Accountability of Innovation

A literature review, framework and guidelines to strengthen accountability of organisations engaged in technological innovation

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Technological advances in fields such as health care, food security and clean energy offer vital solutions to the chronic problems facing human society today. Innovation is a key element of progress and improvement in the quality of life of people across the world. Yet since the Second World War there has been a significant change in the understanding of how technological innovation happens, and how technological innovation in different sectors can be improved.

Literature and practice reveals in particular a growing awareness of the need when innovating to take into account a wider group of stakeholders, including the users, as well as a range of social, economic and cultural factors. It is vital therefore to be much more widely accountable and responsive.

This paper synthesises some of the most important lessons learned arising from this new understanding of innovation, and provides a framework of accountability for organisations engaged in technological research and development. The guidelines focus on supporting organisations to become more effective, while simultaneously ensuring that they adhere to ethical standards in their innovation.

Working towards principles of accountability in the innovation process including engagement with external stakeholders, evaluation, and communicating with them, helps to ensure their ongoing cooperation, acceptance and productive use of often complex technological and scientific innovations beyond the narrow group of experts.

Starting from a literature review, the paper presents a set of guidelines which are designed to assist a research manager reflect on their accountability. It provides options and principles, rooted in the literature, which can help them address the processes and consider organisational change.

The briefing paper is accordingly split into three main parts. The first articulates a theory of accountability, distinguishing between accountability which serves an ethical purpose and accountability which makes an organisation more effective. The second covers the literature addressing the new understanding of innovation, and analyses it for the relevance to accountability. The third part offers a set of guidelines, structured around distinct processes common to most organisations – strategic planning, project identification and design, conducting the research, and then concluding the research process.

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1. Introduction[1]

Our understanding of how technological research and development (R&D) processes work has evolved considerably since the end of the Second World War. This paper analyses the implications of that change for the accountability of actors involved in innovation and R&D work. The paper's scope is limited to the accountability mechanisms and responsibilities of one particular sort of actor: an organisation conducting technological research and development. It is mainly concerned with actors in the public and non-profit sector, although many of the principles will be valid for (and indeed, have been drawn from) the private sector.

The paper therefore seeks to bring together two distinct sets of concepts: one, the new understanding of technological innovation processes, and the second, ideas of accountability. Both have implications for the manner in which an organisation interacts with society. Thus the literature on innovation processes increasingly recognises that the processes are complex, systemic and contingent – abstract terms whose import in this context is explained in Part 3 below. Following on this insight, organisations are recommended to build relations in a particular way – to work through networks and form links, to ensure flexibility in processes, to maintain feedback loops, and to draw on the wider system of actors. The literature argues that following these precepts will make an organisation more effective.

Second, the notion of 'accountability' encompasses all the mechanisms by which society holds an actor to account. It is therefore about regulating the way actors engage with society

[1] The authors are grateful for comments received from external reviewers in particular Prof. Benoît Godin, INRS (Montreal, Canada), and the ongoing support from the International development Research Council of Canada (IDRC) for this work.

in which they exist through defining minimum ethical standards for our actions and the mechanisms by which we are held to account. An alternative interpretation of accountability focuses not on the ethical dimensions of being held to account, but rather on the need to be sensitive and responsive to the interests of various elements of stakeholders, in order to ensure their ongoing cooperation (the "instrumental" interpretation of accountability).

Part 2 of the paper defines in more detail what is meant by accountability, and what in particular accountability might mean for an organisation conducting technological research. In particular, we will use the instrumental interpretation of accountability which focuses on the need to interact with stakeholders to become more effective, rather than accountability focused on ethical responsibilities (the "normative definition"). The instrumental definition allows us to bridge the two areas of literature, and to analyse in Part 3 the implications for accountability of the evolving understanding of innovation processes. It prescribes particular ways of interaction, which will help an organisation become more effective. Part 4 concludes by drawing the threads together, showing that the prescriptions from both an understanding of accountability and drawing out briefly some additional normative considerations which form underlying ethical minimum standards.

2. 'Instrumental' and 'normative' motivations for accountability: being better and more ethical

2.1 Instrumental and normative motivations

The traditional or 'core' (Mulgan 2000) definition of accountability is normative in nature. It signifies the mechanisms used to hold an organisation to account for respecting – or failing to respect – ethical responsibilities. For example, the law courts will hold one to account for failing to respect the laws of the road, an ethical responsibility linked to the legitimacy of the law-giver. The mechanism for holding to account is the court system. Alternatively, consider the ethical code that governs good conduct of a clinical trial, which is enforced by ethics boards and which constitutes the primary accountability mechanism. Interestingly, the individuals centrally concerned – the participants in the clinical trial – may have limited roles in actually holding to account. In the absence of formal mechanisms, in sectors such as international development, there has been a drive for organisations to create their own formal mechanisms and processes by which they allow their stakeholders to hold them to account.

A second interpretation of accountability, derived from corporate stakeholder analysis, argues that an organisation should be accountable because that will increase its effectiveness and ability to deliver on its aims. This is the 'instrumental' justification (Donaldson and Preston 1995).2 It argues that an organisation should take into account those actors whose cooperation is important to the success of the organisation – the organisations' 'stakeholders'. Consider the following example: a non-governmental organisation (NGO) with an expertise in designing machinery in the horticultural sector signs a contract with an international donor.

The contract specifies that the organisation will design and build a new type of fruit-drier, which will be cheap, easy to repair and will not require that the raisins are left out in the open, where they may become covered in dust. From a normative perspective, the organisation will be held to account by the donor for the terms in the contract. This contract forms a normative bond. However, the organisation will have further reasons to do what it can to meet the donors' expectations even beyond the terms of the contract: pleasing the donor

[2] A third understanding of accountability, understood as 'accounting' or 'measuring' the outputs given a certain input, will not be addressed here. See, however, Godin 2005.

may lead to further contracts. The motivation for taking stakeholders' views into account may therefore go beyond the mere letter and term of the contract.

