

# Operationalizing demand-driven agricultural research: institutional influences in a public and private system of research planning in The Netherlands

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**Abstract:** *The trend towards demand-driven agricultural research, which should lead to higher impact in terms of the contribution of research to agricultural innovation at both farm and agri-chain level, has focused attention to the inclusion of farmers in the process of research planning i.e. the generation of research queries, the prioritization of these, and decision making upon resource allocation. Theoretically this would be the 'maximum degree of participation' as outlined in many so-called participation ladders, and should enhance ownership and increase the applicability of research. However, in practice several tensions emerge with regard to the operationalization of such 'user-driven research planning systems'. The paper analyzes such tensions, by focussing on two systems in which user driven research planning is operationalized. One is a system of research funded with levies paid by farmers (i.e. private collective funds) and the other is a system in which government has delegated the planning of research to a multi-stakeholder network constituted by actors from the agri-food chain, researchers and consultants (i.e. using public funds). Taking an innovation systems perspective, with a strong focus on institutional aspects (i.e. norms, values, incentive mechanisms, reward mechanisms) and linkages between actors, the paper identifies several tensions in such system of 'demand-driven' research planning. While the systems have different approaches, the tensions are quite similar. These tensions deal with the different and often limited perspectives on innovation of the actors involved, different and sometimes conflicting progress monitoring and output evaluation criteria, and information asymmetries between the actor groups which influence their capacity to successfully act in the research planning system. The analysis prompts the importance of synchronizing perspectives on innovation, and capacity building among all actors active on such demand-driven research planning platforms to enable them to successfully operate on these platforms.*

**Keywords:** *demand-driven research, research planning, The Netherlands, innovation systems*

## Introduction

### Changes in the agricultural knowledge infrastructure

Over time, major changes have taken place in the relationships between end-users of knowledge (i.e. farmers) and the agricultural knowledge infrastructure. In the context of agriculture the term knowledge infrastructure has been often used to indicate the whole of agricultural research, extension and education establishments. These relationships have changed because of shortcomings of previous innovation support systems for farmers (based on linear, 'science push' models of innovation) that have been criticized in the broad literature on participatory research and extension (Sperling and Ashby, 2001), and because of the development of network and systems approaches to agricultural innovation such as the agricultural knowledge and information systems approach (AKIS, Röling and Engel, 1991), and the agricultural innovation systems approach (AIS, Hall et al., 2006). With regard to conceptual development, Hall et al. (2006) speak about a transition from national agricultural research systems (NARS) to agricultural knowledge and information systems (AKIS), to agricultural innovation systems (AIS). From the AIS perspective, the agricultural knowledge infrastructure forms part of such an agricultural innovation system, but is not necessarily the principal driver as Hall et al. (2006: vii) emphasize: "The innovation systems concept embraces not only the science suppliers but the totality and interaction of actors involved in innovation. It extends beyond the creation of knowledge to encompass the factors affecting demand for and use of knowledge in novel and useful ways". The agricultural innovation systems approach also focuses on enabling and constraining factors for innovation other than knowledge, such as physical 'hard' infrastructure and social 'soft' infrastructure,

including institutions such as informal norms, values, attitudes and practices, and formal rules embedded in legislation and policy (Hall et al., 2006; Klein Woolthuis et al., 2005).

While recognizing the need to take a broad view on innovation, the paper focuses on the interface between end-users (farmers and agri-industry) and research. A number of recent changes have affected this interface. A shift from homogenous production to diversification of products and specialization of producers has resulted in “dispersion of professional interests and aptitudes” (Janssen and Braunschweig, 2003), which affects the interface between the users and producers of knowledge (Smits, 2002). Agriculture is also becoming increasingly knowledge intensive (Hall et al., 2006). Furthermore, privatization of the public agricultural knowledge infrastructure has taken place (Leeuwis, 2000; Byerlee et al., 2002). As a result, a market in agricultural research and extension services has emerged for the support of agricultural innovation processes.

The shift to such a market for ‘innovation support services’ has created new roles for parties on both the demand side (e.g. farmers, funding bodies such as government) and the supply side (providers of research and extension) in respect of employing alternative funding and incentive mechanisms. In the literature much attention has been paid to the potentially positive and/or negative effects of alternative systems of funding and provisioning of agricultural research and extension, in terms of efficiency, effectiveness, accountability, and content. The present thinking is that provisioning of research and extension should be pluralistic with mixed funding and undertaken by both public and private parties (Byerlee et al., 2002; Rivera et al., 2005). A key issue in this discussion is the premise that separating funding from provisioning of research and extension would make service provision demand-driven. Because in a market setting services are contracted, and several providers compete for contracts, this would enhance provider performance and orientation towards clients’ wishes. Clients include government, agri-industry and farmers (Leeuwis, 2000).

