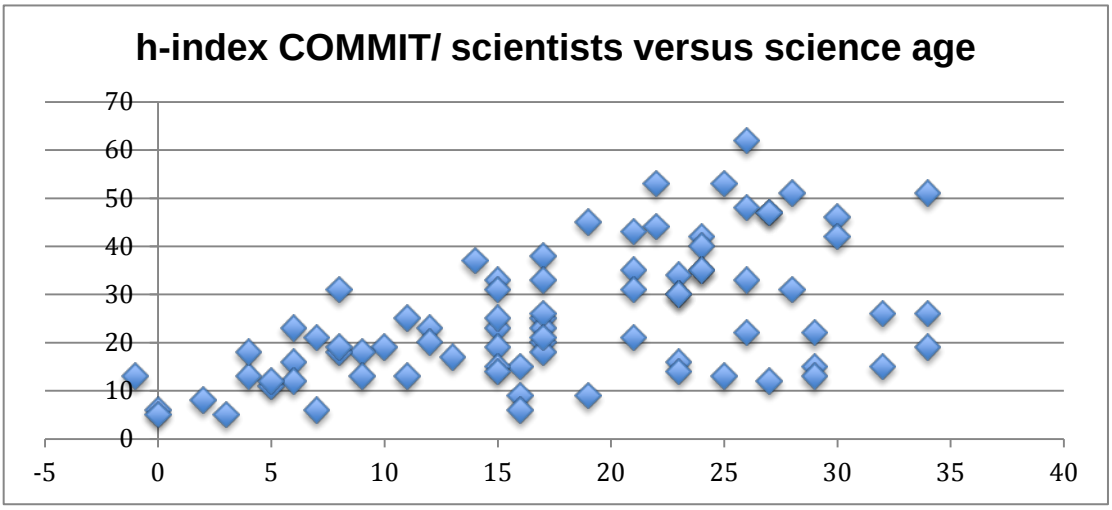

Figure 4 – the h-index of COMMIT/ funded ICT-scientists

Figure 4 shows the h-index for COMMIT/ funded researchers. The general trend is observed that older researchers have a higher h-index compared to the younger generation. Furthermore, the figure reveals that even the young generation of PhD's and postdocs achieve quite some impact since a minimal impact score of 5 applies for PhD's with an impressive ceiling with an h-index of 18. The postdoc generation peaks at 31 with an average just under 16. The COMMIT/ group performance compares favourably to the group's performance of Edinburgh's University Informatics Institute, the largest and to many the best computer science institute in Europe.

Intermezzo

Taking the PhD start-date as a reference point does not account for career- and parental breaks. However, COMMIT/ does not have this information available since this requires privacy sensitive information. As COMMIT/ is compared to Edinburgh's where the correction is missing, it is assumed that this minor imprecision does not introduce a bias.

The results indicate the high international standard and the vitality of the COMMIT/ community of scientists. These impressive h-index scores provide further support of the outstanding quality of the scientists funded through the COMMIT/Program.

Conclusion on science

The COMMIT/Program considers science a true enabler for commercial and societal innovation activities. In order to make a judgement about the quality of the science, 3 measures have been used. All measures independently report significant successes along the ICT-Science dimension, far more than can be expected from a program the size of COMMIT/. In view of these statistics, it is concluded that the COMMIT/Program was extremely successful in terms of its scientific impact.

Pillar 2 – Valorisation

Valorisation is defined as appreciation from outside academic circles. The ultimate achievement is when knowledge or technology as developed in the program somehow inspires a company or feeds a start-up. In the yearly reports COMMIT/ acknowledges that '*… valorisation has a good variety of definitions, from adding visible value to research to the ultimate test as a commercial product in the market*'. More importantly, the COMMIT/Program rightfully asserts valorisation is hard to predict, but by all means active stimulation will improve the chance on a valorisation yield.

In order to boost valorisation maximally, COMMIT/ has requested projects from the start of the program to seek inspiration from the societal or commercial partnerships it is engaged with. The request is to actively collaborate around *worktables*. The concept of worktable forces close collaboration, stimulates the building of demonstrators to show the potential value of the science, promotes dissemination, and actively seeks opinions on the value of the research. Such an active scheme of collaboration requires scientist to think beyond scientific challenges about possible applications. At the same time, it allows societal or commercial parties to adapt early in response to research developments. By starting early, ideas flow inward and outward within the consortium enhancing mutual inspiration.