Normative accountability is a responsibility enforced through a mechanism which holds the organisation to account. Therefore:

Normative accountability = responsibility + mechanism

Key responsibilities for which an organisation should be accountable:

Express commitments: express commitments such as contracts:

- contracts with donors, funders, clients;
- partnerships and cooperation agreements.

Implied commitments: an organisation may also create responsibilities by implied commitment:

- through the mission claims to be working to benefit or work on behalf of a group
- claims to objectivity, quality, public benefit etc.

Ethical standards: normative systems may create ethical responsibilities

- Applicable legal norms;
- Established ethical practices, including research ethics.

Defining a mechanism: If there is no external mechanism to hold to account (such as the legal system or an ethics board) the organisation should create its own mechanism. This would have regard to the following four principles:

Participation: Co-definition of the content of the responsibility by those effected – whether a contract or the application in a specific context of a broader ethical

Evaluation: Evaluation of the activities to see if the organisation has met its responsibilities

Transparency: Transparent and active communication of the responsibility, the results of an evaluation, and any other relevant information.

Complaints handling: a process in place to ensure that the stakeholders to whom a responsibility is owed can complain, and can seek/obtain adequate

The donor, however, is not the only stakeholder in our raisin-drier example. Consider the farmers with whom the NGO is working to perfect the drier's design. They form a second stakeholder group.

While there will be ethical rules underpinning that collaborative work – treat the farmers with respect, inform them of what one is doing, provide feedback on the conclusions of the work and so on – as we will see in Part 3 there are also strong instrumental reasons to take the

farmers' interests into account. These instrumental reasons exist in parallel with ethical responsibilities, such as for example, to act respectfully, to provide feedback on outputs and acknowledge their contribution. Ethical and instrumental concerns therefore accompany each other. This leads us to the next point.

2.2 Differences between the instrumental and normative

While the normative and instrumental drivers for accountability will often accompany each other, they affect organisations' decision-making in quite different ways. Each is founded on different grounds, has different content, and implies different types of sanction. Thus while a normative accountability relationship constitutes an ethical responsibility underpinned by a mechanism to hold to account – and may prescribe the creation of such a mechanism, should it not already exist (Blagescu et al 2005) – instrumental accountability demands taking views into account and balancing these views against other priorities. Consider the following statement of accountability from the instrumental perspective:

> "Accountability is the processes through which an organisation makes a commitment to respond to and balance the needs of stakeholders in its decision-making processes and activities, and delivers against this commitment (ibid, 20).

In other words, 'instrumental accountability' is driven by the need to keep the relevant stakeholder content and cooperative – through responsiveness to the stakeholder's needs. When compared with the normative responsibility, there are several consequences for the nature of accountability. Some of these are outlined in Table 1. The impetus to keep a stakeholder content is determined by the extent to which that stakeholder's cooperation is important. It is, therefore, a function of power – under this view a donor or client holding the long-term financial sustainability of an organisation in its hands may find itself more attentively treated than the farmers of the second stakeholder group, even though they may be the interests the organisation claims to follow.

A second point is to note is the potential diversity of stakeholders. Traditional corporate theory pictured the management of a private company as primarily involving accountability to its shareholders and owners, and responsiveness to a wider group which included employees, suppliers and customers. However, the "stakeholder" theory developed initially by Freeman (1984), suggested that managers should consider a much wider range of relevant "stakeholders".

Table 1.	**Normative Accountability**	**Instrumental accountability or "responsiveness"**
Ground for accountability	Accountability for an ethical responsibility or obligation	Being responsive/accountable will make the organisation more effective and more able to achieve its goals
Absolute v. relative	Usually a minimum standard of behaviour which – unless presented by a moral dilemma – should all be respected	Instrumental concerns balanced against others – any one may be overcome by more powerful countervailing concern.
Nature of Sanction	Mechanism for holding to account and sanctions offered	Withdrawal of cooperation by stakeholder, with attendant consequences
Ex post and ex ante	'Hold to account': after the event enforcement	'Take into account': ensure views are considered from the beginning

For Freeman, a stakeholder was “any group or individual who can affect or is affected by the achievement of the organisation’s objectives” (1984, 46). Impact is the criterion for defining an organisation’s stakeholders, and as a criterion it is simply too broad to be useful.

Accordingly, in Part 3, we review the literature to identify the stakeholders to whom an organisation engaged in R&D should be responsive. We also identify the appropriate ways in which an organisation can structure its internal processes in order to build this responsiveness. To do this, the paper draws implications from the evolving understanding of innovation processes to understand better the stakeholders to whom an organisation involved in technological R&D must be responsive. Prescriptions drawn from this literature are couched in language of increased effectiveness and best practices for innovation – in other words, in instrumental language, directed towards the organisations conducting R&D activities.

3. Accountability and innovating in a complex context

Innovation is no longer considered to be a linear process whereby an idea is conceived, developed in a laboratory or workshop and then brought into the world. It is now widely understood as a complex, contingent and systemic process, involving the interaction of a wide range of actors and the influence of external social, political and economic factors leading to an often unpredictable outcome with unpredictable implications. To understand innovation, it is useful to think of it as distinct from invention (Fagerberg 2005, 4). Invention is the arrival of an idea for a new product or process. Innovation is invention carried out to use; either for commerce or public consumption. Often there is a considerable time lag between the making of an invention (the formation of an idea) and its translation into an innovation. This time lag is a result of the process required to turn an idea into a useable product. Innovation is this process, and it encapsulates both the external conditions which drive and influence the usability of an innovation and the interaction of actors involved in developing an innovation.

3.1 The embedded nature of innovation

Innovation is not merely a result of success in developing a new product, by overcoming technological problems. It also requires the conditions to succeed in the marketplace, be it a commercial marketplace or for public uptake. These conditions include user demand, economic feasibility (i.e. it must be cost effective) and investment in infrastructure to support or deliver the innovation. Thus Mowery and Rosenberg (1998) point out that many important innovations, such as the automobile, were dependent on major public and private investment, as well as innovations, in infrastructure (roads, wiring, systems to distribute fuel, for example) and major changes in the process of production and distribution. These examples illustrate that the context matters.

