Managing public-private innovation programs; Lessons from the Netherlands, the United Kingdom, Finland and Australia

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Foreword

Throughout the Western world it has been widely acknowledged that the building sector urgently needs to undergo transition. This inherently traditional and product-oriented sector is now being converted into a service-oriented branch of industry characterized by healthy internal relations and a clear focus on the needs of the customer and user.

It is certainly not without some struggle and setbacks that the relevant innovations come about. In many countries it is the building sector in conjunction with government that is setting up organizations that are geared to stimulating such modernization and to giving it a sense of direction. In the Netherlands it was the Process and System Innovation in the Building Sector (PSIBouw) innovation programme, rounded off at the end of 2010, that was responsible for this move.

Towards the end of the programme, a comparative study was carried out between a number of similar programmes that are continuing in Australia, the United Kingdom and Finland. The research was essentially evaluative, which meant that it was predominantly oriented towards the relationship between the world of science and the practical situation. After all, fundamental innovations can never come about if there is no proper cooperation between the fields of practice, research and education.

This publication provides an overview of the main results that are being made available to the international forum of building industry innovators. What clearly emerges from this evaluation is that innovations perpetually appeal to the mutual pull of practice, research and education: these parties must remain in close contact. The economic crisis that has hit the building sector hard in the Western world has not been exactly conducive but that is precisely why it is important not to allow things to slacken.

What also becomes apparent from this research is that successful cooperation between the fields of research and building practice often very much depends on the day-to-day leadership displayed in an innovation programme. That is a conclusion I would like to underline but also elucidate: the success of innovation in response to the current crisis depends upon the leadership shown in all areas of the building sector, both from the customer angle and on the part of building contractors.

Now that the economic tide is turning I hope that the lessons learnt from the PSIBouw programme, also in this respect, will be enthusiastically put into practice.

Herman Hazewinkel
Chairman, PSIBouw

Content

Summary

Everywhere in the world governments are promoting better university-private sector collaboration that is dedicated to stimulating the innovative capacity of their economies. In practice, though, it seems to be difficult to bridge the gap between university-based social and engineering sciences and industry. We analyzed this gap by studying various public-private innovation programs that have been set up in the Netherlands, Australia, Finland and the United Kingdom. On the basis of this review we are able to formulate several recommendations designed to stimulate industry-university collaboration.

In this report we shall adhere to Van de Ven and Johnson's (2006) views on the ways in which scientists and practitioners co-produce knowledge. To their minds, the gap between science and practice arises from the knowledge in the two areas being produced in relative isolation. Van de Ven and Johnson maintain that through knowledge co-production scientists and practitioners would generate knowledge that is not only relevant to practice but which would also contribute to the accumulation of scientific theory. Such a dual process, which is known as 'engaged scholarship', should lead to the gaining of scientific knowledge that is more practically relevant and ultimately better.

The case of PSIBouw, a public-private collaboration program in the Netherlands with a budget of 34 million euros, revealed that relationships between academics and practitioners tended to remain 'collaborations of convenience' that are unlikely to continue after funding has been withdrawn. What also proved problematic was finding practitioners who were motivated to become involved and to stay involved in collaborative research. We discovered similar problems in our international comparative study. This situation primarily derives from the stipulations laid down by the funding authority. The EPSRC evaluates funded centers on academic quality, academic impact and industrial relevance (these are the first three criteria given on the EPSRC appraisal form), but there is no real assessment of the cooperation between academia and the field. At project level practitioners are often involved as test cases, as workshop and conference participants, and so on. The centers studied in the UK are primarily funded by national research councils. The same could be said of the programs we studied in Finland, although the new SHOKs are generally more industry-led. In those cases, though, it proved difficult to get the universities involved and just how this model will work in practice remains to be seen. The Australian CRC CI seems to be most clearly aimed at achieving collaboration between the academic world and practice but here, too, we detected tensions between practitioners and academics. Industry sees the CRC CI as too academic but academics claim that 'research struggles in a commercial environment'.

The aim of our study was to analyze four aspects of the various programs.

1 Bridging the gap between practitioners and academics at project level

Within PSIBouw the aim to bridge the gap between practitioners and academics was an important one but it took a while for ideas on how that goal could be realized to develop. By the time the concept of engaged scholarship was finally adopted as the model of choice the program was already almost half completed. By then most of the project funds had already been allocated, so the drawback was that there was little opportunity to use project funding as a mechanism to further engage scholarship.

In general, it is safe to say that most international programs are primarily aimed at bridging the gap between practice and science but in reality most program studies have an 'outsider's' research perspective.

2 Developing a joint collaborative program

The program that PSIBouw started with was the result of a typically Dutch consensus process. It thus provided a very broad research agenda. Moreover, during the execution of PSIBouw, both the board and the program office also wanted to keep it open to new entrants who had not been involved in the development of the original project plan. New initiatives were rarely rejected on the grounds of not fitting into the program. In fact at times getting as many parties involved as possible seemed to take precedence over the internal coherence of the program.

If we compare the PSIBouw experience with that of international programs, we can basically see that two alternative models emerge. On the one side (in the UK and in some programs in Finland) we see a model in which the universities take the lead and develop a research program. In the case of the second model it is industry that takes the lead. Most interviewees stated that it is difficult to develop a collaborative program. In general, practitioners complain that research that is instigated by universities is inclined to be supply driven but that getting practitioners really engaged and developing a more demand-driven agenda is hard to achieve. It furthermore takes time to develop engagement.

3 Creating legitimate authority

The legitimate authority of PSIBouw was concentrated in the Board, but as the Board consisted of high-level and consequently very busy practitioners, many issues were actually determined at lower levels within the Program Office and, to a lesser extent, within the Scientific Core Team. The Program Office consisted of seasoned practitioners but lacked the prima facie legitimacy of the Board. The Scientific Core Team, by contrast, was highly visible within the relevant academic disciplines (mostly engineering and management) but lacked legitimacy in the practitioner community. Ultimately, legitimate authority depended too much on the Board which was composed exclusively of practitioners who lacked the time to be involved in the program on a day-to-day basis.

When compared to other international situations the leadership of PSIBouw seems rather complex and fragmented. At TEKES in Finland, for instance, universities were contributors to rather than owners of the program and this affected the academic legitimacy. On the other hand, with a model where academics take the lead, like at the EPSRC centers in the UK, could make it more difficult to obtain legitimacy in the eyes of industrial representatives. However, the examples of Loughborough and (to a lesser extent) Salford show that this need not necessarily be the case.

4 Developing flexibility

Given the innovative character of PSIBouw, together with the fact that the program was positioned as a research *and* change program, it was important to be able to amend the program whilst it was underway. Fortunately that is also what happened and so various fundamental changes were implemented regarding the content of the program as well as its management structure. To a certain extent this was at the expense of the coherence of the program so, if anything, we could say that there was perhaps too much flexibility in the PSIBouw program.

Furthermore, although PSIBouw was managed in a flexible way internally, it simultaneously had to comply with the rather rigid procedures laid down by the funding authority. These procedures, specifying an upfront definition of the end results and a strict controlling of the activities conflicted with the truly innovative and explorative nature of the program.

In the case of PSIBouw, flexibility was created *within* the program, by allowing new initiatives to be incorporated and by re-designing the program mid-term. This was a very different approach to that adopted in the programs administered by TEKES in Finland. With those programs the aims were established at the outset and flexibility was created by changing the focus and conditions when one program was succeeded by another one. The Australian CRC-CI was organized around five main broad topics. It is not clear to what extent changes could later be made in these topics or in the related projects. The EPSRC centers in the UK had a great deal of flexibility. The EPSRC evaluates on the basis of outputs and allows the centers to take important decisions.

On the basis of our analysis there are three major conclusions that can be drawn:

1. **The barriers between practitioners and academics are rooted in very real differences of interest and perspectives and are therefore not easy to overcome**
2. **If academic quality is one of the main goals of a program then it pays off to give the lead to universities or to agencies that possess academic quality and see that as one of the main evaluation criteria**
3. **The genuine engaging of industry would seem to be something that is strongly influenced by the personal day-to-day leadership of the center or program in question**

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1

Introduction

Innovation is very high on the political and social agendas of practically all developed countries. There are few countries that do not try to stimulate the innovative capacity of their economies. Often this is done by promoting better university-private sector collaboration, the idea being that industry is more capable of and more inclined to perform innovative activities so that the substantial investments made by governments in academic research should promote the achievement of this goal. This is what is happening with varying degrees of success in many different fields and disciplines. In this report we shall be focusing on the attempts made to bridge the gap between (broadly defined) practitioners in the construction industry and social scientists involved in studies of the way in which this particular industry is organized: in the relationships between suppliers, contractors and clients, in the internal organization of construction firms and in the organization of the knowledge infrastructure of this industrial ecosystem.

