Measuring social and economic impact: dead ends and new departures

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Outline

- First a brief summary of the current debate on social and economic impact: what it means, why it has gained so much importance, how difficult it is to implement in an ex-ante fashion?
- Second, how can impact insights be helpful in the design and management of the new notion of mission-oriented research and innovation policy?
- Third, and as most radical reflection, how can we use the advent of big data analytic techniques to develop new digital tools making impact more transparent and making the science and research community less dependent on short term political choices?

1. When I was young

In the old days, we used so-called “tires” presentations to try to vizualise impact ex-post of particular technological trajectories...

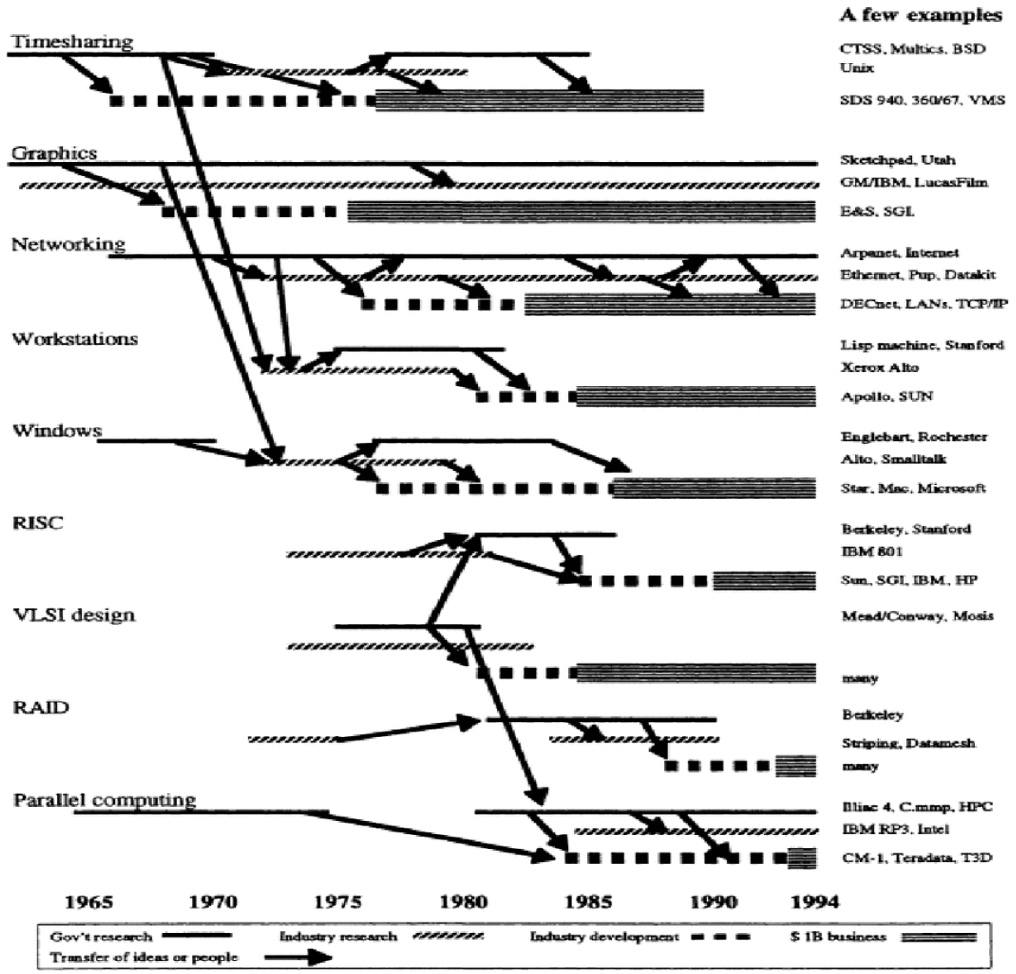
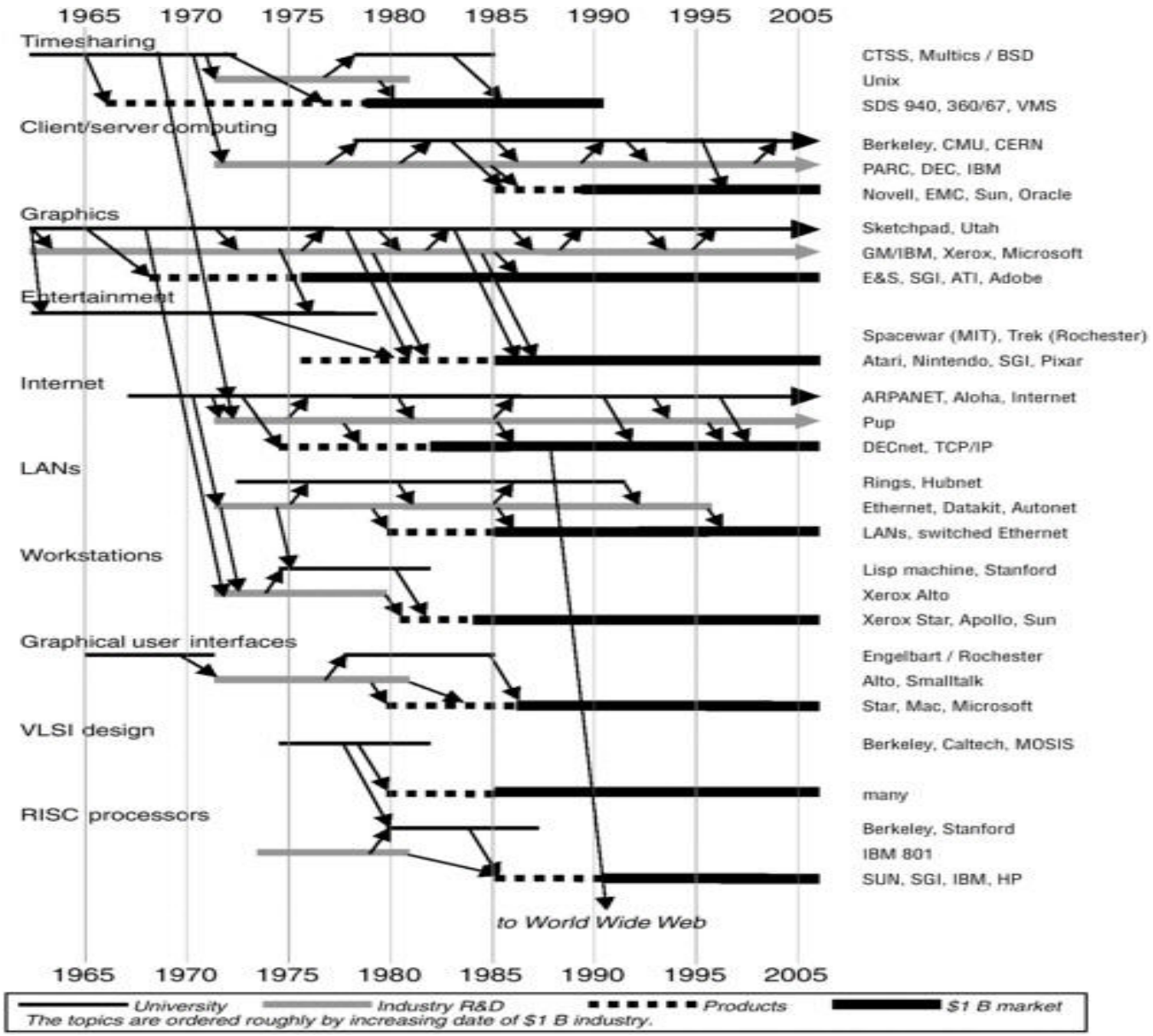