The embedded and contingent nature of innovation has led many theorists of innovation to describe it as a system. While innovation began to be conceptualized as systemic in the early 1900s, the literature on innovation systems did not take off until the 1980s. Today, it is widely accepted and used in academic and policy contexts (Edquist 2005, 185). An ‘Innovation Systems’ perspective captures “all important economic, social, political, organizational, institutional and other factors that influence the development, diffusion and use of innovations” (Edquist 2005, 183). The system perspective of innovation has important implications. As Fagerberg writes, “Systems are –as networks– a set of activities (or actors) that are interlinked, and this leads naturally to a focus on the working of the linkages of the system. Is the potential for communication and interaction through existing linkages sufficiently exploited?” (Fagerberg 2005, 13). Innovators should think not only about the technical aspects of innovation, but also the external conditions and actors enabling the

usability of a technology. These social, economic and political forces upon which innovation is contingent are what Kline and Rosenberg call “sociotechnical systems” (Kline and Rosenberg 1986, 278).

LESSONS TEXTBOX: Lessons for accountability

Wide range of stakeholders: An organisation engaged in research and innovation must ‘take into account’ or be accountable to a network or networks of diverse stakeholders.

- ⇨ *Take **users** into account: if successful innovation depends on user demand, there must be space for communication between users and manufacturers. The technological problems being overcome must be overcome. Gibbons et al characterise this as “knowledge production in the context of application” in their New Production of Knowledge (1994).*
- ⇨ *React to **actors important for delivery**: If an innovation is dependent on investment in public innovation, it will be important for the manufacturing firm to establish links with the public or private sector. What delivery requirements exist?*
- ⇨ ***Other innovators** (see 2.3 below): Innovation is a continuous process of building on existing innovations and is therefore dependent on complementary innovations and inventions (Fagerberg 2005, 5).*

Research processes: The need to react to surrounding context is a characteristic ‘permeates the whole knowledge production process’ and ‘is reflected not only in interpretation and diffusion of results but also in the definition of problem and the setting of research priorities’ (Gibbons et al 1994, 7).

- ⇨ *Taking the views of a broad system of external actors into account is therefore vital throughout the research process from the definition of problems to their prioritisation through to the development and testing of solutions.*

3.2 Stakeholder network profiles contingent on sector

As suggested by the heavily context dependent and contingent nature of innovation systems, there is no single stakeholder ‘profile’ for all research organisations. The industry will be one important factor, amongst many others. Some industries will be highly scientific and will demand that a research organisation interact closely with universities. Others will require closer work with the private sector, or perhaps with users.

A taxonomy developed by Pavitt (1984) which focuses on the private sector differentiates four types of innovation profiles based on the industry: non-/traditional manufacturing where innovations are dominated by the supplier of equipment (e.g. textiles, services); scale-intensive industries where the focus for innovations is on improving assembly and continuous processes (e.g autos, steel); specialized suppliers (e.g. machinery and instrument makers); and science-based sectors where innovation is aimed at generating new products (e.g. pharmaceuticals, electronics). Each category implies sensitivity to different concerns (price or productivity), different sources of technology, different means of protecting and appropriating that technology and different patterns of technological diversification (summary table p.354, Pavitt 1984). For example, in the case of specialized suppliers the key sources of innovation are tacit knowledge and experience of skilled technicians (internal) and user-producer interaction (external). For science-based sectors, on the other hand, the internal R&D and

external scientific research done at universities and public research laboratories are identified as most important.

While criticised for using limited indicators (e.g. Laestadius 1998), neverthless:

> 'A rich and heterogenous tradition of sectoral studies has clearly shown both that sectors differ in terms of the knowledge base, the actors involved in innovation, the links and relationships among actors, and the relevant institutions, and that these dimension clearly matter for understanding and explaining innovation and its differences among sectors' Malerba (2006, 381)

Innovation systems are different; their drivers and patterns of innovation will differ. Within the broad framework of innovation systems, therefore, various conceptions of the role of different actors – the state, the private sector, universities – in driving innovation have been for have been formed: in the case of National Innovation Systems (Freeman 1987, Lundvall 1992, Nelson 1993) the firm was understood to be the driver; in others, it is the state (Sabato and Mackenzie 1982). In the triple helix model (Etzkowitz and Leydesdorff 2000) no single sector leads, but universities, states and private firms combine through trilateral networks and form hybrid organisations.

LESSONS TEXTBOX: Lessons for accountability

There is no single framework, no one stakeholder profile which will determine the accountability for all innovating organisations. The network of stakeholders an organisation should take into account will depend on the industry and research sector.

- ⇨ *Research organisations and innovators should conduct their own stakeholder mapping exercise, and refresh this awareness periodically.*

3.3 Expanding Sources of Innovation

Viewed from the perspective of the health of the 'innovation system' (rather than the organisation), the literature addresses the importance of diverse sources of innovation in an open system, allowing a wide net for identifying and commercializing new innovations. In the past two decades, there has been a marked move toward an increased reliance on external sources of innovation outside the corporate R&D lab; greater collaboration between actors in the innovation system (i.e. university researchers, government labs, manufacturing firms); and greater inter-organizational collaboration within an innovating organization (Powell and Grodal 2005, 57).

From the perspective of the research organisation, Chesbrough argues that the logic of closed innovation, where firms only use the ideas they come up with on their own, has been undermined by the growing mobility of highly skilled workers who take their ideas with them when they move firms, the growing levels of knowledge outside to the silo of the corporate R&D lab, the increasingly fast time to market for products and services making it imperative to develop new ideas and the growing industry of private venture capital "which specialized in creating new firms that commercialized external research and converting these firms into growing, valuable companies" (Chesbrough 2003, xxiii).

Chesbrough's theory of Open Innovation states that innovating firms should look beyond their own capacities to rely on external sources of knowledge and innovation.

> "Open innovation is a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as the firms look to advance their technology" (Chesbrough 2003, xxiv).