The program actively promotes scientific innovation beyond the partners of the consortium by a diverse set of active valorisation programs. Halfway through the program, additional funding has been made available where proposals for valorisation could be submitted in competition over the full range of the program. On the one end the call aimed at proposals delivering COMMIT/ research to a new domain. At the other end the call supported early start-up ideas.

In COMMIT/ the program, it is written that the '*… leading principle for valorisation is that it can be encouraged, not forced.*' To explore the joint effect of the worktable and active valorisation the valorisation paragraphs in the end reports of the workpackages were evaluated as follows. At the highest level, 5, the work in the workpackage has received interest from various external parties or has led to a new start-up. Existing companies or start-ups turn a workpackage into level 4, when the end report mentions their (vital) interest. At level 3, scientific work is translated into a product with a commercial embedding. Whereas level 1 communicates the creation of a prototype, level 2 shows an active attitude to relate to the world about the science via a demonstrator. When no valorisation activities have been reported at all, the workpackage receives code 0.

The end reports of the workpackages are classified to provide an answer to the effectiveness of worktables and active valorisation. The worktable typically fits with levels 1 and 2. From level 3 and up, the valorisation is directed outward as enhanced by active valorisation. Doing so, 40 and 31 workpackages classify for level 1 and 2, respectively, implying that 69% of the work fits with the worktable including mutual inspiration. A nice example is a statement from one report: '*'When training institutes … work together with research institutes … and business in the virtual reality market ..., this could lead to ICT that meets the need for remedial social skill training*'. The levels 3 till 5 are considered as interest or an active push beyond demonstration. They add up to 30% of the program. A total of 6 workpackages are seen as the ultimate

success and 9 of them are assigned to level 4, whereby knowledge feeds into an external product of a partner or a start-up. A quote showcasing an ultimate success lies in the following statement: '*At the end of the project a spin-off company was set up for further exploitation of the interactive wall.*' 16 workpackages are considering commercial or societal exploitation by some form of business development. *Figure 5* gives an overview.