## Operationalizing demand-driven research

A key element in the shift towards demand-driven research is granting end-users institutional influence throughout the research process. According to Röling et al. (2004: 217) these mechanisms are effective in the context of industrialized countries: “Farmers in industrial countries have a well organized institutional influence on decisions about agricultural research ... [and] are perfectly capable of telling researchers what they need.” This contrasts with the situation in many developing countries, where end-user steering of research planning is insufficiently institutionalized. In the debate on farmer involvement in agricultural research, the focus would have shifted too much to participatory methods rather than concentrating on the underlying institutional issues (Hall et al., 2001; Hall et al., 2003). Following Hall et al.’s pragmatic definition, ‘institutions’ refers to the “combined environment of ‘rules of the game’ and physical organizations and the interplay of the two” (Hall et al., 2001: 784). Hall et al. (2003) argue that the rules and norms of institutions within innovation systems govern the following roles and processes for research:

- how research priorities emerge, are promoted and executed;
- the role of various actors involved in the production, transfer and use of knowledge;
- the relationship between the different actors and the factors that affect their relationships;
- how research performance is evaluated and rewarded (incentives), and by whom;
- how research is held accountable to different interest groups and society as a whole;
- how knowledge is built up, shared and used; and,
- how organizations reflect and learn.

As several authors argue (e.g. Clark, 2002; Garforth et al., 2003; Sumberg and Reece, 2004), due to several institutional problems an effective match between demand (of farmers, government) and supply (of research and advisory services) for innovation support services is sometimes hard to make. To facilitate this match, often specialized intermediaries are put in place which act as ‘brokers’ or ‘boundary organizations’ (see e.g. Cash, 2001; Dalrymple, 2005). Examples are research councils (Kassam et al, 2004) or in the case of farmer-funded research there are bodies such as commodity boards and producers’ organizations which act as intermediaries (see Brennan and Mullen, 2002). There are also specialized advisory organizations which fulfill such a role in matching demand and supply (see Klerkx and Leeuwis, in press a). These fulfill a mediating role between the financier, the

researchers, the intermediate users (such as extension service providers) and end-users (farmers and other agri-food chain actors) who are supposed to benefit from the research.

The paper analyses two research planning and execution systems which –in theory– have institutionalized end-user involvement throughout the process, and aims to signal tensions in the operationalization of such demand-driven research planning systems. Elsewhere these system have been analyzed separately in more detail (Klerkx and Leeuwis, in press b; in press c), but the aim of this paper is to provide a comparative perspective. The principal research question is whether there are differences with regard to the degree research is made ‘demand-driven’ between a situation in which farmers fund their own research (i.e. using private funds), and when research is funded with public funds but farmers are given decision making authority in research planning. The paper proceeds by briefly discussing a number of ‘arena’s’ in research planning and execution, followed by a description of the two research planning systems and a comparative analysis of the tension encountered in the different arena’s. It concludes with a number of policy recommendations.

## **Research planning and execution in two systems of contractual research planning**

### **Comparing two research planning systems**

Research planning takes place within several time horizons and at different complexity levels. This paper focuses on a lower level of planning, i.e. research project planning. Capo et al. (2001: 119) define this as “a systematic and integrated management approach to identifying and preparing a plan to resolve a ‘problem’ identified within the broad field of agriculture”. Several pathways can be taken to come to the generation, selection, and execution of research projects, but basic steps in research project planning are proposal generation, proposal refining and modification, and project selection for funding (Daniel et al., 2003). As several authors argue (Stewart, 1995; Davenport et al, 2003), research project planning is the scene of negotiation between different configurations of actors. As regards the content of these negotiations, Braun (1998) has identified three arena’s, i.e. the policy arena, the selection arena, and the control arena, and relates these to phases in the research planning procedure (Braun, 2003). The policy arena is about the fundamental level and long-term time horizon. Typical problems that manifest here relate to goal conflicts. The selection arena deals with the pre-contract phase (i.e. proposal generation, proposal refining and modification, and project selection for funding) and here the adverse selection problem is particularly relevant, which implies that actors cannot make a well-informed decision because of overall lack of information or information asymmetry. With regard to the execution phase of research, Braun talks about the control arena which is about the monitoring of the progress of the research. Typical problem here is moral hazard (being sure that researchers do their best to solve the problems and tasks delegated to them and that they avoid ‘shirking’ behavior) and adequately monitoring research progress.