The idea of open innovation has taken hold in many industries, impacting the way that firms and industries are structured. Outside sources of knowledge are often critical to the innovation process, whatever the organizational level at which the innovating unit is defined. While the term "Open Innovation" is attributed to Chesbrough, he is not the first to point out the importance of looking outward for sources of innovation (Cohen and Levinthal 1990, 128).

LESSONS TEXTBOX: Lessons for accountability:

Research organisations – firms and others – should seek to identify and interact with stakeholders in such a way as to "leverage the new distributed landscape of knowledge" (Chesbrough 2003, 51).

- ⇨ *Researchers and innovators must seek to review external innovators in their field in order: "to identify, understand, select from, and connect to the wealth of available external knowledge" and "To fill in the missing pieces of knowledge not being externally developed […]" (ibid, 53) This can involve entering into specific relationships – partnerships for example - which will carry with them specific accountability consequences.*
- ⇨ *Conversely, rather than shelving unused inventions, they should exploit them by licensing them or creating spin-off ventures.*
- ⇨ *In some industries, tacit knowledge specific to the application context generated by interaction between users and producers (Pavitt 2002). Users should not be discounted as sources of innovation (see below). The tacit element of the knowledge makes is difficult to transmit over long distances or cultural divides, wherein the geographically and culturally limited regional aspect of many innovation systems (Gertler 2003; Asheim & Gertler 2005).*

This observation is supported by extensive research on the sources of innovation (e.g., Mueller, 1962; Hamberg, 1963; Myers and Marquis, 1969; Johnston and Gibbons, 1975; von Hippel 2005). Cohen and Levinthal (1990) argue that the capacity of firms to incorporate outside knowledge, their "absorptive capacity," is critical to their level of success.

User-generated innovation: Of course, as dictated by the embedded nature of research, users' needs and demands will have to be taken into account to define the nature of the problem to which an innovator is responding. They can also be, however, a source of the solution. A great deal of the most useful information is information generated 'at the coal face' – in the field of application through interaction between users and producers. In non-scientific driven sectors in particular, user-generated innovation has been shown to give rise to important advances. The discussion on user generated innovation has been driven by two people, Eric Von Hippel and Boru Douthwaite.

Von Hippel's theory on user innovation refers to innovation developed by consumers and end users rather than manufacturers. He uses empirical evidence to show that between 10 and 40 percent of users modify or develop products to fit their needs (Von Hippel 2005, 4). He argues that innovating users have the characteristics of "lead users," meaning "they are ahead of the majority of users in their populations with respect to an important market trend" (Von Hippel 2005, 4). Research shows that many of the innovations created by lead users often turn out to be commercially successful (Von Hippel 2005, 4). Furthermore, users are more often than not willing to freely reveal their innovations for public consumption. Examples of user generated innovation include the open source software, such as Linux or Apache, but extend to all kinds of industries from extreme sports to medical equipment.

Douthwaite also puts forth a model for user innovation called the learning selection approach (Douthwaite 2002). He argues that innovations that address the needs, culture and context of users are much more likely to be adopted and utilised. He also argues that users are a potentially vast pool of innovative potential. Therefore, innovators should reach out to users and identify "early adopters," or stakeholders who are amenable to learning and helping technology evolve over time.

LESSONS TEXTBOX: Lessons for accountability

Von Hippel argues that research organisations should – insofar as possible – modify their innovation processes to actively search for and incorporate user-generated innovations, as well as encouraging users to drive the identification of problems and priorities for research.

- ⇨ *Von Hippel puts forth the idea of developing toolkits for user innovation custom design.*
- ⇨ *Douthwaite notes that innovative products and processes should be structured so that early adopters are able to modify the innovation (.e. it is not too complex and difficult to understand).*
- ⇨ *He also argues that research organisations should look to incorporate iterated feedback loops (see below).*

This approach enables learning and evaluation quickly and effectively, encourages users to get behind and support a particular innovation, and will ultimately reflect the needs of end users; all conditions which are necessary for developing a successful innovation.

3.4 Internal Innovation: innovation in context of application

Not only should an organisation focus on leveraging external sources of knowledge, but *internal* sources are also important: "…the importance to innovative performance of information originating from other internal units in the firm, outside the formal innovating unit (i.e., the R&D lab), such as marketing and manufacturing, is well understood (e.g., Mansfield, 1968)" (Cohen and Levinthal 1990, 128). Internally, teams should be put together in such a way as to respond to the problem.

In their New Production of Knowledge, Gibbons et al argue that there has been a move from what they call Mode 1 research – which takes place within an isolated theoretical space derived from a single scientific field or discipline – to Mode 2 research, which is fundamentally trans-disciplinary. Mode 2 research they say involves the mobilisation of 'a range of theoretical perspectives and practical methodologies to solve problems' (Nowotny et al 2003, 186) giving rise to a final solution which "will normally be beyond that of any single contributing discipline' (Gibbons et al 1994, 5). Technological expertise is complemented by insight from the social sciences. The problem is not defined by a specific scientific discipline; consequently, neither is the solution. While

While the trend to Mode 2 research is asserted to be of general relevance,

> 'firms that specialize in different products and related technological fields are likely to stress different features of innovation processes, reflecting the nature of the fields of knowledge on which they depend.'

Similarly, context-specific tacit knowledge has been described as most relevant to industrial sectors which have a 'synthetic' knowledge base – one rooted in the context of application where knowledge is generated by using and doing (Laestadius 1998). Advances are made by modification, adaptation, and combining with other technologies.

Sectors with an 'analytic' knowledge base prioritize scientific rather than tacit user-producer cultivated knowledge as a source of innovation. Here the challenges of bridging disciplinary gaps are larger.