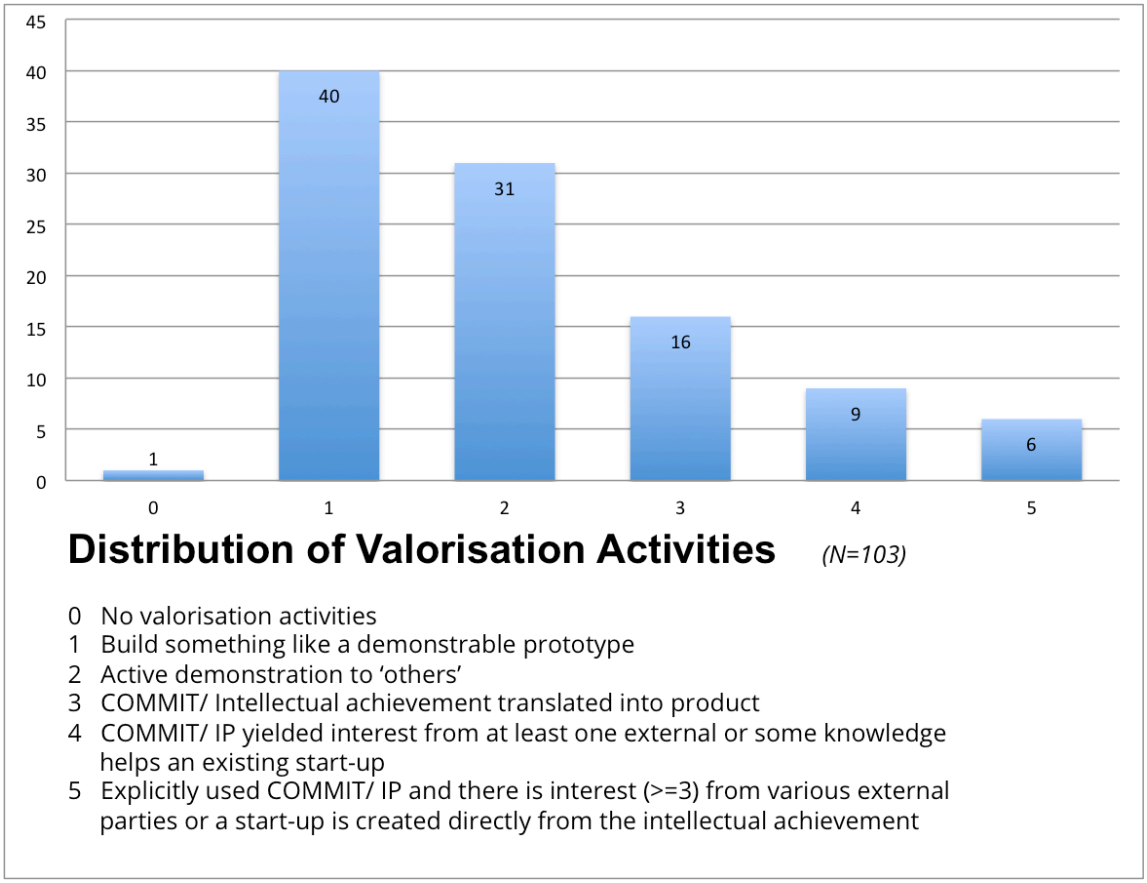

Figure 5 – Distribution of valorisation levels per workpackage

It is noted that the worktable was not easy for always and not easy for all. Some workpackages have been challenged by strategic shifts in partner's company policy, requiring active recruitment of new commercial or social partners. Other workpackages had to work hard due to a lack of commitment of some partners. This has required, at times, management skills beyond the skills of a PhD leading the workpackage.

Conclusion on valorisation

It can be concluded that valorisation within the COMMIT/Program is quite successful both for the worktable concept and the active valorisation. All worked towards demonstrable prototypes, while favouring outward thinking. The creation of a high quality demonstrator was further pushed by the midterm event, forcing all to demonstrate to a large crowd. Interestingly, some research institutes heavily explored business plans and some sought commercial help via EIT-ICT Labs. All efforts signify that collaboration leads to commercial and societal attention. Stated boldly, the COMMIT/ governance of valorisation should be used by other programs as inspiration.

Pillar 3 – Dissemination

In addition to appreciation by societal or commercial parties, spreading the story behind scientific developments is essential in a public-private program. COMMIT/ actively has stimulated such dissemination for 3 reasons. First, as in any other scientific discipline, it is crucial for researchers to explain to the general public why subsidy was needed, which effect is aimed for and when it might be effective. Secondly, as the national ICT-program, COMMIT/ raised the bar to tell a coherent story about the value of ICT-Science. In its yearly report, COMMIT/ writes: '*… One can observe that the most prominent disciplines of science have invested in the skill set to bring the message and the hidden value of science across.*' In other words, there is quite a debate about the value of ICT-Science whereas scientific funding is less a debate in other scientific disciplines. COMMIT/ believes that proper dissemination at the individual level, at the project level, and at the program level helps in showing the value of ICT-Science. Thirdly, good dissemination is a tremendous booster for an academic career. In that way it contributes to building qualified human capital. Researchers with a good story will become better visible, and in the end will be appreciated more by universities and funding agents.

Therefore, COMMIT/ has promoted dissemination during the full length of the program by training scientists in telling a good story at the yearly event. In addition, workpackages were given *so*ft dissemination targets to raise awareness for dissemination. At its midterm event, COMMIT/ recruited a scientific journalist to improve the accessibility of the project's ICT-Science question for a general audience.

In the end report, the workpackages have been asked to report the top dissemination successes, which help the program to understand the effect of dissemination. In the review of the end reports, dissemination was classified in one of 5 levels. The most successful dissemination lies in broad media attention for the COMMIT/ work. Dissemination is assigned to level 4 when there is at least 3 times attention in public media. At level 3, the workpackage has reported one public media article. Where level 1 describes a workpackage to have a media channel available, level 2 is assigned when actively pushing the story using public appearances. For completeness, level 0 is added when the workpackage failed to report any dissemination.

