

Impact assessment of technologies

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"Without reflection, we go blindly on our way, creating more unintended consequences, and failing to achieve anything useful".... Margaret J. Wheatley

Recent days, public investment in development efforts has expanded and hence thought has focused on assessing to what extent such investments are contributing towards development goals. Here comes the widely discussed topic of Impact Assessment.

What is impact assessment and what is the purpose of doing it? How can one accomplish an impact assessment? These are certain queries which are raised as societies are becoming more and more technology reliant and better innovations to result in economic and social benefits.

Impact Assessment

Impact can be described as consequences of an action that affects people's lives in areas that matter to them. The arising outcomes would not have occurred without the original action. But all consequences need not be assessed and it is to be done based on the importance of it. Impact Assessment is a process of measuring the effectiveness of organisational activities or that of a programme or project and judging the significance of changes brought about by those. It is a marriage of Art and Science. Impact assessment is undertaken based on the intended outcomes of the implementing agency and also considering the expectations of the stakeholders for whom it is implemented.

Impact can be of different forms. It does not have to be intended always. Undesired impacts and indirect impacts can also be there, which also are of importance to the implementing agencies. Another impediment is that to study the final consequences of a programme or an organisation, we have to make sure that the consequences are ending, and final, which the assessing agency cannot judge. As far as a research organisation is considered, the scientific as well as societal consequences. But in the case of a project being implemented, the societal consequences are more targeted with different dimensions like social economic, environmental etc. In societal angle, the expectations can be in the form of better products, more employment, improved services, better opportunities, healthier lives, leading to a sustainable development? In other words, impact on society takes in every important aspect/ concern of the society.

Outputs and outcomes in the context of impact assessment

Sometimes, there is an overlapping in the usage of the terms outputs, outcomes and impacts of research, all of which are after effects of an action. Immediate results like income generated, no of stakeholders benefitted, publications, discoveries; patents are normally seen as outputs. These outputs can become outcomes: for example, outputs evolve into policy guidelines, improved competence and product development. In some research impact assessments there are other terms besides outputs and outcomes,

but the logic remains consistent. Impact is then described as increased employment, improved health and/or wellbeing and increased productivity and reduced waste.

The nature of impact is already mentioned. Impact can roughly be divided into scientific and societal. Societal impact in turn can be divided into several categories (see below, for example, European Commission 2010; Delanghe and Teirlinck 2010).

- Scientific impact: contribution to the subsequent progress of knowledge, the formation of disciplines, training and capacity building
- Technological impact: contribution to the creation of product, process and service
- Economic impact: contribution to the sale price of products, a firm's costs and revenues, (Micro level) and economic returns either through economic growth or productivity growth (macro level).
- Social impact: contribution to community welfare, quality of life, behaviour, practices and activities of people and groups.
- Political impact: contribution to how policy makers act and how policies are constructed and to political stability.
- Environmental impact: contribution to the management of the environment, for example,
- Natural resources, environmental pollution, climate and meteorology. Health impact: contribution to public health, life expectancy, prevention of illnesses and quality of life.
- Cultural impact: contribution to understanding of ideas and reality, values and beliefs.
- Training impacts: contribution to curricula, pedagogical tools, qualifications.

All of these forms of impact may be interesting to investigate, but what forms of impact that are assessed do also affect what methods that are the most appropriate.

While looking into the impact made by technologies, we should first think of the system generating the technologies. The research organisations in public as well as private sector develop different technologies intended to extend certain benefits to the users. Publicly funded research has a responsibility to contribute something in return to society. In such occasions, Impact studies are used as a tool to document and show these returns. It may indirectly give a direction to the future research investments and drawing research goals. In necessary occasions it can help the system for re-routing the research efforts to derive better outcomes for the changing social context.

Also, impact studies can strengthen returns to science and society by improving the instruments that are used to fund research. In this instance they may also provide a better understanding of transfer of scientific knowledge into practice. Impact studies provide decision makers with required information and facts on the efficiency with which public funds are allocated and the productivity of these investments.

Direct Impacts:

Direct impacts occur through direct interaction of an activity with an environmental, social, or economic component. For example, an effluent discharge from a fish processing industry into a river may lead to a decline in water quality in terms of high biological oxygen demand (BOD) or dissolved oxygen (DO) or rise of water toxins.

Indirect Impacts:

Indirect impacts on the environment are these which are not a direct result of the project, often produced away from a complex impact pathway. The indirect impacts are also known as secondary or even third level impacts.

For example, as mentioned in above example, when effluent discharge affects water quality, it will in turn, lead to a secondary indirect impact on aquatic flora in that water body and may further cause reduction in fish population. As a third level of impact, due to reduction in fishing harvests, income of fishermen will be affected negatively.

Types of evaluation

Ex-ante evaluations

Ex ante evaluations are forward looking assessments and serve as a tool for decision makers to assess potential impacts of research investments, to help in priority setting and to assist, more generally, in making strategic decisions. Under this approach, expected impact of investments is assessed. This approach requires detailed information on the expected impacts of the new intervention, existing issues and expectations of the technology developing team.

Impact evaluations

Impact evaluations conducted to test the effectiveness and impact of technologies delivered to society by R&D agencies and also programs (or institutional innovations) that promote the adoption of research outputs to end users.

These types of assessments mainly address two types of questions—how to design 'interventions' to increase the adoption of technology so as to increase the impact of investments in R4D? And, what are the impacts of development projects or technologies released that promote the adoption of agricultural technology to end users?

Ex-post impact assessments

Ex-post impact assessments involve evaluating the magnitude and scale of economic and social impacts resulting from the adoption of research outputs (i.e., technologies, practices, institutional innovations). As implied by its name, these types of assessments take place after the evidence of wider adoption of technology.

In the case of agricultural technologies, conducting ex post impact assessments comprise of assessing the impacts of research by using an implicit step-wise process. This process involves tracing the results along the impact pathway from research to outputs, to outcomes and to impacts. The step from research outputs to outcomes involves estimating two key parameters—the size of the adoption of a research output (as measured by production units or social units such as individuals or households) and the average effect size, which measures the effect of a research output per unit of adoption compared with a counterfactual. The step from outcomes to impacts involves using models (such as economic surplus, social accounting matrices or computable general equilibrium) that take into account the equilibrium effects of scaling up the estimated effects per unit of adoption over time and space.

Over last several decades, this approach has seen the application of a diversity of methods to evaluate the impacts depending on the time frame when the assessments are conducted in the lifecycle of the adoption of a technology, the level of aggregation and focus of the analysis, and the type of evaluation questions addressed.

Most widely used approaches in ex post impact assessment of Research and Development are based on partial equilibrium economic surplus model as pioneered by Schultz (1953) and Griliches (1958) in the 1950s, and later modified and adapted by Akino and Hayami (1975) in the 1970s. Overall impact is measured by measuring impacts in terms of total monetary benefits accruing to the society at large and comparing them with total research costs. The results are then expressed as Net Present Value (NPV),

Internal Rates of Return (IRR) or benefit-cost ratio (BCR) to research investments. Impact assessments based on this benefit-cost analysis framework have traditionally focused on assessing the payoffs to investments in R4D. Unlike the traditional economic surplus modelling approach, a combination of a micro–macro approach utilizing sector-level, Social Accounting Matrices (SAM), and Computable General Equilibrium (CGE) analyses a comprehensive assessment of the benefits from a technology intervention.

References

1. <http://www.ucd.ie/research/portal/impact/ucdimpactcasestudies/>
2. European Science Foundation (ESF) classification of impact.