The authors of this report were involved in PSIBouw, a public-private innovation program designed for the Dutch construction sector. One of the aims of the program was, indeed, to bridge the gap between academic research and practice. The vehicle of choice for realizing this program goal was the concept of 'engaged scholarship'. We discuss our experiences with this program so that we can develop ideas about the fundamental difficulties posed by such public-private innovation programs. In our evaluation of what happened in the PSIBouw program we concentrate on four fundamental questions:

- How did PSIBouw try to bridge the gap between practitioners and academics at the project level?
- How did PSIBouw try to develop a joint program between practitioners and academics?
- In what way did the PSIBouw directorate try to secure legitimacy in the eyes of the stakeholders in both groups?
- How did PSIBouw try to realize a level of flexibility in the program that was sufficient to accommodate the evolving needs of practitioners and academics alike?

We will first discuss our observations in relation to the PSIBouw program. In this respect we operated as auto-ethnographists. Our status as insiders allowed us to collect detailed information and provided us with a number of first-hand observations. However, it also made it more difficult for us to remain objective. Partially in an endeavour to remedy this we compared the PSIBouw experience with experiences in three other countries, namely in Finland, Australia and the UK. In each of these cases we looked at public-private innovation programs in the construction industry and concentrated on the same four questions we had asked ourselves when studying PSIBouw. On the basis of these observations and comparisons we were able to formulate a number of general conclusions concerning the bridging of the gap between practitioners and academics.

2

Towards co-production of knowledge

The gap that exists between academic research and practical innovation is often lamented (see, e.g., Bruneel et al. 2010). This is particularly true of the social sciences, where the link between academia and the field is especially weak. '*social science ... is fast becoming a sterile academic activity, which is undertaken mostly for its own sake and in increasing isolation from a society on which it has little effect and from which it gets little appreciation*' (Flyvbjerg 2001: 166). The natural sciences (and their more applied sisters, like medicine and engineering) have been relatively successful in developing cumulative paradigms that lead to a body of knowledge with numerous practical implications. But even here we encounter what may be termed the 'knowledge paradox', that is to say, the phenomenon of publicly funded academic knowledge being insufficiently put into productive use in industry (Grosfeld et al. 2004). Even more paradoxically, the emulation of the natural sciences by social scientists has not led to a replication of this relative success but rather to the opposite, to a situation in which social science *'does not matter'* (Flyvbjerg 2001).

The present gap between theory and practice is not easily closed. Van de Ven and Johnson (2006) discuss three different ways in which the gap between theory and practice has been identified. This is an important point because different perspectives call for different remedies. Probably the most common perception is the one which holds that the gap between theory and practice is a knowledge transfer problem. New knowledge that is produced in academia needs to be translated before it can be successfully transferred to the practical situation.

A second consideration is the fact that theoretical and practical knowledge are distinct types of knowledge. They reflect different ontologies and epistemologies and are produced by different communities of professionals. Proponents of this view dismiss the idea that theoretical knowledge can be directly translated into practical applications. Both forms of knowledge are seen as valid but as representing the world in a different context and for a different purpose. In support of this view, Van de Ven and Johnson (2006: 806) note, *'the purpose of practical knowledge is knowing how to deal with the specific situations encountered in a particular case. The purpose of scientific and scholarly knowledge is knowing how to see specific situations as instances of a more general case that can be used to explain how what is done works or can be understood'*. According to this view the role of scientific knowledge is not so much for it to be applied to practical contexts, as to understand why practical solutions work (or not) so that through a process of generalization more objective and true knowledge of a class of practical problems can be generated. Van de Ven and Johnson note, however, that present-day philosophy of

science denies scientific knowledge the monopoly of objective and true knowledge. Moreover, it is doubtful whether scientists can learn lessons from the field if they remain isolated from that. *'Being in the situation – and fully referenced to it – is a prerequisite for understanding it through action'* (Van de Ven and Johnson 2006: 807). The distinction between theoretical and practical knowledge is similar to that made between basic and applied research. With regard to this latter distinction Beesley (2003: 1519) concludes that it has become *'a handicap to the emerging knowledge-based economy'*. Especially in the social sciences, progress can be seen where there is context-dependent knowledge development, in other words, where there are strong ties between what amounts to more applied and more theoretical knowledge (Flyvbjerg 2001).

However, Van de Ven and Johnson (2006) identify a third perspective: that of the co-production of knowledge between scientists and practitioners. According to them, the gap between science and practice arises from the knowledge in these two areas being produced in relative isolation. They assert that in contrast to what is propagated by the knowledge transfer view, better knowledge dissemination channels do not constitute a solution, because *'dissemination is too late if the wrong questions have been asked'* (Pettigrew 2001: S67). In contrast to the distinct types of knowledge view, Van de Ven and Johnson propose that through a process of knowledge co-production, scientists and practitioners can create knowledge that is not only relevant to the practical situation but which also contributes to the accumulation of scientific theory. It is important to note the dual purpose of the process that Van de Ven and Johnson (2006) call *'engaged scholarship'* since it is thought to be more practically relevant *and* to lead to better scientific knowledge. In other words, both the practical field and science stand to benefit. In the current literature on learning it is emphasized that new knowledge is promoted by adhering to *'appropriation within practice rather than by purely [having] cognitive attempts'* (Ibert, 2004, p. 1533). This perspective corresponds with the concept of *'Mode 2 knowledge'*, advocated by Gibbons et al. (1994) which serves to enhance the relevance and usefulness of research. Mode 2 knowledge, in contrast to the purely academic 'Mode 1 knowledge', is multi-disciplinary and aims at solving complex and relevant practical problems (Van Aken, 2005). The mission of this type of research is to develop knowledge that practitioners can use to solve problems. Researchers who aim to produce practical solutions should become *'engaged scholars'* (Van de Ven and Johnson, 2006).

Worldwide many large public-private partnerships have been launched in an attempt to stimulate the co-production of knowledge. Partnership programs are seen as solutions and as better ways of exploiting the knowledge generated within the existing knowledge infrastructure[1]. Despite the attention devoted to this in the relevant literature and despite the rise in the number of such programs throughout the world, empirical research into the actual management of such collaborative research programs has so far been limited (Corley et al. 2006).

[1] Technolopis report 2006

3

Research Design

In the spirit of grounded theory we are guided in our discussion by a general perspective rather than by a well-articulated theory. In pursuit of the ideas of engaged scholarship, the authors were actively involved in the development and management of a large public-private innovation program in the Netherlands. Van de Ven (2007) states that if social practices are generally found to be continuously created and recreated, the production of knowledge should be instigated by those involved in the dynamic process of organizational change. The researcher should collaboratively engage with users, clients, sponsors and practitioners to understand and solve complex problems (Van de Ven, 2007). As members of the scientific core team we were responsible for the scientific quality of the program and so we advised the board on the coherence of the program and its missing elements. Since we were involved from the initial phase of the program we were able to conduct a longitudinal case study. In conjunction with our internal role we were furthermore able to analyze the internal motives of the various stakeholders. We examined their reasons for wanting to collaborate as well as the barriers to cooperation. Besides carrying out an in-depth case study we studied the comparative initiatives being undertaken in various countries.

Ethnographic case study

We followed the principles of ethnography and grounded theory. Ethnographers are primarily concerned with studying, understanding and explaining human behavior and actions in their social, cultural and organizational contexts (Atkinson, 1990; Harvey and Myers, 1995; Prasad, 1997). Ethnography was adopted for two main reasons. Since we are involved in studying public-private collaborations we were particularly interested in the motives of actors to cooperate. An ethnographer 'lives' in the field for a reasonable amount of time to examine situations, meanings and actions from the point of view of the actors involved (Myers, 1999). Furthermore, in order to understand the way in which the program has evolved long-term presence is required on the part of the research team in combination with participant observation and interviews. Such an approach enables an ethnographer to capture what people say they are doing as well as what they are actually doing (Myers, 1999).

Ethnography is also criticized (Charmaz and Mitchell, 2001). The main potential problems are (1) that the researcher is overwhelmed by the huge amounts of data and (2) that the researcher is caught up in details and localized issues (Alvesson and Deetz, 2000). This often results in low-level descriptions or lists of unfocused categories (Charmaz and Mitchell, 2001, p.161) with the result that often the researcher is unable to say anything of wider theoretical significance (Alvesson and Deetz, 2000, p.77).

In order to overcome these difficulties the ethnographic method is combined with the principles of grounded theory. Grounded theory is an inductive research method that generates theory from data that has been systematically gathered and analyzed throughout the research process (Strauss and Corbin, 1998, p.12). In this approach, data collection, analysis and theory become interrelated. Charmaz and Mitchell (2001, p.160) stress that *'using grounded theory methods can streamline fieldwork and move ethnographic research toward theoretical interpretation'*.