Figure 6 shows the distribution of dissemination over the workpackages. The figure shows that the majority has a story in the form of a website (level 1, 36%) and that actively telling the story is happening frequently (level 2, 38%). Levels 1 and 2 form the core of dissemination success (74%). COMMIT/ is also successful in terms of media attention. When looking at media attention (level 3), 19% of COMMIT got at least in a national newspaper and some workpackages received broad media attention (7% for level 4).

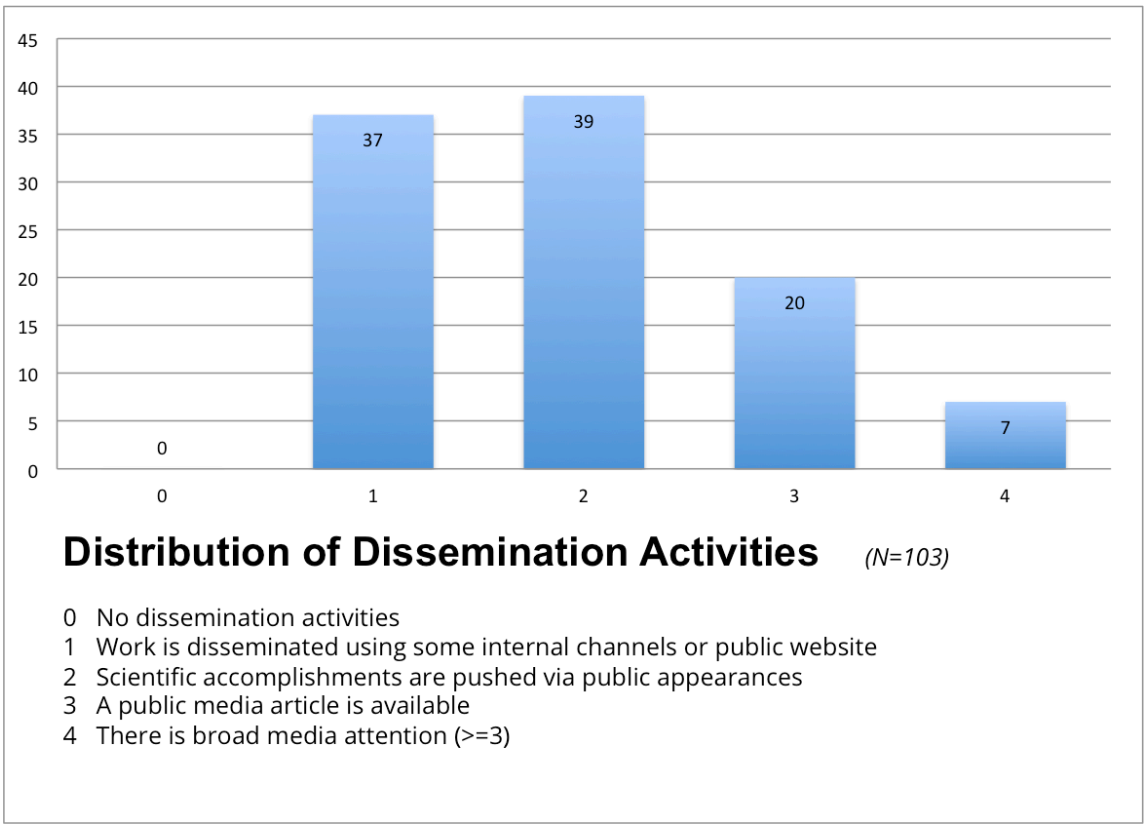

Figure 6 – Distribution of dissemination success

Conclusion on dissemination

These numbers show that the COMMIT/Program is successful on the dissemination axis. All had at least a story ready. Such storytelling is pushed by the program in training sessions for various public events alike the midterm event. The combination of training session and public events was at all levels heavily appreciated by the COMMIT/ funded researchers. Some work within the program has resulted in broad media attention in spite of the fact success cannot be planned.

