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PART II. PROJECT RATIONALE

Paper 2. The Underpinning Science of Sustainable Industry Improvement and Innovation

J. Timms^{AC} and R.A. Clark^{AC}

^ACooperative Research Centre for Beef Genetic Technologies, Armidale NSW 2351

^C Queensland Department of Primary Industries, Brisbane QLD 4000

Abstract. In this paper the science underpinning the Beef Profit Partnerships project methodology is explained. The science is organised around headings associated with the six key elements of the project system model which was outlined in Paper 1 and is described in more detail in Paper 4. The headings are: (1) Focus, targets, outcomes and key measures; (2) Partnerships, networks, social infrastructure and social capital; (3) Technology and information – development, integration, valuation and diffusion; (4) Continuous improvement and innovation process and tools; (5) Capacity, tools and expertise; and (6) Momentum, culture development and institutionalisation.

Keywords: Accelerated adoption; sustainable improvement and innovation; outcome focus; capacity; technology integration; partnership; network; institutionalisation.

Background

The Beef Profit Partnerships (BPP) project is unique in several ways. As well as the clear focus on accelerated improvement, innovation and adoption as described in Paper 1, the project has been designed, and is managed, as a system to achieve sustainable improvement and innovation, and impact on profit¹. Designing and managing projects as systems (that is, using management principles and techniques that follow from systems theory) has been advocated in non-agricultural contexts for a long time (Kast and Rosenzweig 1970; Einsiedel 1984; Morris 1988; Kezsbom, Schilling and Edward 1989; Haines 2000). Unfortunately, traditional, non-systems approaches to project planning, management and evaluation have been, and still are, dominant in many agricultural research, development and extension contexts (Queensland Treasury 1990; Department of Primary Industries 1991; Buford, Bedeian and Lindner 1995; van den Ban and Hawkins 1996; Bramley, Botha and Tarbotton 2003).

The purpose of this document is to briefly explain the science underpinning the Beef

Profit Partnerships project methodology². To be congruent with the systems-based approach used to design and manage the project (described in Paper 4), the science underpinning each of the six key elements of the project system methodology is described separately. Numerous authors have listed elements required for effective improvement and innovation project systems (Doty, Glick and Huber 1993; Harris 1994; Shortell, Bennett and Byck 1998; Plsek 1999; Cao, Clarke and Lehaney 2000; Benner and Tushman 2001; Maurer, Mitchell and Barbeite 2002; Kerzner 2004, 2005).

The system elements of the sustainable improvement and innovation methodology used in the BPP project are:

1. Focus, targets, outcomes and key measures
2. Partnerships, networks, social infrastructure and capital
3. Technology and information – integration, valuation and diffusion
4. Continuous improvement and innovation
5. Capacity, tools and expertise
6. Momentum, culture development and institutionalisation

1. Focus, Targets, Outcomes and Key Measures

Various authors highlight that setting well defined outcomes and targets can lead to higher levels of performance for both

¹ Another important aspect of the design of the BPP methodology is that it is based on the concept of trans-disciplinary thinking. The BPP methodology draws from several different sciences and disciplines including systems science, management science, business science, innovation science, education science, economics, anthropology, psychology and sociology, as well as being informed by the more traditional disciplines associated with agricultural research, development and extension.

² This paper is a summary of a much longer document with an extensive reference list that is available for interested readers on the BPP website.

individuals and groups (Taylor 1911; Mace 1935; Kast and Rosenzweig 1970; Locke and Latham 1984; Matsui, Kakayuma and Onglatco 1987; Maskell 1989; Wright 1989; Klein and Mulvey 1995; Klein et al. 2001; Tovey 2001; Marlow 2005). A number of other authors use the concept of 'focus' to emphasise the importance of concentrating attention on target outcomes (Harris 1994; O'Brien et al. 1995; Bessant and Caffyn 1997; Plsek 1999).

The corporate documents of many R&D organisations show that there is an expectation that R&D and extension projects will contribute to the achievement of significant outcomes including: reduced poverty, raised standards of living, improved livelihoods and better lives of rural populations (ACIAR 2001; AusAID 2001; FAO 2005); sustainable development in developing countries (AusAID 2001); increased long term profitability of agricultural businesses (Australian Wool Innovation 2004); and improved management of natural resources for the greatest possible long-term social, environmental and economic benefits for everyone in the nation (Land and Water Australia 2001).