The paper looks at two systems in which users are involved in research planning and execution. One is a system of funding of research through compulsory levies imposed on farmers to install ‘contractual research planning’: placing significant control of the resources available for financing research in the hands of stakeholders, creating the means to exert a demand pull on the system (Stewart, 1995; Sperling and Ashby, 2001). Under the farmer levy funding system, it is ‘collective private’ funds (contributed by farmers) that are used in this way. Because of the large number of levy payers, producers are usually represented through boards with decision-making authority. These boards need to be part of strong farmer organizations that can raise commitment to the levies amongst their constituencies and effectively represent producers’ interests and negotiate with other stakeholders such as government (Sperling and Ashby, 2001). This combination of demand pull and farmer representation on research planning boards means that funding research through farmer levies is generally considered to be an effective way to institutionalize end-user involvement in research planning.

The other system is a system under which government has delegated responsibility for the allocation of public funds to research to a heterogeneous network of societal actors (both public-and private) relevant to innovation in a certain area. Several authors stress the importance of engaging in such public-private partnerships (see e.g. Hall et al., 2006; Hartwich et al., 2007) According to Braun (2003: 320), when research is governed through systems of delegation to networks, this is “...at least

in theory, the most adequate way of dealing with the paradox in science/research policies<sup>1</sup>: reducing the direct influence of the state in funding policies, respect for the independence of scientific institutions, fostering of 'vigorous' scientific institutions, and a strong commitment of scientists to user interests." Such a system implies that research councils, which often form an intermediary layer between government and researchers (e.g. Kassam et al., 2004; Dalrymple, 2006), have to broaden their scope towards managing multilateral relationships and develop what Gulbrandsen (2005) calls 'innovation agency'. Such innovation agency fits with current perspectives on the role of research within a broader innovation system.

This paper compares the cases of the Dutch Dairy Commodity board, which represents contractual research planning with collective-private funds, and the case of Bioconnect, which represents delegation of planning of publicly funded research to a multi stakeholder network. Both cases have been presented separately elsewhere in more detail and we refer to these publications for details on the research methods (see Klerkx and Leeuwis, forthcoming a, b). The main difference between the two cases lies in the role division that is made in the research planning and execution process, and the actors that are included overall.

## Farmer involvement in both systems

Figure 1 shows this role division for DCB, and figure 2 shows this role division for Bioconnect. The main difference lies in the degree of interactivity in the different steps.

As figure 1 shows, DCB employs a quite linear 'pipeline' system, in which farmers can indicate their queries (directly or through representatives) but these queries are then further processed by people who have specified roles in the research planning and execution process. As a consequence, in each step the institutional background of the actors involved (i.e. norms, values, incentives) determines the direction in which the queries are molded. Since this happens in each step in a quite isolated fashion, the end-users cannot exercise a direct influence and as a result the queries may become alienated from the problems or challenges they are supposed to address. Although representatives of farmers are involved, these are farmers at policy level (active in the farmers' organizations) who, despite being rooted in the grassroots level, wear 'policy goggles' and let themselves being informed by researchers and their long-term research program rather than 'real farmers' at the grassroots level.

As figure 2 shows, the system of delegation to networks in the Bioconnect approach is not like DCB's pipeline approach in which different actors exercise influence at different steps in the research planning and execution process. Here demand articulation, research prioritization, and research guidance takes place integrally, and is coordinated and monitored through a single platform (called product workgroup – PWG) in which all relevant actor groups are represented, i.e. farmers, agri-chain industries (input and processing), civic advocacy groups, researchers, and consultants (i.e. extension service providers). These persons are generally not active at a policy level, but are nevertheless requested to forward a query that is representative for the broader constituency for which they are supposed to speak. The PWG has been delegated decision making authority for the allocation of public research funds, as a result of which they are not completely free in their choices: they have to remain within thematic frameworks set by government, each with an earmarked budget.