Pillar 4 – Internationalisation

For science the only dimension that matters is the international dimension. Researchers present their work at international conference and publish in international journals. Therefore, internationalisation in this context does not mean to address the international character of the research as such internationalisation will automatically be the case. Rather the pillar addresses extra-ordinary accomplishments in the international scientific arena including attention of international media and international commercial parties. Similar to the pillars valorisation and dissemination, these aspects of internationalisation are hard to manage but good science and good dissemination in combination will enhance appreciation at an international level.

he paragraphs in the end reports on internationalisation have been classified into one of 5 levels. The highest appreciation, at level 4, is winning an award or delivering a keynote at an international conference or international commercial interest. International at level 3 is international media attention, appreciating the value of finding Dutch ICT-Science in international media. Level 2 addresses international collaboration with research institutes, research & development departments, within EU consortia and a like, expressing the recognition in international research as a valuable partner. Regular science publications at conferences and journals are evaluated in the pillar of ICT-Science and scored here at level 1. For completeness the list also classifies no international efforts at level 0.

Figure 7 shows the distribution of internationalisation as emerging from the end reports. For the highest category, 13 awards and 4 other significant events are accomplished: international keynotes, internships at Google and the acquisition of Euvision by Qualcomm. Research collaborations with international partners also reveal a big impact at international level: 24 end reports mention follow-on research in an international setting. The common practice of internationalisation falls within the usual strategy of publication via scientific channels (*n=61*).

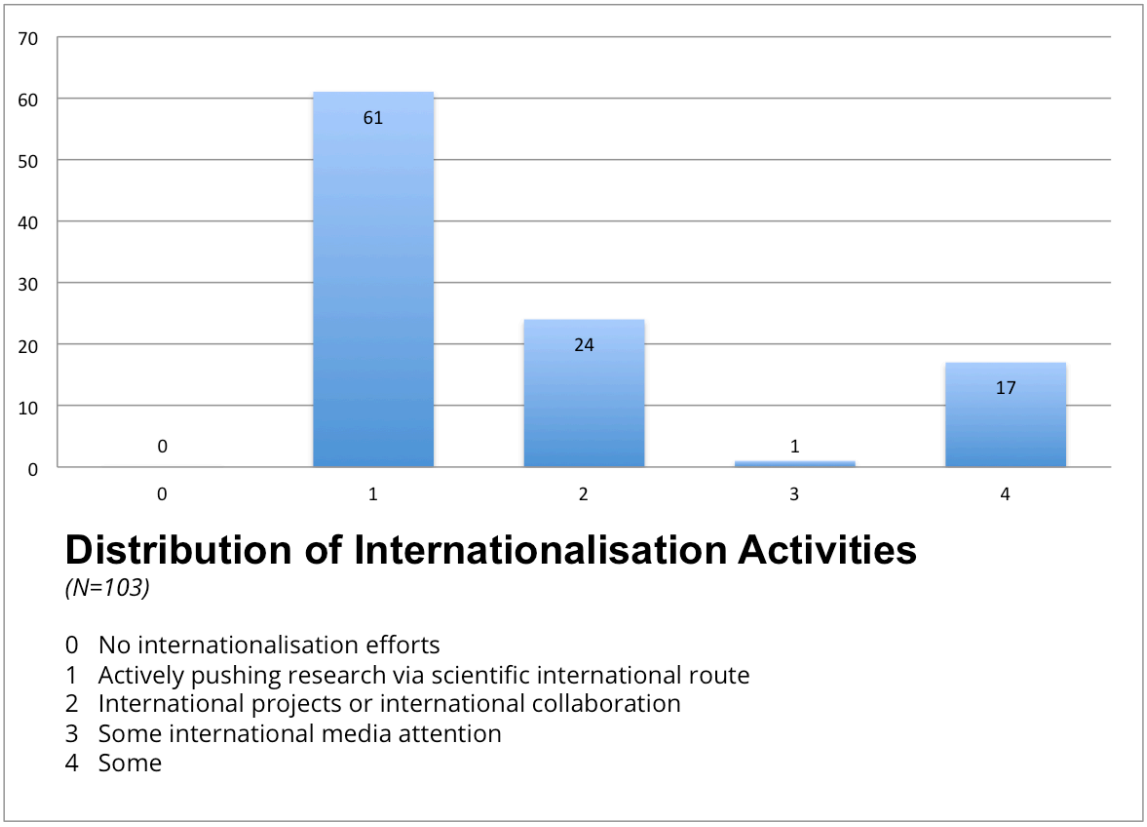

Figure 7 – Distribution of Internationalisation success

Conclusion on internationalisation

Internationalisation is hard to quantify and hard to qualify. By classifying the reports into 5 levels, the work reveals international impact. Significant impact has been accomplished via traditional scientific channels. Apart from the exceptional acquisition, a good number of awards, COMMIT/ funded research also demonstrates impact by a substantial amount of follow-on EU or US-research collaborations and a broad group of keynotes.