LESSONS TEXTBOX: Lessons for accountability

Organisations should think about how to construct their internal hierarchies to respond to research problems, priorities and objectives which will frequently require trans-disciplinary responses and organisations which can react to these responses:

- ⇨ *In constructing evaluation frameworks, success should be evaluated not in terms of scientific quality control mechanisms, such as peer review, but rather in terms of the success in responding to the problems at hand.*
- ⇨ *Structurally, organisations should be capable of reconfiguring flexible problem-solving teams in response to the complex and evolving issues which Mode 2 typically addresses – and these should not necessarily be purely 'in-house'. This will require flexible programmatic structures, reporting lines, and an ability to form accountable and transparent partnerships with external actors.*
- ⇨ *Organizations which represent sectors relying on 'analytic' and scientific sectors face a greater risk of technological stagnation and 'lock ins' if they detach themselves from global scientific knowledge pipelines (Asheim & Gertler 2005).*
- ⇨ *Technological innovation may benefit from linking with organisations conducting relevant social science research, and should consider this.*

3.5 Feedback and Learning

Fundamental to the foregoing has been the need to collect and learn from feedback received. Indeed, we have focused on the 'to whom' of accountability – the stakeholders. This section deals in more detail with the "what and how" – what recommendations does the innovation literature

Another focus in the literature is the importance of feedback and learning between actors in the innovation system. Kline and Rosenberg highlighted this in a seminal paper written in 1986. They broke down the conventional, and in their minds ill-conceived, characterisation of innovation, what they term "the linear model." This model suggested that the innovation process begins with scientific research which leads to development, then production and then marketing. One of the key concerns Kline and Rosenberg raised was the way the linear model ignored the continuous learning, or "feedback signals" (Kline and Rosenberg 1986, 277) required between each step in the innovation process to create a successful innovation suitable for end-users and responsive to market forces.

For example, research on the innovation process within large manufacturing firms determined that one of the most important factors to successful innovation is the degree to which firms fostered and enabled collaboration and feedback between product design and corporate functions such as manufacturing and marketing. Without feedback and

collaboration, many product designs were too difficult to manufacture and/or failed to take into account very basic user requirements (Forrest 1991, Rothwell 1992). As Edquist writes,

> "The SI [systems innovation] approach places innovation and learning processes at the center of focus. This emphasis on learning acknowledges that innovation is a matter of producing new knowledge or combining existing (and sometimes new) elements of knowledge in new ways" (Edquist 2005, 184).

This emphasis on learning and feedback extends to all actors in the innovation system. As the discussion on open innovation illustrates, the distribution of knowledge in the innovation system means that there is potential for learning and feedback between a wider range of actors.

Furthermore, the influence of external political, social and economic factors on innovation means that those involved in innovation will need to reach out to various external actors (i.e. policy makers, end users) for feedback and collaboration in order to succeed in developing a useable innovation. In sum, from the innovation systems perspective, a key element to successful innovation is the degree to which learning and feedback flow throughout the system.

LESSONS TEXTBOX: Lessons for accountability:

In sectors where knowledge is generated in the field of application, organisations should look to incorporate processes which interact with stakeholders through iterated feedback processes.

- ⇨ *Throughout the identification, prioritisation and design of projects, the research process and the timing of introduction into the market, research organisations should seek to generate feedback on decisions, thus ensuring that the projects meet the needs and demand of the intended users and beneficiaries.*
- ⇨ *An important aspect of this is for the research team and the framework of commitments they face to have the flexibility to make constant adjustments and improvements to a product based on user and market needs.*
- ⇨ *Communication is vital: the successful execution of the innovation process depends on each actor from innovator to end user communicating feedback to each other.*

3.6 Innovation policy and funding

Innovation policy demands that investment in research results in outcomes with practical use – although the extent to which this is a recent phenomenon is strongly disputed, with others arguing that research, whether in universities or elsewhere, has always had links to practical application of varying degrees of closeness (Godin 1998, Gibbons et al 1994). We have seen how this has been reflected in a shift in the fluid structure of research activities – the diversity in form (and frequently hybrid nature) of the organisations involved; the networks and partnerships; the move to transdisciplinary research teams working on practical applications at the coal face. Drawing on literature from authors such as Chesbrough and Von Hippel, these changes make commercial sense - although evidence suggests that in different sectors areas investment and user demand triggers innovation more swiftly that in others, where innovation stems from the 'scientific community' or supply side (Pavitt 1984).

TEXTBOX: A timeline of social priorities in research

Changes in the criteria for achieving public funding for research can have a profound impact on the accountability mechanisms organisations must adopt. These changes are part of wider fluctuations in social attitudes to research, and the linkages between universities, industry and the role of the state.

- Immediate post-WWII period: pure science was afforded a 'macro-protected space' and explicit distance was put in place between knowledge generation and the prospects for its application – the expansion of the body of scientific knowledge was the main concern;
- 1970s: In 1971 the OECD issued a landmark publication which called for greater social relevance of scientific knowledge production: 'Science, Growth and Society. A New Perspective' or the 'Brooks Report'. During the 1970s the importance of science-based technologies to national economic competitiveness – and the universities' failure of universities to contribute - was recognised. Pressure mounted to buttress the role of science as the engine of industrial performance.
- 1980s: Economic shocks sharpened the focus of policy makers on the place of scientific research in revitalizing national economic wealth. Increasingly 'strategic research' (Irvine and Martin 1984) emerged as a regime which sought to provide solutions to practical problems. Linkages between science, technology production and its diffusion and use became progressively pronounced as innovation policy sought to redesign the institutional context in order to promote innovation which could contribute to the economic recovery. These should be seen, not as a solely recent trend, but as part of an fluctuation between different
- 1990s: mounting calls were made for a 'new social contract for science', which would tackle 'the most urgent needs of society, in proportion to their importance'. Described critically as 'post-academic science', these calls have not gone unchallenged.

Sources: Gibbons et al 1994; Lubchenco 1998; Elzinga 2004; Rip 2000, 2002; Rip 2000, 32; Ziman 2000; Elzinga 2004; Lundvall & Borrás 2006

Changes in public innovation policy have influenced how research investment is to be allocated, which questions and problems are to be prioritised, how quality is to be understood and how success is to be evaluated. For organisations reliant on public funding, the range of valid options for research will be determined by donors. In some sectors that range will be more restricted than in others: and it may caused tensions between the priorities of downstream users and those of funders. The case of international funding of research in the health sector is instructive. Priorities have typically been set "through a panoramic, but selective overview of some major players" (Nuyens 2005) characterised by what the Bamako Call to Action describes as a "misalignment between funders, governments, and other organizations in relation to research for health" (article 6).