FIGURE 1.2 Government-sponsored computing research and development stimulates creation of innovative ideas and industries. Dates apply to horizontal bars, but not to arrows showing transfer of ideas and people. Table 1.1 is a companion to this figure.

It lead to various notions and classifications of technologies based on their impact: Incremental, radical, pervasive, transformative or general purpose. I spent most of my early career days trying to measure those different impacts based on new and old indicators…



The debate today: defining impact

- Social or societal impact is a particularly broad concept.
- In the recent Dutch KNAW report on “Charting impact”, impact has been limited to the contribution made by research and innovation to changes in sectors and challenges facing society. Sectors could include the economy, culture, public administration, and healthcare, while the challenges include broad issues such as climate change, immigration, quality of life, the environment, the rule of law, and security.
- That might seem pretty broad but actually doesn’t include two crucial areas of impact: the impact on science itself (remember: “standing on the shoulders of giants”) and the educational impact (delivering year after years new graduates). These can only be measured at the micro-level: e.g. the case of a particular brake-through scientific invention or of a university/research lab. The well known “starmetrics” project from Julia Lane and Paula Stephan are attempts to do this.
- We tried to do something similar for Maastricht University but were confronted with major lack of data.

More policy interest in impact

- Driven in countries where public research funding has come under political pressure (the UK, US, Australia, the Netherlands) as need for accountability on the part of the research system and for justifying public investments in research (tax payer's interest).
- Politically there is, however, also an increasing desire to influence the direction of research, particularly given the urgent societal challenges but also as a result of more regional "smart" specialisation.
- Question remains whether projects can be selected on the basis of their likely impact. To what extent is ex ante impact assessment an oxymoron.

Three levels of impact

1. Output: the most direct results of a study, often apparent in the relatively short term.
   Example: research publications, prototypes, patents, procedures

2. Outcome: the medium-term results, often a clear relationship with the objective of the research project/program.
   Example: increase in the vaccination level of children in a country.

3. Societal impact*:* means the effect in the long term.
   Example: reduced infant mortality.

Ex-post impact assessment

1. Econometric studies determine the economic effects of, *e.g.* research universities and universities of applied sciences as a whole.
2. The case-based approach to assess what the societal impact has been of *individual* research projects/programs.
3. Societal impact/relevance as a component of research evaluation is increasingly one of the aspects assessed with a great deal of information being gathered about *utilization* of the knowledge generated.
4. Process-oriented methods clarify the course of the *pathway* leading from the research to its impact on society. These methods focus not on the nature and extent of the societal impact itself but on the process leading to it (*e.g.* the involvement of the networks).

KNAW report on ex-post impact assessment

Increase the use of the ex-post evaluation information

VSNU, KNAW, NWO, VH, TO2

- *Make the narratives produced within the framework of the evaluations of universities, institutes, etc. easily accessible to a wide audience. Consider whether the evaluation committees' societal relevance assessment can also be linked to those narratives.*

OCW

- *Commission one or more institutions to produce a comprehensive report on the societal impact of research in the Netherlands, and have it updated after a number of years. This report must be designed in such a way that it not only provides a snapshot but, specifically, can identify changes over time. It should to a large extent make use of the information already available such as narratives from evaluations, annual reports, project/program reports.*

Advice on ex-ante impact assessment

Focus ex-ante evaluation not on determining societal impact itself but on the factors and processes that increase the likelihood of such an impact.

- *Continue along the planned path of requiring applicants for research funding to consider how their proposed research can have an impact on society, and what action is needed for that to be achieved. E.g. this can involve asking for impact pathways to be specified. Ensure that they do not become static documents but rather a means for promoting utilization by society. This will also require enabling researchers to devote time and attention to the necessary activities.*
- *When assessing and evaluating researchers, take explicit into account the performance and efforts aimed at achieving an impact on society.*

NWO

Learn from ex-post impact assessment

Utilise ex-post experience to increase the societal impact of future projects.

- *Investigate what relationships and environmental factors encourage the societal impact of research, and utilize the understanding achieved to further improve policies for promoting societal impact.*
- *Do not link measurement of the societal impact of research to research funding, given that doing so will create undesirable incentives to maximize the value of these indicators. Measuring these indicators will not, generally speaking, lead to an increase in the impact on society.*

OCW

2. Impact and missions

- Such learning from ex-post impact assessment will be particularly useful in developing and designing the proposed “mission-oriented research and innovation policies” which have been debated more recently at the EC level. The central question here is whether it is possible to organize efficiently research & innovation *around a technology related mission or a set of overarching goals*.
- This also open the door for *technological areas where technology already exists* but is relatively unexplored and has great potential for improvement; and is capable of solving *friction on markets for ideas and technologies* in sectors where the path from idea to impact is particularly difficult such as many of the “wicked problems” missions are supposed to address.
- The two sides of the mission-oriented policy consist of a mission-oriented innovation policy approach and a mission-oriented research approach.
- The core principle consists of being non-neutral in selecting missions, aiming at impact, while being relatively neutral vis-à-vis specific applications.