Both in DCB and Bioconnect research coordinators (called knowledge managers in Bioconnect) have a pivotal role as bridges between the different parties involved. In the context of DCB, research coordinators often act as 'messengers' of the policy makers in DCB, and represent DCB's interest in bilateral relationships with researchers. They hence fulfill a more traditional intermediary role as is often attributed to research councils or research coordinators, between the financier of the research (i.e. the client) and the executors of the research (the contractor), Within Bioconnect, the knowledge managers fulfill a more active facilitator role on the platforms on which multi-actor negotiations takes place with regard to research planning and monitoring. Their role is to mediate between the different actor groups, i.e. facilitate communication between actors who are driven by different norm, value and incentive systems, and generally employ different discourses (i.e. farmers discourse, policy discourse, scientific discourse).

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<sup>1</sup> Braun (2003:309 ) formulates this as follows "A basic paradox in funding policy is that policymakers want to guarantee maximum welfare benefits without violating the independence of scientists and their organisations."

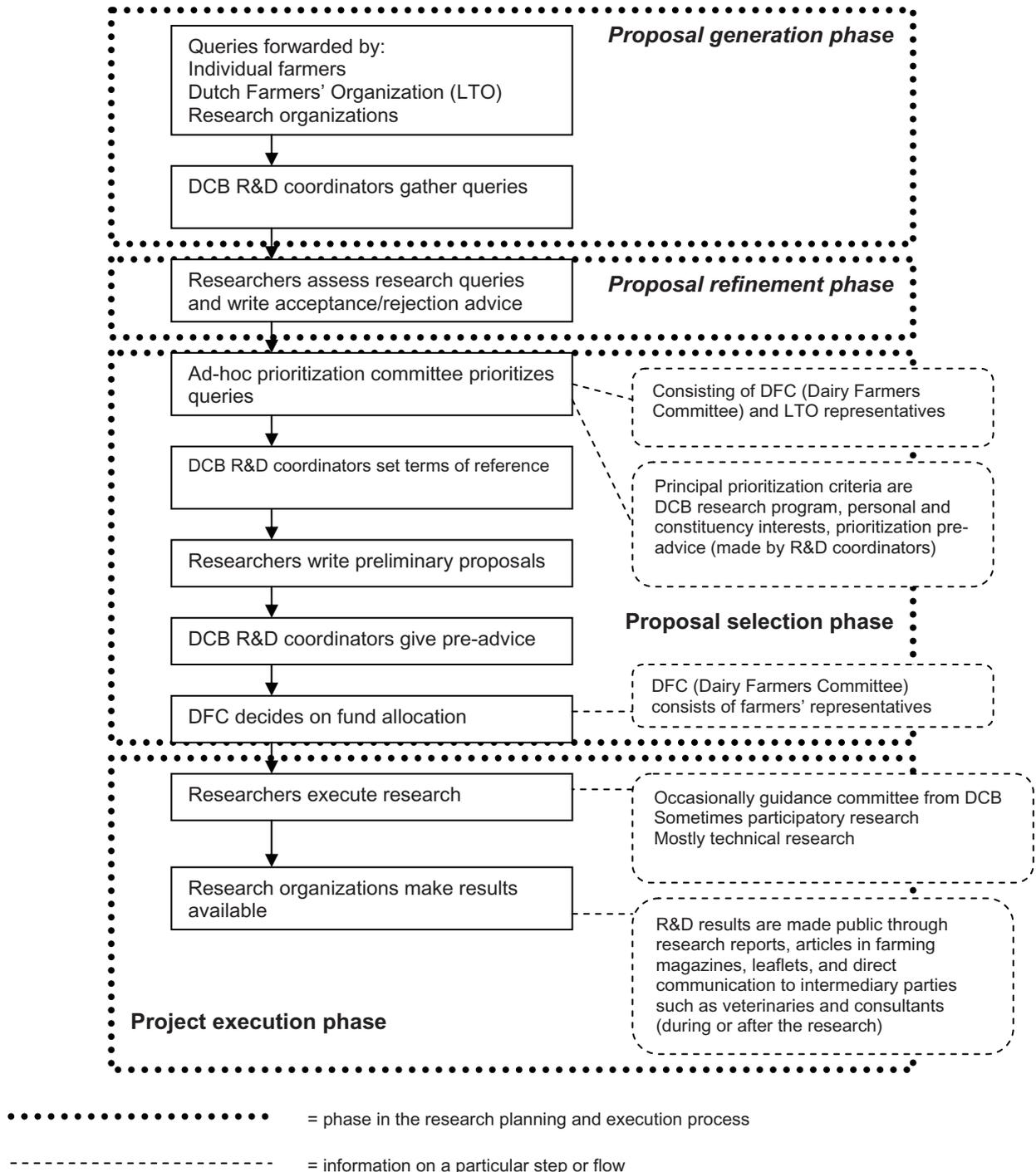


Figure 1. Set up research planning procedure DCB

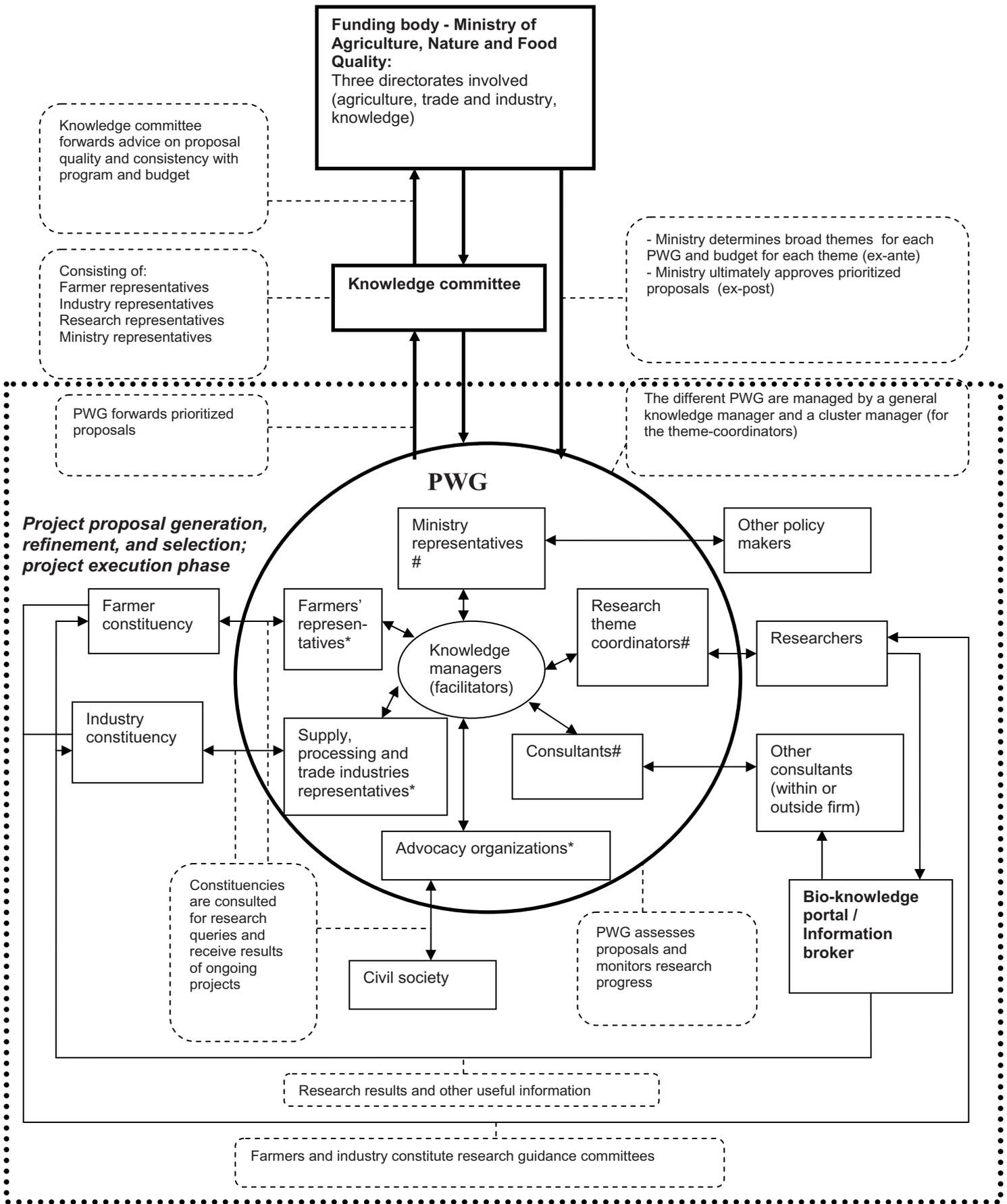


Figure 2. Set up research planning procedure Bioconnect

Both approaches focus on research planning, and on research as a means to bring about innovation. From innovation systems theory emerges that several other elements than scientific knowledge are needed to bring about innovation (see Smits, 2002; Hall et al., 2006). However, whereas DCB generally focuses on making scientific knowledge available and puts great responsibility with farmers for acquiring and implementing this knowledge, Bioconnect takes a more integral view and has research guidance committees consisting of users in all research projects and has a unit which aims to streamline different sources of information and make these available for farmers by means of a single portal. Furthermore, the interaction between different actors in the PWG enables