***LESSONS TEXTBOX: Lessons for accountability**:*

The support of donors is a necessary condition for a research organisation to deliver effective and relevant work – that the work meets the needs and demand of downstream users and is of a high quality is insufficient of itself. The challenge arises where the priorities of an organisation's intended beneficiaries and donors do not align. In this circumstance, a research organisation can do several things:

- *Ensure inclusive planning and strategy setting processes which can identify threats to financial security, and explicitly devise a strategy to mitigate the risks.*
- *Develop a diversified funding base where possible, perhaps including capacity-building or consultancy services to generate funds which could be channelled into the core mission of the organisation.*
- *Cultivate and manage relationships with donors, and seek through persuasion, strong evaluations, and strong evidence showing user needs and user demand.*

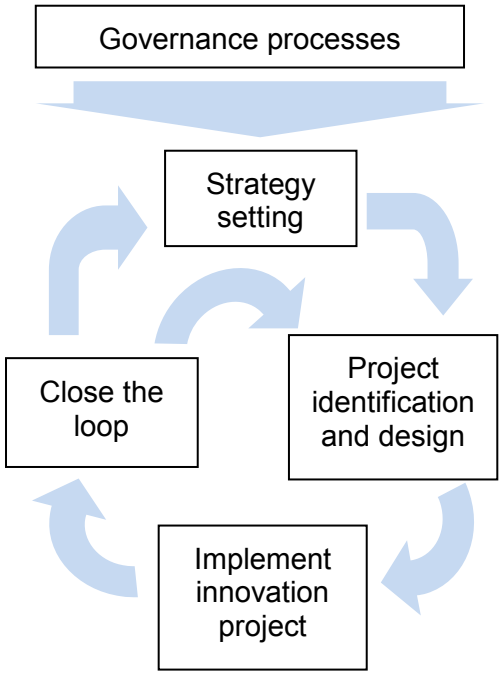
The focus of much of the investment has been on cracking the big problems: solving the 'neglected diseases' afflicting the global south. Investment in innovation has therefore been typical of what Pavitt identified as "science-based" sectors which require a huge outpouring of scientific effort, triggered by investments and few organisations have the technical capacity to engage.

Amongst research organisations working in the global south, capacity to engage at this level has in general remained low - as is the capacity to deliver products developed. Researchers have accordingly been dominated by multi-national companies, by public bodies like the TDR and increasingly progress has been made through innovation vehicles called 'public-private product development partnerships' (PDPs).

4. Accountability guidelines for innovation

If accountability is to be considered the process of taking a range of stakeholders into account and balancing their interests, then the literature on working within innovation systems offers some interesting lessons. Many of the lessons apply to innovation policy, and how at the system level networks can be created to foster innovation, but many are instructive at the level of the organisations. Before we synthesise the lessons learned in detail, it is worth drawing out two common threads from the foregoing discussion. One thread pertains to the stakeholders of a research organisations; another concerns the nature of the processes by which these stakeholders are to be engaged in an accountable way.

Processes offering opportunities for accountability



The literature recommends that innovators need to take into account the interests of a variety of stakeholders throughout the processes of an organisation engaged in scientific or technological innovation. This includes the processes of identification of problems and priorities – through strategy setting and the identification of a particular project – through implementing the project and all the way to closing the loop. Closing the loop refers to a bundle of activities, including finalising products, disseminating them, evaluating the responses and communicating results to stakeholders. Governance systems – such as advisory boards, internal project meetings and so on – exist as ongoing mechanisms for responsiveness, forming a common bond through each process. Each of these processes can be characterised by iterated feedback loops eliciting the needs, responses and knowledge of stakeholder and feeding them back into the processes.

Four principles of accountability: What does it mean in practical terms for a research organisation to be accountable to its stakeholders? From the foregoing, it is possible to identify several key ideas which should inform how an organisation conducts its research:

- *Participation:* participation concerns the way in which the organisation involves stakeholders in its decision-making processes and activities and gives them a voice

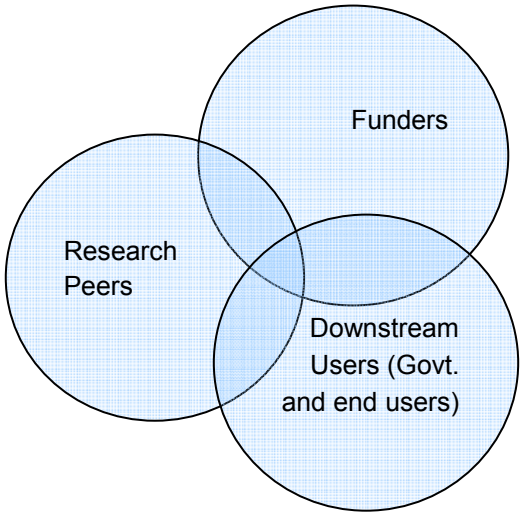
in the activities of the organisation. This will happen in an ongoing and consistent manner, through repeated feedback loops.

- *Monitoring and adaptive management:* the organisation will ensure that it monitors the project and changes its behaviour on the basis of what the monitoring phases turns up.
- *Evaluation and learning:* an accountable and responsive organisation will evaluate its projects and will try to extract lessons learned, and then change its behaviour to take into account these lessons.
- *Transparency and communication*: maintaining good transparency and communication as an ongoing principle to ensure the wider group of stakeholders remain informed and engaged.

Each of these four areas draws on a wealth of good practice and knowledge – and compares closely with the four principles of normative accountability identified by Blagescu et al 2005 – transparency, evaluation, participation and complaints handling.