Perrin (2002) identifies and summarises major challenges synthesised from papers and presentations prepared by around thirteen member countries of the OECD in relation to results-focused management in government. The papers and presentations contain numerous references to terms reflecting a primary concern with input, or to a limited extent, output, such as: 'efficiency', 'productivity', 'activities', 'procedures', 'expenditures' and 'outputs'. But in general, there was much less use of outcome-oriented terms, such as: 'benefits', 'value', 'effectiveness', 'outcomes', 'impacts' or 'quality of life' (Perrin 2002).

According to Perrin (2002) the creation of a results-oriented culture is essential for actual implementation of a results-oriented approach. Despite the efforts of regional and international bodies, little progress has been made within agricultural R&D institutions towards instilling a mentality, culture and awareness of the need to achieve high-impact outcomes (ISNAR 2003). Lewin (1946, 1947) proposes that the lack of objective standards of achievement has two significant effects: (1) it deprives people in inter-group relationships of their legitimate desire for satisfaction on realistic bases; and (2) in a field that lacks objective standards of achievement, no learning can take place. O'Riordan and Rayner (1991) emphasise the

need to link target outcomes to inspiring visions, missions, and to the needs, values, beliefs and principles of partners and participants.

Smith (1999) further emphasises that whichever word you choose - outcomes, impacts, consequences, ends, effects - the important thing is that the clear and easily grasped meaning of that word is the performance outcome or result of effort, and not a description of the effort itself. To achieve satisfying results it is important that people set outcome-based targets rather than activity-based goals (Smith 1999). Schaffer and Thomson (1992) support this perspective by highlighting the fallacy of 'activity centred' approaches that confuse needs with means, and processes with outcomes.

Various authors highlight that when working in partnerships it is crucial to have a shared understanding of target outcomes and the key concepts associated with those outcomes (Sterman 1994; Robertson and Tang 1995; Rounthwaite and Shell 1995; Abel et al. 1998; Penna and Emerson 2003; Perrin 2006). Sterman (1994) emphasises that for collaborative work, it is essential to develop shared mental models both of targets and of ways of collaborating effectively to achieve them, and that the shared understanding of these mental models must be regularly checked and improved. There are a number of effective tools to achieve shared mental models, which result in considerable improvements in the effectiveness and efficiency of achieving rewarding results, which in turn sustain motivation and build momentum.

According to a number of authors, performance measurement drives behaviour and behaviour change (Mace 1935; Maskell 1989; Francis 1992; Kaplan and Norton 1992; Miller 1995; Kerssens-van Drongelen and Cook 1997; Smith 1999; Davies and Kochhar 2000; Tovey 2001). It is widely recognised that the measures of performance used have a strong influence on activities and results (Kaplan and Norton 1992). The adage 'you get what you measure' holds true (Kerssens-van Drongelen and Cook 1997). Performance measurement also supports the prioritisation of actions and enables comparing and tracking of performance changes and differences (Francis 1992; Miller 1995; Schumann, Ransley and Prestwood 1995; Kerssens-van Drongelen and Cook 1997).

Because measurement is so valuable in enabling and achieving improvements and

innovations, a simple, effective measurement system should be designed, using a holistic approach (Kaplan and Norton 1992). Several authors advocate the design of systemic performance management frameworks, such as a balanced score card, which include outcomes and targets, linked to critical success factors (CSFs) (Kaplan and Norton 1992; Waldman 1994; Sinclair and Zairi 1995; Harrington 1998; Cao, Clarke and Lehaney 2000; de Waal 2002; Marlow 2005). Since the measures of performance must align with the purpose of the measurement (Kaplan and Norton 1992), the identification of key performance indicators (KPIs) that are linked to CSFs is critical (Kaplan and Norton 1996; de Waal 2002; Marlow 2005). Davies and Kochhar (2000) emphasise that key actions need to be designed, prioritised and linked to KPIs to ensure impact on CSFs, and the achievement of target outcomes.