International comparative study On the basis of the PSIBouw case study we developed a first theoretical framework that we compared with the scarce theoretical studies. This resulted in a framework of analysis that enabled us to undertake multiple case studies. We selected three international collaboration programs.

The cases selected were based on:

- The institutional context of the countries included. Western countries were chosen so that we could compare the cases.
- The scope of the programs: construction innovation
- The length, scale and experience gained with the programs

The cases selected were these:

- Finland (various programs)
- EPSRC construction programs in the United Kingdom
- The CRC program for innovation (Australia)

4

The Case of PSIbouw

The Dutch PSIBouw program, with its 34-million-euro budget, was known as a BSIK program and it was aimed at creating a sustainable knowledge infrastructure that was designed to have a positive impact on the economy and on society. PSIBouw is a network of construction firms, research institutes and engineering firms. Numerous committees, advisory boards and scientific reports have, in the past, proposed cultural, institutional and market changes within the industry but, until the turn of the century, none of these initiatives could be said to have had any significant impact. It was this realization that led to the establishment of the PSIB-Commission. PSIB, which later came to be known as PSIBouw, stands for Process and System Innovation in the Construction Industry. PSIBouw brings together all the major stakeholders in the Dutch construction industry: clients, contractors, suppliers, consultants and academics. The need for such an initiative was also supported by the outcome of the Parliamentary Inquiry on collusive tender practices. PSIBouw evolved from a process of trial and error. In its early phases PSIBouw could be characterized as a loosely-knit consortium that was occupied with the writing of a proposal that was ultimately submitted during the BSIK tendering procedure. The research proposal was predominantly compiled by academics and consultants.

PSIBouw had four key objectives:

- **to improve the socio-economic benefits for society**
- **to increase the added value for clients and other stakeholders**
- **to augment the profitability of the industry**
- **to stimulate innovation**

From the very beginning PSIBouw has struggled to strike a balance between theory and practice. The original proposal was criticized by the industrial sector for placing too much emphasis on scientific research. In the end, it was a more demand-driven and top-down structured program that was proposed and finally developed. The industry wanted to steer the program. The idea was that the industrialists would set the agenda and the researchers would then realize it. However, the focus was on quick wins which was not conducive to finding innovative and sustainable solutions. Moreover, the approach only widened the gap between academia and practitioners. It soon became apparent that a new approach was needed.

The final program was therefore the result of an iterative process. Following numerous discussions within PSIBouw and outside the organization as well, various scenarios were developed pertaining to the future of the construction industry. These scenarios related not so much to rigid future situations but more to plausible and wished for future scenarios. They give direction but are continuously adapted in the light of new insight and knowledge. A set of themes was subsequently developed by the board, the project office and the scientific core team. These themes were based on the debates that had been carried out on issues relating to policy, society and practice. For each specific theme a concrete community was organized consisting of leading academics and industrial frontrunners. These practically oriented communities are furthermore responsible for developing a research agenda and stimulating proposals for innovative research projects and experiments in the field. The research proposals are always evaluated by the scientific core team for their scientific quality and innovative content whilst the project team assesses their practical value and financial soundness. The scientific quality evaluation is based on a blind peer review system (involving two referees). The scientific core team and the project office also safeguard the cohesion of projects and, where possible, establish links between projects and experiments. In a bid to meet future targets, project managers meet with the project office staff on a regular basis to discuss the various results and their contribution to the overall mission of the program.

4.1 Bridging the gap between practitioners and academics at project level:

On the basis of our evaluation there are three key factors that can be distinguished: motivation, cultural differences and different time horizons.

The intrinsic motivation of academics and practitioners A first important lesson that was learnt from the case study was that both parties need to acknowledge the clear benefits of collaboration. Academics and practitioners should always start from a joint problem perception point.

Many researchers are not very open to collaboration with businesses. Collaboration is often seen as a way of funding research rather than improving quality and ensuring that the results are more relevant. According to Lee (1996), in the nineties most academics still feared that close cooperation with business would interfere with the freedom to pursue long-term, unbiased, fundamental research. Although this attitude may have become less pronounced in recent times, scientists are still working within organizations that often emanate marked ambivalence towards more practically oriented activities. The situation may be summarized as follows: universities are glad to receive the funding generated by research done in collaboration with the business sector but individual researchers are rarely rewarded in the way that colleagues engaged in more fundamental work are rewarded. In other words, changes are needed both at institutional and individual level. From the point of view of companies the enthusiasm felt for working with scientists is often half-hearted at best. Noorderhaven and Dewulf (2007) noted that building up a relationship-based network of scientists and practitioners at PSIBouw is difficult because of the skepticism of construction practitioners and the lack of a learning mentality. Even if funds and employees are devoted to a collaborative project, there is always the risk that one or both of these components will be withdrawn before the project is concluded. This is particularly true of employees, and perhaps more so in the construction industry than elsewhere, as the planning of activities and manpower is more difficult in this project-based industry. However, if the changes made in the composition of a research team are too frequent this will undermine the principles of engaged scholarship.

This corresponds to the recommendation made by Van de Ven and Johnson (2006) to the effect that the research project should be designed to address a *'big question or problem that is grounded in reality'*. In essence this means that the research agenda is not primarily dictated by the trajectory of theoretical development but rather by the problems experienced by practitioners. This does not mean that researchers should simply ask practitioners to define the problems to be studied. It is only when practitioners meet with their problems and researchers are confronted with their theoretical agendas that interesting and relevant problems can be defined.

Cultural differences Affiliated to this point are the cultural differences that exist between scientists and practitioners. The research project should be designed to embrace a collaborative learning community (Van de Ven and Johnson 2006: 811). This means that the research team should consist both of members who are relative insiders familiar with the practical setting in which the problem studied is experienced and members who are relative outsiders to that setting. With this approach, organizations are not seen as *'data collection sites and funding sources'*, but rather as bodies providing *'a learning workplace (idea factory) where practitioners and scholars co-produce knowledge'* (Van de Ven and Johnson 2006: 809). Based on a case study conducted within the microelectronics industry in Italy, Balconi and Laboranti (2006) confirm the value, also for scientific performance, of face-to-face knowledge exchange between academic researchers and researchers from industry. A similar conclusion is drawn by Ayas and Zeniuk (2001) based on their study into project-based learning which was carried out at Ford and Fokker. In these two firms genuine partnerships were created between academics and project team leaders thus enabling practitioners to develop learning capabilities that *'transcended the boundaries of specific projects'*. Understanding the language of practitioners is important if the gap between science and practice is to be bridged.

Time horizon Both factors are connected to yet a third factor, namely the time horizon. During the PSIBouw program there was clear tension between scoring quick wins and doing fundamental work leading towards innovative PSIBouw solutions.

Noorderhaven and Dewulf (2007) drew attention to the tension that exists between quick wins on the one hand and fundamental and innovative studies on the other hand. Scientific research is a long-term process but companies, particularly construction companies, want to have quick solutions. The PSIBouw Program Office often also emphasized the importance of securing quick wins in order to demonstrate the value of the program to the sector. Though this is understandable, a program consisting of too many quick wins will fail to make a fundamental contribution and it will become more difficult to retain the interest of scholars.

All in all, and in spite of some examples of successful engaged scholarship, the practice within PSIBouw has not lived up to the ideal. The relationships between scientists and practitioners have too often remained *'collaborations of convenience'* (Bammer 2008), formed exclusively by the constraints connected to the funding.

The forming of long-term relationships between partners is a necessary precondition for learning processes (Ibert, 2004). Building the trust and personal relations necessary for collaborative research takes time. According to Van de Ven and Johnson (2006: 813), openness and diffusion seldom occur until a sufficient number of interactions over time have occurred for participants to come to know and trust one another, . It therefore takes time to develop engaged scholarship . A clear example is the development of the partnership between MIT and Ford that was studied by Ayas and Zeniuk (2001, p. 74). At first the Ford project manager was very skeptical about *'having a bunch of academics come in and mess around with his business'* but his attitude changed dramatically during the process. To this argument may be added the expectation that collaborative research teams dealing with complex practical issues may require more time to experiment with several approaches and possible explanations, before arriving at a deep understanding of the problem being studied.

Another problem is the time span of a PhD study which normally takes four years in the Netherlands. There is clear tension between this and the industrial demand for short-term solutions.

4.2 Developing a joint collaborative program

Before a joint collaborative program can be developed there must be commitment concerning the content and scope of the program. Besides this, the program organization, researchers and team members involved have to create legitimate authority and be flexible in their approach.