Stakeholders: while every organisation will have its own stakeholders, each one must think in terms of the interests of three groups in particular. First, there are the 'downstream' users and consumers. These include the 'end user' of a new agricultural tool or seed variety - the beneficiaries. They will also include the delivery vehicle for the product or process – in the case of agricultural science, for example, the National Agricultural Research and Extension System of the country in question. Second, there are the other innovators. These may include state funded research institutes, universities, private sector firms or non-profits. A range of new arrangements are being used to develop hybrid research teams through networks and partnerships. Third, there are the funding sources, whose priorities will determine in part the financial sustainability of an organisation. An organisation may expect to have to maintain and balance accountability relationships to each group throughout its research processes.

Stakeholder Groups for Innovators



To be accountable, therefore, an innovator should think in terms of principles, processes and stakeholders: in designing their organisations' accountability, managers should think on how they can best embody the accountability principles in their relations with all their key stakeholders, through all their organisation's work from strategy planning to concluding their processes. The next section synthesises these good practices and outlines how the principles and measures can be implemented in the four key ongoing research processes identified above: strategy formulation; project identification and design; conducting research; and closing the loop. Monitoring and evaluation is a thread running throughout, and can be considered a complementary 'sub-process'. Finally, two additional supporting processes should be made available to stakeholders: an information release policy, and a complaints handling policy. We outline how all of these processes can be more transparent and participative.

Process 1: Strategy formulation

The strategy for an innovation organisation must locate them in the midst of a complex mix of actors from the private, public and non-profit sectors. To do this, the strategic plan of a research organisation will interpret the organisation's mission and define the "research niche". It is the framework within which an organisation works for a defined period of time (often 3-5 years). As a document positioning the organisation in a complex field, it should be flexible, provide direction, but allow the organisation to react to changing circumstances.

Participation: the strategy can benefit from input from several stakeholders:

- Understanding the 'market' for research and funding environment will be important to ensure that it is financially sustainable. The strategy should be seen, in part, as a fund-raising document, and should include a strategy for fundraising which will contribute to financial sustainability.
- Insofar as the mission intends to further the interests of a particular group (whether "rice farmers" or more specific communities) it is important that this group – the "intended beneficiaries" (see textbox) – are engaged in the development of the strategic plan. This will ensure that it takes into account their priorities. Where the group is as large and indistinct as "rice farmers", manageable methods to collect their priorities include using targeted focus groups (as IRRI's strategy, for example, currently uses to a limited extent).
- Involving research staff in strategy formulation – through, for example, retreats and workshops - harnesses their expertise in the area, and ensures their ownership of the plan.

Other stakeholders to be engaged should include the government, private sector actors, international and national policy-makers and the users of products from the research. These can be consulted through workshops during the formulation of the strategy plan, or brought in as peer reviewers.

Evaluation and learning: to bolster input from strategy should draw on previous evaluations and may usefully include additional evaluation processes and reviews to ensure that lessons are learned.

Risk of mission creep and capture: In circumstances where the priorities of the intended beneficiaries are not on donors' agendas, there is a risk that the research organisation will tailor its mission to ensure financial sustainability, at the expense of relevance to the goals of the intended beneficiaries. A manager must balance the instrumental goals of keeping donors happy with the ethical goals of ensuring relevance to their core stakeholders. Where possible, research managers should prioritise mission relevance, while actively selling the value of their mission to donors using evidence gained through their consultations of the beneficiaries' priorities, and prior evaluations indicating the impact that research can have.

Process 2: Project identification and design

How are projects identified and designed? While the strategic plan provides the basis on which projects are developed, it will usually (assuming appropriate levels of flexibility) require a process of interpretation by which research priorities are identified and projects designed – whether the research focuses on desirable crop traits or a policy problem. This process of interpretation and design should be accountable.

Participation: Many research projects will be identified on the basis of technical criteria identified by researchers ("supply-led" identification) often informed by the research background and programmatic structure of the organisation rather than the problem or

needs. To be accountable, insofar as possible, supply led priorities and proposals should not be prepared in a vacuum however, but should invite inputs from key stakeholders:

- *Intended Beneficiaries (demand):* To be accountable, proposals should not be driven purely by "supply" but by beneficiary demand. Researchers should invite inputs from the users of the research, either as part of an ongoing relationship or through focus groups and workshops, to ensure the research meets their needs.
- *Donors:* donor-demand can drive project identification. However, just as donor priorities can capture the strategy of a research organisation, they can also increasingly dictate the content of projects and the trajectory of programmes – the risk of mission creep. In circumstances where donor priorities diverge from the interests of their beneficiaries, research managers may once again need to balance financial sustainability against the mission of the organisation and the relevance of their work to claimed beneficiaries.
- *Other internal stakeholders:* Project designers should consult as widely as possible on the knowledge within an organisation when designing a project. If possible, they should transcend the programmatic areas (since research problems are frequently best responded to by trans-disciplinary teams). One option is to create an internal proposal review board populated by experts in a range of fields.
- *Academic field:* a research organisation must position its projects to support and capitalise on other expertise, if necessary though forming partnerships and links with other researchers.

Transparency: details on grants, evaluation frameworks, donors, and projects should be made public. These should be posted on the website, and if necessary, managers should explore more active means of communicating the information to key stakeholders.

Evaluation: in designing the project, previous project experience provide a valuable resource, and a research manager can draw on these in formulating the research. All research proposals, moreover, should include a monitoring and evaluation framework appropriate to the activity – which may involve for impact assessments for some research products, but may involve actor oriented or outcome-oriented tools for others (other Briefs in this series have better developed these ideas).

Process 3: Conducting research

There is a temptation for researchers – as experts in their field – to conduct their research in a void. Their expertise, the factor which makes an organisation successful and financially sustainable, can distance researchers from their stakeholders and particularly the intended beneficiaries. At the same time, researchers need to contextualise their work and maintain relations with the users of the technological product (whether "end users" or "next users").

Participation: Reviews of literature on both policy relevant research and technological research and development show similar evolutions in understanding of the research process, from a linear models where research forms a step distinct from the dissemination of its products, to a model where policy formulation or research can best be understood as systemic and complex. This new systemic understanding suggests that ongoing interaction and feedback loops with key groups of stakeholders can help ensure the relevance of an improved agricultural input or product (whether engaging in policy-relevant research or developing technological products):

- *Expertise in innovation system:* researchers should draw as much as possible on the wider research community, by engaging in partnerships and networks. Collaborative research projects allow researchers to draw on expertise external to the organisation.