joint learning and facilitates that other factors needed for innovation (such as consumer demand, a joint goal and cooperation of the agri-food chain, enabling infrastructure and legislation) can be addressed. The Bioconnect system hence seems to be a more comprehensive system to make research demand-driven and to successfully embed research within a broader innovation system.

## **Problems in the different arenas of research planning: a comparative perspective**

Table 1 sets out the main tensions for both systems in relation to the arenas of research governance identified earlier (i.e. the policy arena, selection arena and the control arena). From table 1 emerges, that DCB is characterized by an overall lack of interaction in the different arenas, which does not allow for any direct negotiation between relevant stakeholders as to the desired research or other activities to support innovation. This means that farmers' preferences are 'overruled' at later stages by researchers' preferences and policy makers preferences. In some cases this may well align with farmers' real demands, but it may also be research for which there is no real demand. In many regards, what appears to manifest here is a lack of participation of farmers. Although there is interaction with researchers, there is no dialogue in which to come to a joint query which a) addresses farmers' current needs and b) addresses researchers' interests and incorporates the state of the art in research. A salient observation was that, whereas the system is set up to be steered by end-users' needs, these needs are not always welcomed by DCB, since it desires to undertake more vanguard types of projects. Despite this being a legitimate stance, no approach has been designed to articulate such vanguard projects with end-users and other stakeholders. What in this sense appears to manifest is what Sperl and Ashby (2001: 177) call a 'reverse participation problem', arguing that "if farmers' groups fail to consult with researchers when defining their agendas, a research strategy may emerge that has limited potential for technological progress, precisely because the subjects selected may not be amenable to technical investigation".

Furthermore, DCB appears to have a limited view on innovation, as it sees 'research' as 'innovation', whereas sometimes the solution to farmers' queries might not be research or research needs to be complemented by several other activities. In the case of DCB, due to (historically derived) policy choices to focus on research and task divisions in the research planning process, the range of solutions to the queries farmers forward is often narrowed down right away to production-technical research. Other types of research such as management oriented, social science, and economic research seem to be underrepresented. Furthermore, research might not be the most adequate and/or desired way of tackling farmers' queries. This focus is in line with observations by others that often innovation is seen to equate to conducting production-technical research projects, whereas innovation needs to be seen much more broadly in terms of an interactive design or product development process (Leeuwis, 1999; Sumberg and Reece, 2004).

In line with such an innovation system perspective, in the Bioconnect system a wide range of stakeholders is involved to make a contribution in terms of articulating knowledge demands and adding knowledge to the process. Furthermore, in contrast with DCB, Bioconnect pays structural attention to the dissemination of knowledge generated by research through a central portal, and through the different informal networks attached to the different research projects in which farmers participate in research guidance committees. Despite the higher degree of structural participation and interactivity, there are a number of problems. These concern the operationalization of participation in the different arenas. At the policy arena level, a principal tension appears to be that, within a network approach, multiple actors need to negotiate an agreed joint goal to forward a shared query to the

Table 1. Comparison between DCB and Bioconnect in the three arena's of research governance