How to organize a mission-oriented innovation policy

- Conceptually, a MOP supposes an ability to deploy a fully articulated plan that moves backward from the expected social results to the required technology development.
- The role of demand as materialized in end-use will thus be crucial. End-users refer here to both consumers and professional users. The literature on the social dimensions of technology, on human-machine interaction, and on user-experience and interaction design has shown how the adoption and use of technology is dependent on social processes of legitimation, practice, learning and intimacy. An approach based on top down, or technology push models of innovation makes little sense. It explains why the research supply push in addressing societal challenges has been poor in both output and impact.
- However, with respect to "missions", there is no "demand" in an economic sense but only a "need", often a latent need: "*Accessing users is painful, slow and expensive… the ability of users to articulate their needs verbally is quite limited, so many traditional social science research tools are of limited help, not to say deliberative procedures.*"

How to organize a mission-oriented research policy

- The core difficulty will be how to deal with the increase over time in technological uncertainty. Over the deployment of a mission programme, new technologies will make old choices obsolete and earlier commitments resembling a waste of money and time. Under current research and innovation policy, once expenditure has been committed, it becomes extremely difficult to make forward-looking decisions, and ignore the sunk costs. Escalating commitment will be the typical outcome, leading to huge cost increases.
- Scientific experiment proceeds through reverse engineering of nature, so that artificial manipulation and experimental observation cannot be separated. Under these conditions, new hypotheses are continuously generated in scientific laboratories, and many technological options are consequently opened…
- Technological uncertainty magnifies a peculiar problem in mission-led policies, i.e. a trade-off between long term commitment and the top down choice of the mission and the need for flexibility allowing for multiple decentralized bottom-up experiments.

3. Big data and impact

- Ultimately the societal impact of research and innovation involves a large set of different activities, involving a diversity of interactions in various ways with both short term results (outcomes) and longer term effects (impacts). Many of these features are today captured in digitally collected indicators. On their own (publications, impact factors, R&D, patents, innovation counts, etc.) these only describe one facet of the research and innovation system and fail to describe its full functioning.
- Hence the question raised back in 2016 at the OECD Blue Sky III Forum whether big data and digital technologies could not be a more useful technology for identifying at the global level, the chain of research actors in particular fields; their output and contribution to particular technologies and innovations; their location and international networking; their paid and unpaid linkages with private businesses.

Blockchain as research impact tool

- Blockchain technology appears particularly interesting when confronted with complex products whereby the value chains are based on intellectual property (IP).
- Getting at the impact of research and innovation seems an interesting application area alongside other applications for distributed ledger technologies as in the case of the music and film making industry, where distributional issues are global and trust (amongst artists, composers, movie makers, producers) is based on reputation.
- The *Harvard Business Review* conducted a couple of years ago, a research project exploring how blockchain technology could securely move and store host "money, titles, deeds, music, art, scientific discoveries, intellectual property, and even votes“ (See Tapscott, Don (2016)).

Identifying research and innovation impact

- In short: in so far as a blockchain could serve as the distributed, encrypted public trail of that part of research investments which has led to significant innovation rents that can be easily audited, the funding of a part of public research could become integrated in the economic system directly through a reallocation of those innovation rents to public research, but also as collateral for attracting more private funding in public research.
- Blockchain would also be particularly useful in areas such as “open science” and the contribution of citizen science on the one hand; and the location and recuperation of innovation rents on the other side.
- Developing a pilot project in the development of using blockchain in Public Research Organisations appears the most logical step (public investments resulting in public rents) to figure out how this could be implemented. An example to illustrate my point.

Hidden impact “benefits”: an example

- Deltaris, a Dutch Public Research Organisation set up in 2008 has a turnover of roughly €100 million a year of which the publicly funded, knowledge research base is *today* about €10 million down from €17 million in 2008. Yet the impact of the research in addressing big societal challenges is rather significant.
- In The Netherlands e.g. future flood protection taking into account sea-level rise and the changing patterns of precipitation costs roughly €1 billion every year in the protection of dikes and dunes. The country’s so-called “flood risk committee” recommended increasing all protection standards by at least a factor of ten, a rather costly step.
- Deltaris, using operations research techniques, determined that it would be efficient to limit increased standards to only three critical regions. The total costs of the study were less than €1 million. It resulted in €7.8 billion less investment costs in the coming 50 years for The Netherlands while strengthening the country’s defense against flooding.
- In most of these cases the savings realized thanks to publicly funded research, are translated into “*government funding rents*” freeing public resources to be spend on other priorities or reductions in taxation.

Conclusions

- The research community should investigate the possibilities of Blockchain as radical new impact measurement instrument.
- In an ideal world, Blockchain in research and innovation would do justice to the systemic nature of innovation and incorporate more fully citizen science and user innovation into impact measurement.
- At the same time Blockchain would also allow as FINTECH instrument better use of knowledge “intangibles“ as collateral and as “GOVTECH” instrument, provide a neutral instrument to redistribute privatized monopoly rents back to the systemic network of public collaborative science and innovation, and as a result make the public funding of research less dependent on countries’ short term budgetary priorities.

Thank you for your attention!

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