Partnerships improve research by harnessing the different expertise and knowledge that exists between organisations to build a stronger research team. The key to good partnerships is transparency and clarity in terms of reference, in the memorandum of association, in responsibilities, and expectations.

- *Next users:* success of a research product will frequently hang on its uptake and acceptance by policy-makers and next users. Consequently, researchers must ensure that their products are adapted to their expectations. This involves ensuring their ownership and familiarity with the project, and confidence in the quality of the product.
- *Intended beneficiaries:* whether engaged in technological innovation or policy-relevant research, drawing on the context and needs knowledge of the intended of the users can improve the research. Thus, in the case of technological research, the team should consider building into projects innovation processes by which prototypes go through iterated feedback loops of testing, adaptation to context by users, and alteration.

Some research disciplines are more suited to work in isolation than others. In the case of research, those organisations which rely on secondary data and on the mastery of complex causal models will limit the space for meaningful participation to fellow experts. The challenge for these research disciplines is to allow laypeople to participate meaningfully in the decision-making processes of an organisation.

Transparency: Being transparent while collecting and analysing data has both ethical and instrumental motivations: ethically, the principle of informed consent is common to many systems of research ethics, and in many research disciplines informs interactions with all research subjects. Instrumentally, clarity about the purpose of research to stakeholders will increase their ownership of the research and thus will lower the risk of disengagement of those involved. Transparency entails requirements on researchers to explain the nature and purpose of the research, what will be done with the information, and must seek permission to carry on before proceeding.

Evaluation of research progress: Continual and ongoing assessment of the research will be useful for three reasons:

1. monitoring ensures that the research remains on track and is meeting its goals. It allows research managers to highlight problems early, and to try to meet them;
2. It allows research managers to identify and adapt to challenges; and
3. monitoring will usually be a reporting requirement to the funder.

All three are important – wherever possible, research managers should resist the temptation to permit either the considerations of internal progress management or the needs of the donors to eclipse the other.

Process 4: Communicating research and drawing conclusions

Communicating research is not simply an activity to be conducted at the end of the project, but one which should build on prior networking and linkages. As research draws to a close and recommendations are formulated, the termination of a project should involve ‘closing the loop’, evaluation, and communication of the successes.

Evaluations: Commonly, the termination of a research project will be accompanied by a reporting requirement stipulated by the funder in the course of the research. Again, evaluations should react to contractual demands as well as an opportunity to learn from the research process. Tools should be chosen accordingly. For the latter, exhaustive impact assessments are not necessarily the most effective tools – narrative evaluation tools which

attempt to analyse and understand the causal links by which positive results occurred using qualitative data may be more effective. Organisations should, moreover, encourage participation of a wide variety of stakeholders involved in the research project in the evaluation process.

Feedback: At the close of a project, the organisation has an opportunity to ensure that it obtains feedback from the progress, which it can feed into future work. This will build on prior links and communications.

They should also, however, look to maintain communication to their stakeholders and ensure that they provide feedback on the innovation process' results.

The conclusions of a research project should be communicated to all stakeholders, including those involved in the research collection. The result of the project and any evaluations should form part of this activity of 'closing the loop'.

Process 5: Information Release

A commitment to release information on request is an important guarantor of transparency, the more so because the legitimacy of a policy research community relies on the quality of their evidence, and their openness to inquiry as to possible biases.

Commitment: Research managers should make public a commitment to release information on request (subject to key caveats). The commitment should include:

- the mission, strategy and research agenda of the research;
- key ongoing projects, and their methodologies;
- information about key stakeholders including donors, partners, research networks and advocacy coalitions of which it is a member;
- if a non-profit organisation who, as specifically as possible, are their intended beneficiaries
- basic staff profiles.

The general commitment is however subject to several caveats, whereby research organisations maintain some level of secrecy, either to protect sources or to protect staff conducting sensitive research.

> ***Textbox: <u>Transparency dilemma</u>:*** *For many research organisations, their data comprises a valuable asset bought by a great deal of effort and expertise. For a researcher to open the body of work to the public, is for them to lose its uniqueness, and thus its value. An organisation in an ideal world may wish to be transparent, but may not be able to afford to release the data to its competition – presenting it with a transparency dilemma. We argue that before research products has been made public, there is no need to be transparent. Once the organisation steps into the public domain and uses their research to claim objective support for their position, the obligation to be transparent is triggered.*

Process for managing requests for information: the process should allow any stakeholder to make information requests addressing any subject that affects the claims that an organisation makes in its attempts to change policy. Where resorting to a caveat to refuse information, the refusal should be justified.

Implementation and governance: Responsibility for creating and managing complaints should be allocated to a member of staff – who may require training. Line management of the process should be specified, and should be regularly monitored.

Prominence: both the commitment and the mechanism should be appropriately communicated to key stakeholders, i.e. through the website, partnership agreements, newsletters, posters in public places or verbally etc.

Process 6: Complaints Handling

Complaints handling mechanisms are necessary elements of good governance and accountability. By implementing a complaints handling process, a research organisations shows its stakeholders that its takes its accountability to them seriously, and forges stronger bonds between them as a result.

Commitment: the commitment should cover objections to a particular policy-position as well as complaints directed at the manner in which staff members of an organisation have conducted themselves.

Process for handling complaints: a complaints handling policy may require two separate processes: one which invites and handles complaints from anyone affected by the research organisation's activities; the second, which addresses substantive criticisms of policy recommendations.

Governance and implementation: due to the potential sensitivity of complaints regarding staff conduct, staff training and management oversight will be vital.

Prominence: As with the information release process, communication of the policy is particularly important because it offers a means of redress to stakeholder groups who normally have no other means of redress. In particular, it is important to reach those stakeholders with no formal relationship to the research organisation: beneficiaries and communities involved in the act of research affected by the activity of research and partner researchers.

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