	DCB	Bioconnect
<b>Policy arena (overall goals)</b>	Incoherence between: <ul style="list-style-type: none"> <li>- Farmer goals vs. researcher and policy goals ('real demands' at grassroots level vs. demands as determined by researchers and as described in research programs/vision documents)</li> </ul>	Incoherence between: <ul style="list-style-type: none"> <li>- Farmer goals vs. agri-chain goals (oriented towards farm level production issues v.s oriented towards chain level processing/logistic/retail issues)</li> <li>- Long- vs. short term (researchers and government think with a long term perspective vs. farmers want quick results)</li> <li>- Sector goals vs. government goals ('micro-prioritization criteria' of the PWG vs. the 'macro-prioritization' of the thematic budgets as determined by government)</li> </ul>
<b>Selection arena (priority setting)</b>	<ul style="list-style-type: none"> <li>- Low quality of demand articulation (farmers are not involved in demand articulation, and their input is deemed insufficient and is often overruled by researchers)</li> <li>- Pre-selection by researchers based on their criteria for relevance (i.e. personal interest, gaps in scientific knowledge, well-articulated queries, strategic [chain level] rather than operational [farm level] issues)</li> <li>- Selection by policy makers based on their policy goals (long term research program, policy program of the farmers' organization to which they belong)</li> </ul>	<ul style="list-style-type: none"> <li>- Information asymmetry between different actors in the network (about the proposals being discussed, as well as about their place and role in the network and broader Bioconnect system)</li> <li>- Role divisions between theme-coordinator and knowledge manager are not clear (theme-coordinator also mediates between researchers and end-users – mere secretarial role for knowledge manager)</li> <li>- Formats for proposals need to address different demands of different parties (most notably end-users who want to be briefly informed vs. government demands which emphasize completeness, scientific rigor and accountability for spending)</li> </ul>
<b>Control arena (progress monitoring)</b>	<ul style="list-style-type: none"> <li>- Low interaction in the research process, both between researchers and end-users and between researchers and the financier</li> <li>- Generally no active formal link between researchers and end-users (although on an occasional basis and informal basis this exists)</li> </ul>	<ul style="list-style-type: none"> <li>- Formats for monitoring address different demands of different parties (most notably end-users who want to be briefly informed vs. government demands which emphasize completeness, scientific rigor and accountability for spending)</li> <li>- Output preferences (different demands of e.g. farmers, government and researchers themselves with regard the goal the output serves [i.e. informing farmers, providing accountability for use of public funds, scientific publishing]).</li> </ul>

researchers. Whereas within a bilateral relationship goal conflicts concern the financiers desired trajectory versus researchers' interests (cf Braun, 2003), in a situation in which there are multilateral relationships there is more potential for goal conflicts. At the PWG level, this could be observed in several respects: farmer interests versus agri-industry interest, short-term focus versus long-term focus, and user interest versus government interest. The first two conflicts could result in users not seeing a need to participate because there are no apparent direct private benefits, as was the case with industry actors in Bioconnect who found that too much attention was paid to farmer's problems and as can be observed in a call for better remuneration for time invested. The third conflict, perceived as an annoyance but a relatively minor problem within Bioconnect, could, however, become a more serious problem in a situation in which private interests are less aligned with public interests, i.e. when in a system of user demand-driven research within a given framework the micro prioritization criteria of users do not correspond with macro priorities of government. At the selection arena level, the findings confirm the observation of Davenport et al (2003: 247) that there is no such a thing as 'generic users' who "represent all of the facets of their sectors equitably and with equal voice" (see also Sperling and Ashby, 2001). It appears difficult to establish a single collective query that satisfies the diverse needs. Furthermore, a lack of capacity to act in the network (PWG) due to inadequate competencies of some network participants or insufficient involvement of some network participants can hinder effective functioning of the PWG's. There exists information asymmetry among the different actors, because a certain format for proposals is used, which not all actors can understand or which takes too much time to read. As a result, not all actors participate well informed in the discussion. This may lead to a situation that some actors can exercise more influence. In case of Bioconnect, the task of the knowledge manager was to act as a facilitator/mediator and mitigate such inequalities, but this was hindered because the theme coordinator could better perform such a role because he/she was better informed about the topic. This was sometimes perceived as undesired steering, although it was not intended that way by theme coordinators. At the control arena level, a similar issue related to different information needs emerges. The involvement of different actors that have different needs with regard to monitoring output (i.e. for accounting, accountability, information purposes) increases bureaucratic requirements as it appears hard to integrate the needs of all principals within a single format. In this regard it is an interesting paradox that farmers and industry actors especially complain about

formalization of the PWG and an increasing amount of information they need to assess, but that at the same time this increases their insights into the process of research agenda setting and execution, which results in a call for even more information, which in turn calls for more information processing capacities (in terms of competencies and time).

The Bioconnect case indicates that despite incorporating a strong commitment to users' interests, delegation systems also allow government to continue exercising a great deal of direct influence as it determines the macro priorities within which users can maneuver. Furthermore, although researchers that are active in the negotiation arenas within such a system may be very committed to user interests, this does not mean that their constituencies (i.e. the researchers they manage or represent) act in the same way and effectively embed user interests in their research. However, the results suggest that introducing a network delegation model can help induce institutional change towards interactive ways of working, because interaction of researchers with users is built into the system and is a prerequisite for obtaining funding. Despite the initial reluctance of some researchers, it does install a learning process in relation to more interactive ways of working.