Developing commitment concerning the content and scope of the program

PSIBouw bears all the characteristics of a broad research agenda founded upon consensus between the many different parties involved. One might see this as a true Dutch tradition and something that is comparable to the communicative or community planning approaches adopted in urban planning (see e.g. Healey, 2006). *'Process and system innovation'* is not a very restricted definition of the field of inquiry, and 'construction' is a very broad area of application. There were therefore few occasions when a potential project was rejected because it did not correspond with the program definition (any rejections were most likely to be linked to the proposed solution not being innovative enough). The vague and wide barriers of the program are essentially understandable. Because PSIBouw wanted to be a program for the whole sector the interests of all the parties concerned had to be served. However, it would seem that a program with narrower scope would have been able to make the effects more clear. In the case of PSIBouw this is rather difficult, as the efforts have been so widely dispersed.

There seems to have been a certain degree of tension between arriving at a top-down and a bottom-up definition of the research program at PSIBouw. There was strong pressure not to discourage the participation of sectors or categories of participants (e.g. various professions). Wherever possible initiatives were therefore accommodated within the program. However, it is clear that such a practice could easily compromise the coherence of the program. From time to time there were spates of more top-down attempts to define or redefine the program. The combination of these two forces and episodes led to a rather diverse and relatively unfocused program. Moreover, the focus of the program changed due to pressure being exerted from the Regieraad Bouw. The unclear focus was the major criticism leveled by the Committee of Wise Men that constituted the review panel.

Creating legitimate authority

When analyzing risky, early stage and complex technology partnerships Vonortas and Spivack (2006) observed that these collaborations demand an optimum degree of central authority. Too much central authority or too little central authority leads to problems. In cases where the central leadership is too strong, members of the collaborative body will feel left out of the decision-making process and will thus perceive the power distribution to be unfair. In other situations where there was a lack of central leadership Vonortas and Spivack (2006) observed that this initially led to a heavy administrative burden for all participants but that later on in the program it led to the power being concentrated among a few participants. This led in turn to the same kind of dissatisfaction with the decision process as that described in the cases characterized by centralized leadership from the very beginning.

PSIBouw is not completely comparable with these technological partnerships but certain analogies may be drawn. We have already sketched the tension between top-down (centralized) and bottom-up (decentralized) decision making within PSIBouw. Here we will concentrate on the matter of the type of central leadership that PSIBouw had and how effective it was. The PSIBouw Board clearly forms the most obvious nucleus of legitimate power within the PSIBouw constellation. The Board consists of esteemed practitioners who combine the position of power that accompanies their Board membership with expert and referent power, to use the terminology of French and Raven (1960). But the same factors that give the Board its inherent strength also constitute its weakness. Because these individuals were all experienced and well-known practitioners, the amount of time that they could devote to PSIBouw was limited. As a result, the power of the Board was largely wielded through the authorization of proposals developed by the Program Office and, to a more limited extent, by the Scientific Core Team (in Dutch: Wetenschappelijk Kern Team, or WKT).

In relative terms the Program Office lacked referent power, even though it consisted of seasoned practitioners. The authority of the Program Office was predominantly based on the power to decide over resources (reward power), subject to approval by the Board. Over the course of time, the Program Office also accumulated considerable expertise in the field of change management, thus increasing its power basis. However, the expertise of the Program Office, as well as that of the Board, did not extend to the scientific domain so making it difficult for either of the two bodies to exercise legitimate authority over the complete PSIBouw network, (i.e., including the research division). According to our assessment the WKT did have expert power and legitimacy within its own domain but not in the practical domain. Within the PSIBouw constellation the WKT lacked position power, in spite of its somewhat grand task description.

The picture that emerges from this analysis is that of a program which lacked authoritative central management, in spite of the efforts and good intentions of the Board, Program Office and WKT. Alternatively, in the words of Scharpf (1998), there might be said to be a lack of input and output-legitimacy. Input-legitimacy has to do with the extent to which decisions reflect the will of the public or, in the case of PSIBouw, the sector. Input-legitimacy proved to be hard to achieve since it was and still is unclear who the sector is and who represents it. The second form of legitimacy refers to the legitimacy of the results and products and to the opinions that the key stakeholders have about these products. In general, it could be concluded that the stakeholders in the sector were skeptical about the achievements of PSIBouw.

There were three main reasons for this:

- for most outsiders the decision-making process remained something of a black-box;
- there were a large number of stakeholders and their interests were too diverse;
- the communication level could have been substantially improved.

What probably also partly accounted for the lack of authoritative central management was the continuously shifting balance between top-down and bottom-up decision making described above. In this respect our assessment of PSIBouw cannot therefore be entirely positive. In a future program a possible option might be to have a management team heading the Program Office that consists of both experienced and esteemed practitioners (e.g., people who have recently retired) and similar counterparts from academia. With such a setup the Board could more safely step back, play a modest role and give precedence to the Program Office when drafting its strategy. Likewise, with such a set-up, the WKT would also have less reason to become involved in strategic discussions and could thus have a more restricted but nonetheless vitally important role in guaranteeing scientific quality.

Developing flexibility When assessing how PSIBouw had evolved Noorderhaven and Dewulf (2007) concluded that a program built on communities and practice-based networks needed a kind of structure that would afford considerable flexibility. It is impossible to ex ante design such a program in any detail as nobody can predict what will, in practice, become the most successful communities and in what direction they will go. The PSIBouw program management system has indeed proven to be flexible, as demonstrated by the various fundamental changes made in both the program and the management structure itself. The price of such flexibility is that it has been a considerable burden because of the discussions and debates entailed in various forums. Nevertheless, we can safely say that also in this respect PSIBouw has been successful.

At the same time, though, PSIBouw had to operate within an administrative system dictated by the conditions of the BSIK scheme which might be said to be founded on institutionalized distrust. As a result, even though the Program Office and other branches of the PSIBouw group practiced flexibility, that same flexibility was forced to take place within a framework of rather rigid rules. The Program Office should be applauded for having largely succeeded in removing the burden of having to comply with such rigid rules from the shoulders of project participants. Despite everything it seems opportune to assert that a truly innovative program (and that is what PSIBouw aspired to be) is not well served by having a regime of up-front definitions of end results accompanied by the strict controlling of activities in the way dictated by the BSIK regulations.

However, it should also be stated that many academics and practitioners criticized PSIBouw for its unclear decision-making process.

5

An evaluation of three international cases

The previous chapter revealed the lessons learnt from the Dutch collaborative program known as PSIBouw. These lessons were consolidated in an inductive way. We tested our findings alongside theoretical insight. This resulted in various initiatives that either enabled or hampered engaged scholarship.

The next step was to compare these findings with the internationally learnt lessons. As stated in the introduction, many collaborative programs can be found worldwide but little ex post evaluations can be found.

We selected three countries with a long tradition of collaboration between practitioners and scientists. Written material was analyzed in order to reconstruct the background and the contexts of the various cases. Since we were interested in the 'engagement' of both academia and practitioners, and more particularly in the motives and interests of the various actors, interviews were conducted with both sides. An open way of questioning was adopted since we wanted to understand the specific context of the programs and the way in which the programs had been developed.

The following framework was used to analyze the cases:

- Program description and background
- Bridging of the gap between practitioners and academics at project level
- Developing a joint collaboration program

The following cases were studied:

- The TEKES program Finland
- The CRC for innovation (Australia)
- The EPSRC centers in Loughborough and Salford (UK)

The level of analysis differed per case. In practice, it proved to be difficult to arrange interviews with people in industry. In the cases of TEKES and Loughborough we did not have the opportunity to meet representatives from industry.

5.1 TEKES Finland

As in many countries in Europe, Finnish universities and other research institutes, like for instance VTT, are struggling because the level of direct funding is decreasing. Competition is growing more fierce. Increasingly research projects are being tendered out. TEKES is the largest funder of research institutes in Finland. We therefore focused on the funding provided by this agency.

Program Description TEKES receives lump-sum funding but has to report to the Ministry of Labor and Industry. This would indicate that generating competitive advantage within the Finnish industrial sector is the primary aim of the TEKES programs. Many respondents stated that Finland is too small to focus on the internal market and that therefore the programs should focus on competing internationally. Although the interest of businesses remains the prime focus, the impact that TEKES's funding has on the industry has not really been measured.

TEKES operates at the points where public and private but also basic research and business development intersect. It not only provides funding but also services, some of which are free, while certain other services are offered at cost price. Services are either delivered by TEKES staff or by third parties. TEKES organizes various other activities such as workshops and seminars.

Fifty percent of the TEKES budget is tied up in specific programs. A distinction is made between research projects and company projects.