Pillar 5 – Synergy

COMMIT/ has aimed for synergy between projects, whether a joint effort in writing a shared publication or a joint effort for a new proposal or a new business initiative. COMMIT/ has invested in community building through the yearly Community Days, the worktable and the empowerment of the young generation. At a program level, these efforts are conceived as ways to boost synergy.

As before, the end reports on synergy have been sorted in levels. At the highest level 4, explicit synergy is described with more than one COMMIT/Projects. Level 3 was awarded for collaboration with one COMMIT/Project. Level 2 describes that work leading to collaboration with another organisation. Level 1 describes synergy between workpackages in the same project. And at the lowest level, no synergy is reported.

In *Figure 8* it can be observed that of 103 end reports, 8 of them describe a collaborative effort with multiple COMMIT/Projects and 14 report collaboration with one other project. Combined, this shows 21% of the workpackages have collaborated with at least one other project. Moreover, quite a few workpackages report synergy within their organisation. A good example is the spin-off in the e-Salse project of the Netherlands eScience Center with the client-modelling group. Likewise, quite a few reports mention intra-project collaboration at level 1, adding up to 49% of the total. A majority of the workpackages, 51%, does not report synergy activity.

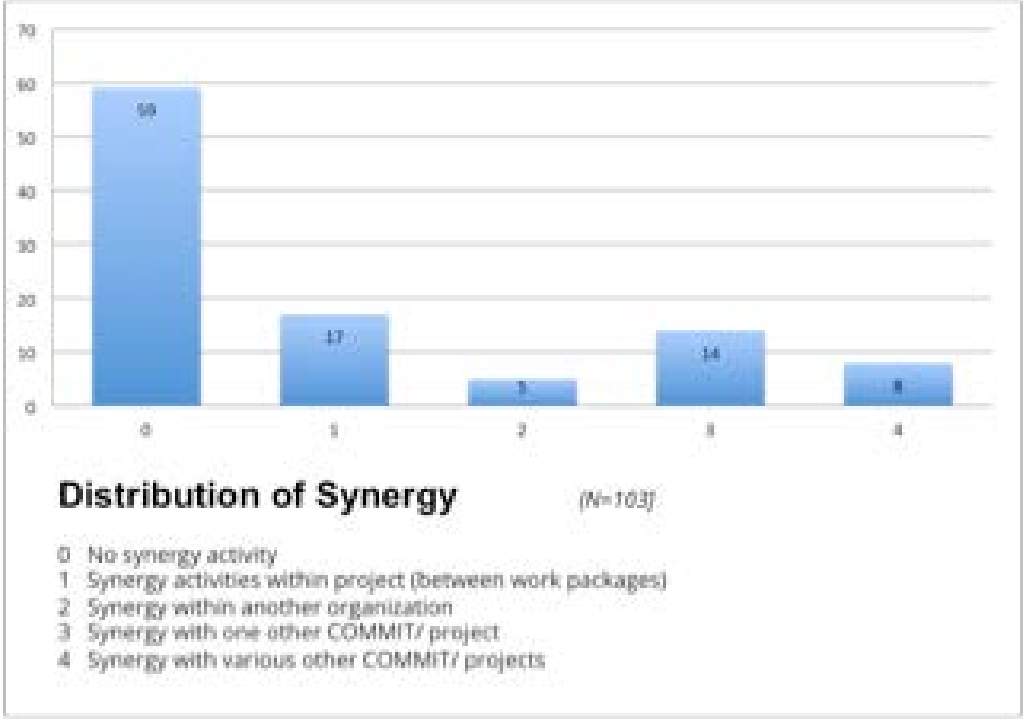

Figure 8 – Distribution of synergy

The COMMIT/Board pushed heavily on synergy via community building. This has yielded an active exchange. The development of a golden demo in preparation for the midterm event also significantly has amplified synergy between workpackages within one project and between projects. In addition, but rarely mentioned in the end reports, using the power of the community to improve the story of science is a clear example of synergy at the program level.