## Conclusion

From the comparison between the two systems a number of lessons can be drawn. A first lesson is that user involvement in research planning can be beneficial, but should be adequately organized. This requires considerable input in terms of time and money, as has been earlier note by Sperling and Ashby (2001) and Dorward et al. (2003). Furthermore, participation in formal planning procedures requires considerable skills from users, who hence should be trained to act in the different arena's (see also Jacob et al., 2005; Lettl et al., 2007). When users are not sufficiently empowered they cannot act as equal partners of researchers, which may downplay their role. Nonetheless, it should be recognized that sometimes users can play a less significant role due to the complexity of some problems, and that 'full participation' is not always the most suitable strategy (Sumberg et al., 2003). This is also not always desired by users. However, users should be well informed about what is going on, in reporting formats understandable to them. This draws attention to a second issue, that there are several demanding groups in research, with sometimes very contrasting demands. This is the case both between different groups (ie. government, users) but also within groups because these are heterogeneous (Davenport et al., 2003). As Sperling and Ashby (2001) noted, it is the task of a facilitator to balance the different demands into a mutually acceptable solution. However, sometimes there can be several parties that can fulfill a facilitating task and it is not clear who does what, and with what intentions.

An important finding is that a broad view on innovation should be taken, and that in addition to farmers having the means to exercise demand in the economic sense through contractual research planning, they must also be enabled to create adequate substantive demand for research and other activities that can support farmer innovation. Such substantive demand articulation is about the concretization of latent and/or incipient needs to guide knowledge and technology development (Sumberg and Reece, 2004). Boon et al. (in press) define it as: "an iterative, inherently creative process in which stakeholders try to unravel preferences for and address what they perceive as important characteristics of an emerging innovation." Besides stakeholders being involved to make a contribution in terms of articulating knowledge demands and adding knowledge to the process, an innovation systems perspective suggests that they should also be involved in joint identification of other enabling or constraining factors to innovation and in joint action to capitalize upon possibilities and remove impediments that may be, e.g., of a legislative, infrastructural, policy, and cultural nature (cf. Klein Woolthuis et al., 2005).

Institutional learning and change would therefore be needed. Often, focus is on institutional learning and change in (public) research establishments (e.g. Hall et al., 2003; Gandarillas et al., 2007). These should evolve from a linear, supply-driven model of innovation to a demand-driven innovation systems model. DCB and Bioconnect employ certain institutional arrangements that supposedly make research demand-driven: research is funded with farmer levies or farmers are otherwise granted decision making authority, research prioritization and decision making on fund allocation is governed by a farmers' representatives, and privatized research providers are contracted, all of which should enhance client-orientation. However, as this paper has shown, these institutional arrangements do not automatically successfully grant end-users and other relevant stakeholders real participation and control in innovation processes. Institutional structures may not allow the full operationalization of demand-driven innovation, as the case of DCB shows, or there is a need for considerable finetuning of

the process because different actor groups have different requirements as regards demand articulation, prioritization, and progress monitoring as the case of Bioconnect shows. Whereas the case of DCB shows a situation in which such institutional change has yet to be undergone, the case of Bioconnect shows a system in which operationalization of demand-driven innovation has been better developed. However, this case shows that this is an ongoing learning process. For this matter, it does not appear to make a difference whether a system is publicly or privately funded: it matters that the participatory process is well organized and the institutional context is receptive to such a process.

In a system in which a financier (either private or public) can exercise great influence on the way research is executed, and can make research establishments more responsive to the needs of end-users, the financier itself has to be sufficiently responsive to the needs of end-users. Ensuring that end-user demand steering is fully operationalized in the research planning procedure would require, above all, institutional learning and change within the funding organization (i.e commodity boards or government). Furthermore, following Hall (2005), organizations that govern research need to reflect on whether they should shift from developing science and technology capacity, to innovation capacity. In such a context, these organizations would have, besides their role as research coordinators and commissioners, a role of facilitators who match demand and supply for innovation support services (see Klerkx and Leeuwis, in press a). This would imply a change of scope in respect of innovation, of mandate, and of capacities.

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