Example: The Sustainable Community Research Program

This program started in 2007 and will continue until 2012. The total sum put aside for this program is 100 million euros). In total, 24 research projects have been started. Sixty percent of the project budget is funded by TEKES, 15% by industry and 25% is obtained in the form of matching grants offered by the different research institutes.

The aim of the program is:

1 to stimulate green technology. 'Change is a business opportunity not a threat'
2 to kick-start the development of markets, as every firm believed: 'green technology does not sell' and that led to a lack of demand and thus a lack of supply

The key drivers of the program are the impact of climate change, health, and ageing.

In practice, consortia of research institutes were asked to come up with proposals. In the first round 75 project ideas were submitted. At that stage no formal commitment from industry was required. The input of academics was important. Research projects should target more than one of the program's sub fields.

In the end 26 projects, 20 of which were research projects, were selected.

Bridging the gap between practitioners and academics at project level Collaboration between companies, research groups and the public sector is one of the outcomes that is appreciated but it was not explicitly a goal of any of the programs. Companies are represented in councils within research projects and consequently exert influence on the content and focus of all the respective projects. This is not, however, the case with company projects.

Companies can do projects in-house and can gain subsidies for up to 50% of the total funding. Other programs prescribe collaboration. Company funding may amount to as little as 10% of the project costs but at least that shows that the companies have a degree of interest (companies MUST put some cash on the table, that cannot be completely subsidized). Large corporations *have to* collaborate, SMEs can do it all alone.

A major facilitator of cooperation between industries and research institutes in Finland is the small-scale nature of the network. Everybody knows each other. This was a fact that was acknowledged by all the interviewees. 'The biggest asset is that we know people. (...) The vice chancellor of Helsinki University of Technology and the director of VTT studied the same subject at university and were in the same year. Informal networks are important. Strategy is developed in this way.'

Developing a joint collaborative program We make a distinction between the development of the strategic TEKES program and the way in which specific programs develop.

The strategic report published by TEKES was developed for a 4-year term. The program was developed together with stakeholders from the academic world, the practical field and government. In general, the discussions at TEKES start internally and are of an open nature. Of course there is always some 'conflict and lobbying', as the TEKES respondents verified but the culture at TEKES is to keep things open-ended and broad-minded. Ideas are based on initiatives launched by TEKES. The customer groups and focal areas are defined. The second step is to discuss the strategic agenda with individuals within academia, market players and government agencies. Finally, a board decision is then taken.

Regular strategic discussions take place (three to four times a year) with the different academic and industrial parties,. According to respondents from the various universities and from the work floor, the construction industry is not well represented within TEKES. There is a lot of lobbying from industry but the amount of lobbying coming from the construction industry is poor. One academic stated that 'In some sectors there are professional lobbyers and full-time researchers at the firm's top but not in the construction sector. The building industry is geared to influencing the government in terms of what is to be built etcetera but not in terms of what needs to be researched.'

In the last few years Strategic Centers for Science, Technology and Innovation (SHOK) have emerged. According to several interviewees, the SHOKS initiative came from industry and government in reaction to the dominance of TEKES. It was the government that decided to launch these centers and TEKES is financing them (at program level but is not examining individual projects). Strategic centers are based on 'business ecosystems' and are collaborative programs between companies, universities, VTT and TEKES. The governance structure is lean and mean, mostly comprising a research director and an operational director. Support services tend to be outsourced.

Companies are willing to invest in order to:

- Improve the speed and effectiveness of their innovation activities
- Ensure that they are able to participate in determining the needs

In 2009 the following two programs were in operation:

- The first program in the Forest cluster
- The information and communication industry (TIVIT OY) program

And by then two centers had been approved:

- Metal products and mechanical engineering
- Energy and the environment

At the time of the interviews two other centers were being planned, for health and for the built environment.

SHOK on the built environment

SHOK on the built environment was not originally on the list of centers to be approved.
According to one person that actually had a positive influence, 'as it brought together the various players in the construction sector, otherwise they would probably have disagreed among themselves even more'.
Industry trading associations took the lead. Forty-eight organizations have agreed to become shareholders (the initial sum required to buy themselves in lies between 20,000 and 100,000 euros; after that about 10% of the initial amount is required to pay for administrative costs).
TEKES will probably fund about 5 mln. The total budget is approximately 40 million euros.
Free riders cannot participate.
Some 200 people from industry were involved in the research program development.

The center's main areas of interest are these:

- The space and the premises required to meet user requirements
- Competitive community infrastructure (life cycle management, community planning)
- Innovative processes and building information modeling
- Energy efficiency

Two types of projects have been distinguished:

- Public projects (60% funded by TEKES)
- Private projects (40% funded by TEKES)

In spite of the recession, construction firms are now stepping in to help. They know that they will have to do something, even if that is only to retain their present positions. And today they are more willing to spend because now, with the center, they will have more influence, according to one respondent. It has been difficult to get the universities involved in Shok.

Regarding legitimate authority, we could say that with SHOK in practice it was a very small group took the decision. At the time of the study only 8 people were involved. In future it will probably be the organization's Board, consisting of approximately 11 people, that will be involved.

5.2 Australia

In Australia we had the chance to meet up with academics and with representatives from industry. We were therefore able to make a good analysis of the how the program and the co-production of knowledge is developing. We focused on the CRC program for Construction Innovation. The National CRC funds are aimed a) at generating applied research outcomes and b) at ensuring that improved levels of engagement develop between industry and research. The CRC for Construction Innovation is one of the 12 CRC centers to have been approved in the year 2000.

Program Description In 2001, the CRC (Cooperative Research Centre for Construction Innovation) model introduced the building and infrastructure sector to a new culture of cooperation and engagement between industry, government and research. Through its professionally coordinated research program and its roll out to the industry, the CRC for Construction Innovation succeeded in gaining the sector's confidence in this model at a critical time. It is now entering a phase in which the capacity for government research is being reduced but the industry is also being confronted with massive growth and transformation.

The main topics CRC Construction Innovation is concentrating on are:

- Sustainability - changing industry behavior
- Digital modeling - integrated systems
- Safety - committed to implementation
- Infrastructure - improving processes
- Procurement - supporting business processes

Drivers and barriers to co-production CRC is driven by the industrial sector. The majority of the members on the CRC board are drawn from industry. Project proposals need to have the majority approval of industrial representatives. One industrial leader stated that thanks to such involvement, the construction industry had become more proactive.

According to the CRC program management body the reasons why industry wishes to participate are these:

- To have their own projects
- To be part of a network
- In the interests of marketing

The key incentives for universities are:

- To secure a leadership position in their field
- To benefit from significant research funding
- To train up junior researchers

The CRC (i.e. for Construction Innovation), had a significant impact on the university with a key role in the program, Queensland University of Technology. The CRC program makes it much easier for some certain to contact industry but the faculty has not changed across the board. Mostly CRC is a conduit for younger researchers 'to cut their teeth'. In terms of high-profile outcomes, other contacts (bilateral) are more important. The direct contacts with companies are more focused.

However, industry's self-interest and lack of time have played a major role. The attitude of industry is that it first wants the validity of an innovation to be proved.

The motivation of academics is also criticized. According to civil servants, the different agendas of academia and Public Works constitutes one of the main impediments. Public Works is not bureaucratic at all, but the university (QUT) is very rule-driven, especially at central university level. At faculty level that is better. Moreover, civil servants at Public Works are motivated to be involved in this type of research:

- Because of their intrinsic interest in the topics
- Because that is the role that is expected and demanded from PW
- As there is 'a sense of public good' attached to such research
- As they find it personally and professionally rewarding

According to some civil servants, Public Works participated in the CRC because they do not have the time or the manpower to carry out such research independently. The actual level of participation entered into in the CRC is an awkward issue. Engagement costs time. One interviewee stated that it was hard for them to get involved because his department had been downsized and so they had to prioritize and decide where their energy should be channeled.

- **'It's the networking which is crucial, within or outside of the CRC.'**
- **'When we work with academics it takes us a lot of time to teach them, to make them know what we as practitioners know. Universities are moving away from us, infra is not seen as sexy stuff. Our projects are often too small for a PhD project.'**
- **'We have to do more networking with academia, set the agenda. Ten years ago we didn't have many graduates, so we lost the contacts. Road design is not taught at universities anymore. We now do more, fund students, etc.'**
- **'Involvement in a scheme like CRC is a way for MR to become more attractive as an employer. But a program like the CRC needs to meet the demands of the various players, not only the academics.'**
- **'It was difficult for MR to get qualified employees; at the moment it is easier because of the financial crisis. People do not work for MR because of the money; they come for other reasons.'**
- **'Co-production of knowledge is important but, in the end, the results also need to be communicated in the right way.'**

Citations from interviewees about the gap between practice and the academic world

We also pinpointed some clear cultural differences between industry and academia. The personalities involved play an important part. In each case the project leader has to develop a 'we' feeling within the project team. It was found that frequently insufficient attention is given to cultural change. Implementation requires different types of skills and capacities from those required for research, all of which may necessitate a project change among leaders.