Conclusion on synergy

The results reveal that collaboration does happen but not necessarily within COMMIT/. Of course collaboration for one project may be as intense or an instrumental as it is for others. Sometimes synergy is mentioned as the motivational driver to participate, or collaboration emerges as a driver for NWO-funded follow on projects.

Conclusion

As a program working at the foundations of data science, ICT-Science is seen as a general-purpose technology driving the economy while playing a central role in society. As a program, COMMIT/ sees science, technology transfer and development as the necessary steps preceding commercial and societal success. This is the reason why the program does not only focus on excellent ICT-Science, but also aims to enhance knowledge transfer between public and private parties. Where the goal of the COMMIT/Program was to stimulate the ICT-Science community to make a move from behind the walls of academia and into society, it aimed to reach use-inspiration for the research form societal and commercial parties by active collaboration.

The program was managed along five pillars:

1. ICT-Science
2. Valorisation
3. Dissemination
4. Internationalisation
5. Synergy

End reports of 103 workpackages have been used to assess the effect of the program from a bottom-up perspective.

To enhance knowledge transfer, a strong emphasis in the program had been on active collaboration around the worktable, since it induces close collaborations between its members around the table. The worktable demands the scientist to explain the research in terms of possible application, while at the same time societal or commercial parties may pick up ideas to adapt to research developments. The motivational statements of the (non)profit partners clearly show that the worktable concept is valid. All are motivated by the collaboration when there is something concrete at the horizon: research as a solution, a service, a product or a shared technology. The worktable concept is a proper method of steering public-private partnerships since starting with science and moving forward leads to successful outcomes.

High quality ICT-Science is an enabler for dissemination, valorisation and (international) collaboration. The science quality was reviewed using 4 metrics:

- General classification
- Publication volume
- Quality of scientist

A general conclusion is that each of these metrics individually demonstrates the success beyond expectation. For example, the list of awards demonstrates high international standards of research. Also, the volume surpasses expectation by a factor 6. Likewise, the individual h-index scores are impressive, signifying an outstanding impact of the scientists funded in the COMMIT/Program. When looking at these statistics, it can be concluded that the COMMIT/Program was quite victorious in terms of scientific impact.

The program promotes scientific innovation beyond the consortium by a diversity of active valorisation programs. At the start of the program, active steering around worktables helped to bootstrap public-private collaboration. At half time, new funding, set aside at the start, was available in competition for valorisation proposals. Valorisation around the worktable summed up to the majority of the collaborative inspiration. The remaining part is achieved at the end and beyond the existing consortium as supported by the valorisation projects of the program. This is illustrated by the following quote: '*At the end of the project a spin-off company was set up for further exploitation of the interactive wall.*' Based on these observations it is concluded that valorisation successfully achieved impact at the worktable and via valorisation projects.

Dissemination implies spreading the story behind scientific developments to a general audience. The COMMIT/Program actively stimulates dissemination to be transparent on the spending of public money, to tell a coherent story on the value of ICT-Science, and to develop human capital thus improving professional career options. In the review of the end reports, many scientists were found to excel in telling their science story. All had at least one story ready in many cases stimulated by the program management in their organisation of public events. Some of work in the program has resulted in broad media attention whereas others were less successful. This may be due to the fact that some parts of ICT-Science are hard to explain in general. Having a good story ready whenever an occasion occurs is a true enabler for successful dissemination.

Managing the international component of success is hard, as is measuring it. COMMIT/ is interested in internationalisation via the common route of science via publications. At the same time, COMMIT/ also aims and has achieved at reaching international media, winning international awards, delivering keynotes at conferences, and engaging in research collaborations. In that sense, internationalisation was not about commercial impact as it is hard to quantify directly, but rather on telling the story as an essential first step.

The last pillar of COMMIT/ is accomplishing synergy between and within projects, whether it will be a joint effort in writing a shared publication, a joint proposal or a joint business initiative. Building through Community Days and the empowerment of the young generation significantly have enhanced synergy. The review of the end reports reveals that collaboration happens but not necessarily within COMMIT/. Of course not all projects are quite as intense in terms of collaboration given their nature. Nevertheless, the level of synergy outperformed many NWO-funded projects proving the value of program management on the topic.

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Printer:
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