One interviewee compared the differences in culture to a 'tribal mentality': there is still a bit of 'them and us' in the commercial and the other sections of PW. According to this individual, practitioners and academics do not operate as a team. What is important is building trust. 'CRC doesn't look at that. You may not meet again for 14 months. It's important to get discussions out of the boardroom and into a more relaxed environment.' Another person alluded to 'dry gullies', in other words, to the fact that in research there will always be activities that have no concrete outcomes and this has to be accepted. On the other hand, industry has to apply more discipline, without being stifling. 'Research struggles in a commercial environment'. Another interviewee stressed that you have to be careful with regard to conflicts of interest: what do you want to achieve? Putting research findings into practice is a project in itself. The CRC aims to bridge the gap between research and practitioners but also between policy and research. According to one key civil servant there is still a big divide between the Department of Main Roads on one side and CRC/QUT on the other side. The CRC is seen as a research institute.

The Public Works interviewees denied the 'small-state effect' (in contrast to what we were told in Finland). Nevertheless, there are quite strong boundaries between different groups within the government and within society. The government is expecting more system-oriented, cross-disciplinary work from the universities. CRCs influence the agenda of universities. Universities are driven to find commercial outcomes.

Developing a joint collaborative program The Australian market is very fragmented. Leighton (Hochtief) is the dominant contractor in Australia. But the market consists mainly of SME's. There are about 200,000 SMEs (which means that 14 % of all the enterprises in Australia) are working in the construction industry. It is quite difficult to keep the industry and especially SMEs engaged. A lot of communication now goes via the internet and e-mails.

Companies participating in the CRC have to contribute in cash and in kind. SMEs cost anything from 50,000 Aus. $ cash and 50,000 Aus. $ in kind per year, up to 500,000 Aus. $ cash and 500,000 Aus. $ in kind per year.

If the CRC were discontinued (as actually happened) the university would lose some funds and coordination but, according to university staff, 'would gain in terms of [reduced] complexity'. The majority of the research would be continued, even without the help of the CRC, probably on a smaller scale and in a less complicated way. The CRC center is at arm's length from the university. It is almost an external funding body.

Government agencies were also involved. Public Works Queensland was heavily involved in setting the agenda for the first bid. Public Works put in 14 proposals to the CRC. The commitment of Public Works to the program was initially based on the notion that that would be good for the State and for the industry. One example of this was a project that was designed to improve the documentation involved in construction projects.

According to some stakeholders, the Australian industry is becoming a bit more mature in the sense of not necessarily wanting instant quid-pro-quo for the money invested in the program. 'The industry is starting to see the benefits of sharing information and to spend less time competing.'

As the program was being developed some changes were made. At first the CRC CI thought that researchers would play an important role in dissemination but that was not how it worked. In the recent years media specialists and science communicators were also involved. The CRC also has educated industry on the matter of research and, according to one of the stakeholders interviewed, that has helped 'to remove some of the mystique surrounding research'.

A valuable legacy of the CRC has been the formation of the Australian Sustainable Built Environment Council. The ASBEC is all about 'reducing ecological impact, improving economic returns and extending community amenity of the built environment'. The ABEC is evolving to undoubtedly become the leading consultative council on sustainability.

The CRC has functioned like a testing ground. More attention should now be paid to the implementation of products and approaches. The CRC was not focused enough on the importance of the implementation of the results of the program. Some stakeholders, like for example Public Works, pushed the CRC CI to put more emphasis on dissemination. This is crucial for the CRC's credibility, more to the point, it is the reason for the CRC's existence in the first place.

To the academic world the CRC does not have great legitimacy. ARC grants give a researcher status but the CRC grants do not. In the construction business the CRC is accepted because ARC does not really cover that. The legitimacy on the academic side is also criticized by some academics who claim that 'Within CRC there is enough freedom to do interesting academic research.'

Several stakeholders mentioned that people working in industry know about CRC. They are now waiting for the results. It is more of a research center than an authority within the industry.

5.3 ESRC/EPSRC Centers in the UK

The UK has a long tradition of industry-university research initiatives funded by the two main British research councils, the Economic and Social Research Council (ESRC) and the Engineering and Physical Sciences Research Council (EPSRC). Some of those consortia stipulate in their proposal selection criteria that each project team has to include members who represent university departments and at least one of the industrial partners. The review panels consist of leading academics and practitioners (Van de Ven, 2007). Launched in 2001, the Innovative Manufacturing Research Centre (IMRC) program provides a focal point for research excellence, to actively collaborate with UK businesses, to facilitate knowledge transfer and the exploitation of research results and to in this way make a vital collective contribution to the future of the UK economy and society. We therefore analyzed two major EPSRC centers that focus on construction: the Innovative Manufacturing and Construction Center (IMCRC) in Loughborough and the Salford IMRC Center for Research and Innovation in the Built and Human Environment.

The people we interviewed informed us that there had been an evaluation in the 1990s. When the IMRC centers were first initiated 80% of the funding was allocated to a limited number of universities in a ten-year program. Later on this policy changed so that the programs were reduced to five years and more universities were involved.

A national debate is continuing on the future of EPSRC centers. It is argued that they should focus more on certain themes but according to some interviewees this would bring with it high transaction costs.

5.3.1 The IMCRC Loughborough

The Loughborough University Innovative Manufacturing and Construction Research Centre (IMCRC) is one of sixteen UK-based Innovative Manufacturing Research Centers funded by the EPSRC. According to the relevant website the Loughborough Center is the largest of the EPSRC-funded centers in terms of the number of academics involved, the size of its grant and the breadth of the work undertaken.

Program description The Centre covers a range of research issues pertaining to design, processes and materials, business and management. The sphere of interest even extends to manufacturing, construction, systems engineering and computer science. Many of the projects bring together academics from different areas in their desire to investigate various problems. Such cross-disciplinary research is a major advantage in such a large center (www.lboro.ac.uk).

The program that started in 2001 had a total budget of 16 million pounds for a period of five years. In 2006 a second term was approved and a further 16 million euros was allocated.

Bridging the gap between practitioners and academia at project level One of the main purposes of the IMRC and IMCRC centers is to bridge the gap between science and practice. One way to engage practitioners and to get academia to cooperate is by requesting that all projects have a 50% matching profile (in kind or in cash; but mostly in kind). If academics are to be stimulated to engage in the centers it is important to implement various incentives. As one interviewee stated: 'Academics follow the rules! If the rule prescribes that you have to get a hairdresser involved, they will do that.'

To bridge the gap between academics and practice, academics are encouraged to submit joint applications.

Most of the involvement of practitioners takes the form of in-kind contribution. Many PhD researchers are involved in practice but the involvement of practitioners is mainly confined to advisory board membership, participation in workshops and debates, etcetera.

According to the academics we spoke to the following critical success factors can be distinguished:

1 Past experience between partners. Some parties have worked closely together in the past.
2 Industry pull projects tend to be more successful than academic push projects

Developing a joint collaborative program People in industry play an important role in the governance structure of IMRC. The steering committee consists of people drawn from the industrial sector. They have to approve projects. All the projects undertaken were reviewed by industry. If an academic submits a proposal he needs the support of industry beforehand but that is still no guarantee that the steering committee will approve the proposal.

According to the interviewees, IMCRC has a high academic bias. IMCRC was successful in achieving a second round of funding partly on the grounds of its long historical tradition of cooperation with industry.

It is unclear what the future requirements of EPSRC will entail. EPSRC wants IMRC to make its impact felt but that is hard to do. One reason for this is because the EPSRC itself has to prove its impact to the relevant administrative body. Centers are pushed to reposition themselves for the period after 2011.

5.3.2 The Salford Center for Research and Innovation

The Salford Center for Research and Innovation was formed in 2002 and was given a total budget of £ 2.95 million for 5 years. That contract was renewed in January 2007 for a further five years and the allowance was £ 4.94 million. The Center incorporates three schools relating to: the Built Environment, Art and Design, and Computing Sciences and Engineering.

> **The vision of SCRI** To have a construction industry that is highly valued by society.
> **Mission** To become a leading multidisciplinary center in the built and human environment nationally and internationally, in order to support a construction industry that is valued by society.

Program description SCRI has a leading role in CIB, in Construction Revaluation, in Lean Construction and within the International Alliance for Interoperability. According to the interviewees, SCRI should move from being a nationally leading organization to being internationally competitive.

SCRI has recently redefined its focus so that it now concentrates on these four themes:

- Realizing value in use
- Procuring value
- Seamless Delivery
- Research exploitation

Some of the important fields of interest at the center are:

- Asset management (with the nuclear group and the Highways Agency)
- Procuring value (many successful projects with local communities)
- Building Information Models

Bridging the gap between academia and practice at project level According to one of the interviewees, past experience is important when it comes to the matter of getting people involved. 'Humans act as 'vectors' taking the information that they really understand [from having been involved in the research process] and applying it to different situations'. People on both sides have to be interested in cooperation. Normally this is only possible in relation to specific topics. Engagement has to do with social aspects.

'It's all action research, it's about intervention'.

A specific form of co-production is to be found in the Knowledge Transfer Partnership domain (60% funding and 40% from the organization itself). These partnerships have limited budgets so that knowledge transfer on strategic issues can be stimulated between universities and practitioners. Within these Knowledge Transfer Partnerships existing products are improved and new products are developed. The marketing strategies required to enter new markets are developed. These activities are more or less consultancy activities.

According to practitioners, KTPs have two clear impacts:

- To give rise to direct savings emanating from improved processes in the first years of operation;
- To generate, in the long run, increased profits.

The importance of maintaining strong relations with local businesses is also stressed:
'things come about organically, because you are involved'
One leading academic stated that the people involved are:
'just individuals. Bringing researchers and practitioners together, allows them time for socializing, etc.'

Several academics noted some clear cultural differences with industry. One academic said: 'It is very constraining, you can only sell what industry understands, leading-edge research is not being done'. What is important is to build a sense of community between companies and universities. Firms are not keen to develop new ideas. Moreover, 'A special pitfall in the UK is the association of construction with the social sciences, rather than being a technical discipline'. Other critical statements are:

> *'You need organic communities, not big schemes'*
> *'Industry just wants to have something to put on the desk, they don't want to know about the underlying theories etc.'*
> *'Construction is not a discipline in itself, researchers have to go to the disciplinary conferences'*

Developing a joint collaborative program The EPSRC Centre has a budget of £ 4.9 million (full economy costs and EPSRC covers 75% of that). A hundred percent of the funding comes from EPSRC but they have 'promised' that an extra 50% funding (in kind or in cash) will come from industry though that is not mandatory.

At the start, there was no letter of support from the industrial partners. This was not requested by EPSRC. The aim in the center's second round is to deliver 'value'. However, the center is primarily evaluated on (scientific) output; not on the impact it has on society.

In the center's first years a kind of sequence was followed: 'First we started with activities, then we defined themes; then we concentrated on projects and finally on the sector'. The Centre was worried that after five years they were not making enough difference to the sector. In the first period the basic precept had been to focus on academic research and so the Centre had tried to find projects that corresponded to the research being conducted by academics. Nowadays projects and themes are defined by industry and research is very practically oriented. The driver is:

LET'S MAKE AN IMPACT.

The topics dealt with are the result of debate with the field (the demand side) alongside own quality (i.e. being supply driven)

Collaboration with other universities is often difficult due to the great bureaucratic or administrative load.

National platforms between industry and science are important but money is important for making a difference

The identification of activities is carried out by the management committee in consultation with the Research and Steering Committees. The decision to fund a project is based on the assumption that *'an idea is valid and offers a novel contribution to the research community'* (year report 2009).

The following success factors for cooperation/programs were mentioned:

- Limited scale
- Strong social relations (team)

The success factors are as hard to define as those which exist within PSIBouw. The university business collaboration side is not yet very well developed. The SCRI Forum organizes participatory workshops between industry and academics through breakout sessions and networking. The Forum includes a mix of speakers from academic circles and industry. Approximately two-thirds of the people who attend are from industry.

One problem discussed during our visit was the fact that companies often do not want to pay for research if the results are for the public good. One leading academic recommended 'make the point that being involved in the research process is what counts; the tacit knowledge they get out of it'. The interviewees agreed that industrial engagement only seems feasible with dedicated topics or where the themes are broad, high-level and high-profile (and that they learn from that 'by osmosis').

One clear example of company engagement is demonstrated by Sellafield. According to the people of Salford Sellafield has a long-term perspective (because of the nuclear business); this makes it easier to collaborate with researchers. They have also worked with the same team of researchers for eight years. At the beginning they had very different ideas but over the course of time they have moved towards a shared perspective.

6

Conclusions and reflections

In this project we examined in some detail the way in which PSIBouw operates as a public-private innovation program and we paid particular attention to how the program serves as to bridge the gap between the academic and practical worlds. We also questioned to what extent the proclaimed ideal of engaged scholarship has been realized. We specifically tried to answer the following four questions:

- How is the gap between practitioners and academics bridged at project research level?
- How are joint collaborative programs developed?
- How is the legitimate authority of the program's leaders ascertained?
- How is flexibility created within the program?

We first focused on our own experiences and observations within PSIBouw. After that we made study trips to three countries (Finland, Australia and the UK) in an endeavor to find answers to the four questions relating to major programs concerning construction innovation situations that are comparable to that of PSIBouw.

6.1 PSIBouw

Bridging the gap between practitioners and academics at project level

Within PSIBouw the aim to bridge the gap between practitioners and academics was an important one but precise ideas on how to realize that goal only developed over the course of time. The program was virtually half completed when the concept of engaged scholarship was finally adopted as the model of choice. A major drawback was therefore the fact that by then most of the project funds had already been allocated, so there was little opportunity to use project funding as a mechanism to further engage scholars. The best tactic was to emphasize the significance and importance of engaging scholars in existing projects. But the projects had not been designed or selected on the basis of such criteria.

If we look at what has been realized, we can conclude that what has happened in practice within PSIBouw has not lived up to the ideals. Relationships between academics and practitioners have tended to remain 'collaborations of convenience' that are unlikely to continue when the funding ceases. It also proved problematic to find practitioners who were motivated to become involved and to remain involved in collaborative research. The specific nature of construction as a project-based industry also played a part in all of this, as it meant that employees were very mobile and that activities like collaborating with academics were difficult to plan.

Developing a joint collaborative program The initial PSIBouw program was the result of a typically Dutch consensus process. It consequently provided a very broad research agenda. Moreover, during the implementation of PSIBouw the board and the program office wanted to keep the program open to new entrants who had not been involved in the developing of the original project plan. These new initiatives were rarely rejected because they failed to fit in with the program. Indeed, at times getting as many parties as possible involved seemed to be more important than the internal coherence of the program.

Creating legitimate authority The legitimate authority of PSIBouw resided with the Board but as the Board consisted of high-level and therefore very busy individuals many matters were actually dealt with at lower levels: within the Program Office and, to a lesser extent, in the Scientific Core Team. Though the Program Office consisted of seasoned practitioners it lacked the prima facie legitimacy of the Board. In terms of the scientific community, the Program Office generally lacked contacts. The Scientific Core Team, by contrast, was highly visible within the relevant academic disciplines (mostly engineering and management) but lacked legitimacy within the practitioner community. All in all legitimate authority depended too much on the Board which consisted exclusively of practitioners who lacked the time to get involved in the program on a day-to-day basis.

Developing flexibility Given the innovative character of PSIBouw and the fact that the program was positioned as a research and change program, it was important to be able to actually make changes in the program whilst it was underway. That was, indeed, what happened. Various fundamental changes were made in the content of the program as well as in its management structure. To a certain extent those changes were implemented at the expense of the coherence of the program so, if anything, we might say that there was maybe too much flexibility in the PSIBouw program. Moreover, a consequence of the flexible nature of PSIBouw was that during its entire lifetime an extraordinary amount of energy went into discussions and debates. Those discussions and debates had divergent forums with changing representatives. Many academics and practitioners who were less closely involved in this process confessed to finding the decision-making processes within PSIBouw unclear.

Furthermore, although the internal management of PSIBouw was flexible it ultimately had to comply with the somewhat rigid BSIK procedures. These procedures, specifying that there should be an upfront definition of the end results and strict control of activities conflicted with the truly innovative and explorative nature of the program. From this point of view it is not surprising that PSIBouw has not been consistently positively evaluated by the BSIK leadership.

6.2 International programs

Bridging the gap between practitioners and academics at project level

In general we could say that most international programs are primarily aimed at bridging the gap between practice and science but in reality the studies performed in these programs have an 'outsiders' research perspective. This is primarily due to the requirements stipulated by the funding authority. The EPSRC evaluates funded centers on their academic quality, their academic impact and their industrial relevance (these are the three first criteria listed on the EPSRC appraisal form) but there is no real assessment of the level of cooperation between academia and what continues in practice. At project level practitioners are often involved as test cases, as participants in workshops, at conferences, and so on. The centers studied in the UK are primarily funded by national research councils. The same could be said of the programs we studied in Finland, although the new SHOKs are more industry-led. But in those cases, it proved to be difficult to get the universities involved and precisely how this model will work in practice remains to be seen. The Australian CRC CI seems to be the program that is most clearly aiming at collaboration between academia and the practical situation but here, too, we noticed tensions between practitioners and academics. Industry perceives the CRC CI as too academic but academics complain that 'research struggles in a commercial environment'.

Overall, our impression is that in spite of its shortfalls PSIBouw has performed relatively well in terms of bridging the gap between practitioners and academics. One indication of this was that in all three international programs it proved difficult for the program organizers to put us in direct contact with practitioners. The practitioners that we met were mostly involved at program level, rather than at project level. During our site visits we also saw some very interesting projects which were had proven successful in terms of joint development but these examples primarily hinged on personal motivation or a long tradition of cooperation between the practitioners and researchers in question. This was, for instance, the case with the Sellafield representatives at Salford's CRI. Another such positive example was that of the Public Works Queensland staff working with CRC CI but the latter is a public agency rather than a business firm.

Developing a joint collaborative program Ideally, representatives from the field and from academia should jointly develop an innovation program. This was very much the case with PSIBouw although, as mentioned above, this led to the creation of a very broadly defined research agenda. If we compare the PSIBouw experience with the experiences reported in international programs, we basically see two contrasting models. On the one hand (in the UK and in some programs conducted in Finland) we see a model in which the universities take the lead and develop a research program. The relevance to industry is an important criterion for the funding agency (in these cases EPSRC or TEKES) but so is academic quality. Actual collaboration with industry is seen as a bonus, rather than as a must. In the case of Finland we think that the earlier programs adhered to this model while the introduction of the SHOKs represented a shift to the second model characterized by industry taking the lead. In the case of Finland it was the funding agency TEKES that took the initiative to bring together representatives from an 'industrial ecosystem'. In Australia CRC CI was dominated by industry and public agencies and stood at arm's length from the universities.

Most interviewees stated that it is difficult to develop a collaborative program. In general, practitioners complain that research done at universities is supply driven and that getting practitioners really involved in developing a more demand-driven agenda is difficult. Engagement also takes time. Many people argued that collaboration requires trust which is something that takes a number of years to develop. Past experience is also important. Maybe strong collaborative relations are easier to achieve at project level than at program level because of the more intensive and frequent interpersonal interaction taking place within collaborative projects.

All in all, we can conclude that the PSIBouw model of involvement of representatives from industry and academia was very open. But this model created problems of its own, because it compromised the coherence of the resultant program. The TEKES model followed by the SHOKs, in which a strong government-affiliated actor took the lead and helped to maintain a clear focus while at the same time ensuring that the influence of industry remained strong, may be a good solution as long as the programs also remain innovative and exploratory enough to be of interest to academia.

Creating legitimate authority Leadership at program level in Finland clearly resided with TEKES. This agency has a strong position, as it can allocate funds which, in relation to the size of the country, are substantial. It was difficult for us to evaluate the legitimate authority of TEKES (both in the eyes of industrial representatives and in the eyes of academics). In particular research institutes like VTT are too dependent on TEKES to allow themselves to dare to be very critical. This is not true of industry but in Finland it proved impossible for us to interview industrial representatives (which, in itself, reflects negatively on the legitimacy of TEKES vis-à-vis this facet). In the UK the centers funded by the ESRC and the EPSRC have long-term funding and are sufficiently big enough to develop identity and leadership. In the case of the IMCRC in Loughborough in particular this seems to have played an important role. The director of this center had a strong personal ambition to work with industry (or even 'for' industry, as he himself put it). Leadership was more diffuse at the Salford center. In Australia the CRC CI leadership was officially with the program Board but in practice the program director played a very important part. His approach seemed to be to forge bonds between practitioners and academics that were based on good diplomacy and strong personal commitment and involvement. This was more than a full-time job but ultimately, even with this approach, the legitimacy of the program's leadership was not ensured.

When compared to these international examples the leadership of PSIBouw seems rather complex and fragmented. As with TEKES, universities were contributors to rather than owners of the program and this had an impact on the aspect of academic legitimacy. On the other hand, a model in which the academics take the lead, as with the EPSRC centers, could make it more difficult to obtain legitimacy in the eyes of representatives from industry. However, the examples given by Loughborough and (to a lesser extent) by Salford show that this need not be the case.

Developing flexibility In the case of PSIBouw, flexibility was created *within* the program, by allowing new initiatives to be incorporated and by re-designing the program midway. This diverges from the programs administered by TEKES in Finland (with the exception of the new SHOKs program). In the case of those programs the aims were set at the start and flexibility was created by changing the focus and conditions when one program was succeeded by the next. With the SHOKs the role of TEKES will be more limited and once a SHOK has been set up and approved the decisions regarding research will be taken by the SHOK board. It is still too early to tell as the SHOKs are still in their early stages but there seems to be a danger that the research emerging on the SHOKs will point to an overemphasizing of short-term projects. In that case there will probably be sufficient flexibility from one year to the next but this could be at the expense of project depth and consequently at the expense of commitment from academia. The Australian CRC CI was organized around five broad main topics. It is not clear to what extent later changes in these topics or in the projects that constituted them were possible. The EPCSR centers in the UK were found to have a great deal of flexibility. The EPCSR evaluates on the basis of output and allows the centers to take important decisions.

Looking back at PSIBouw after having observed the practices in Finland, Australia and the UK, we think that PSIBouw was perhaps too flexible. The consensus process on which the program was initially based made the scope of the program broad. That scope was subsequently changed and broadened even further. A setup in which there is clearer leadership, either from industry or from academia, has its advantages, as long as legitimacy from both groups is ascertained.

6.3 Overall conclusion

Making a comparison between three international programs enables us to come to a more informed evaluation of PSIBouw. As stated earlier, the aim of this research project was not to arrive at an overall evaluation but rather to assess the extent to which the program has succeeded in bridging the gap between practitioners and academics. From this perspective our evaluation of PSIBouw is relatively positive. The aim of developing genuine engaged scholarship has only been very partially realized but international experience shows that this is extremely difficult. Only in a few cases have foreign initiatives clearly succeeded better in this respect but then at a price. Rather than repeating the observations detailed in earlier sections, we will summarize here our findings in the form of three main conclusions.

1 **The barriers between practitioners and academics are rooted in very real interest differences and perspectives and are therefore not easy to overcome.**

In other words, these barriers are not just a matter of differences in style or a lack of mutual familiarity, although these factors also play a role. Government-sponsored public-private innovation programs try to provide incentives both to industry and to academia but it seems that the result is second-best for both groups. This is something that is very deeply rooted in the way practitioners and academics are evaluated and in the characteristics of the tasks in which they try to excel. So far no program seems to have found a really satisfactory solution to this problem.

2 **If academic quality is one of the main goals of a program then it pays off to give the lead to universities or to agencies that rely on academic quality as one of the main evaluation criteria.**

This is what we observed in the pre-SHOK TEKES programs and the EPSRC-funded centers. This way of organizing and funding research is fairly attractive to academics. However, whether it also leads to collaboration with practitioners depends very much on the way in which the program is led or the funding agency.

3 **Genuine engagement on the part of industry seems to be strongly influenced by the personal day-to-day leadership provided by the center or the program.**

It requires a very special combination of qualities to bring practitioners and academics to the same table and encourage them to collaborate. In the case of PSIBouw we think that the leadership was too markedly oriented towards industry to be really appealing to academics. We saw some examples of personal leadership in the international programs that embodied at least some of the key ingredients of what we would be looking for: strong personal drive and commitment to engaged scholarship; academic credibility, an accumulation of past high-caliber research activities; and industrial credibility, built up either from having managerial responsibility in a major firm or from a track record of delivering value-for-money with practically applicable research.

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Managing Public-Private Innovation Programs

Managing Public-Private Innovation Programs PSIBouw was a Dutch innovation programme involving numerous organizations within the building, government, education and research sectors. The central objective was to stimulate the modernization of processes and systems in the Dutch building sector through research, the developing of a new set of instruments and knowledge transfer.

The programme was completed in 2009. The professors Geert Dewulf (University of Twente) and Niels Noorderhaven (Tilburg University) formed part of the programme's Academic Core Team. They conducted an evaluation that was predominantly directed towards the way in which the relationship between practitioners and research could be seen to develop during the programme.

This evaluation, together with the publication Durf (i.e. Dare), also available in English and compiled for an international audience, marks the completion of the programme.

Further information on the programme and its publications is still available on the following website: www.debouwvernieuwt.nl

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