To be of value in a partnership, KPIs need to be meaningful and easily shared so that they can be used to identify and promote practices and methods that achieve success i.e. 'evidence-based practice' (Cochrane 1972; Stetler et al. 1998; Davies, Nutley and Smith 2000; Wolfe 2000; Stuart, Tondora and Hoge 2004; Backer et al. 2005; Pfeffer and Sutton 2006). Measurement of KPIs needs to be timely i.e. they need to give early and meaningful indication if actions are achieving impact, or not. KPIs should provide meaningful 'feed-back' and 'feed-forward'. Feed-back, feed-forward and support for action to achieve targets, need to be timely, regular and frequent (McGregor 1960; Kast and Rosenzweig 1970; Reber and Wallin 1984; Radawski 1999; de Waal 2002; Marlow 2005).

2. Partnerships, Networks, Social Infrastructure and Capital

The ability to achieve our goals, fulfil our missions, and make our contributions to the world depends as much on the resources available in and through our networks (our social capital) as it does on our individual knowledge, expertise and experience (our human capital) (Baker 2000). Gladwell (2000) poses that if you want to bring about fundamental change in people's beliefs and behaviour, a change that will persist and serve as an example for others, you need to create a community around them, where those new beliefs can be practiced, expressed and nurtured. Research shows a direct link between social capital such as regional improvement and innovation networks and quality, purpose and meaning of life. Building networks improves our personal lives

as it contributes to the world by making it a more connected place (Baker 2000).

Bryant and Wells (1998) propose that one of the key concepts associated with a systems perspective on innovation is the importance of a supportive culture and social infrastructure. A recurring theme at the National Innovation Summit in Australia in 2000 was that collaborative activities such as networks are an effective means of achieving increased improvement and innovation (Department of Industry, Science and Resources 2000). Holbrook and Wolfe (2000) claim there is also a growing realisation that innovation is grounded in local and regional conditions, and that industry and regional economic growth can be accelerated through the design and management of regional innovation systems that include effective regional improvement and innovation networks and partnerships (Asheim 1996; Asheim 2003; Asheim and Coenen 2005). More than ever before, improvement and innovation need to draw on networks and cooperative arrangements (OECD 2000; Howard 2005).

Networks are purposeful, value-adding partnerships based on reciprocal transactions between partners. They are oriented to a common purpose which is beyond the limited abilities of individual network members (Chisholm 1996; Gray and Wood 1991; Roussos and Fawcett 2000). That is, individuals and organisations come together to achieve outcomes that none of them can achieve separately. Network activity has both external effects (impact on the community) and internal effects (impact within the network) (Chisholm 1996; Ashby 1956). Members choose to belong to networks, and the network is controlled by the members who determine the network's rules, processes and procedures (Chisholm 1996; Weiner, Alexander and Zuckerman 2000). Each member is equal within the network (Chisholm 1996; Gray and Wood 1991) and there is no centralised source of power (Chisholm 1996).

Building a culture and the associated capacity, where network members and partners manage and lead the network, and achieve improvement and innovation across the network is critical to viable regional networks. This type of capacity can contribute to achieving an "Enterprising State" (Considine 2001) in which the role of citizens changes from one of 'entitlement' and 'dependency' to new forms of 'self-mobilisation' and 'self-enterprise'. This is the key to a future state of 'entrepreneurial governance' (Considine 2001). Hill (2002)

emphasises the need to institutionalise the participation of partner organisations in networks. It is critical for network members to make representations to senior management of organisations involved in the network, explaining what the network is about, providing details of upcoming activities and establishing ongoing communication (Wellington 1999).

The concept of 'New Regionalism' (Rainnie 2004; Garlick 1997) is aligned with the type of culture that is supportive of sustainable improvement and innovation networks. 'New Regionalism' is about developing creative regions that have the ability to generate and implement new ideas, by actively linking its structures and processes of innovation and learning to regional needs.

Another factor critical to the success of regional improvement and innovation networks is to ensure that the network addresses issues that matter to local people over time, across concerns, and across generations of dispersed leadership (age and experience) (Roussos and Fawcett 2000). It is critical to develop specific, measurable, actionable, realistic, targeted and time-framed (SMARTT) outcomes on which the network can focus and against which network members can monitor and celebrate their progress (Fawcett et al. 2000; Weiner, Alexander and Zuckerman 2000; Hill 2002). Weiner, Alexander and Zuckerman (2000) emphasise the need to celebrate successes, even small ones. 'Quick wins' and small successes early on build confidence among participants and provide motivation for subsequent accomplishments (Mays, Halverson and Kaluzny 1998).

From sociology, anthropology, military science and organisational science we know there is a balance between a network being too large and too small (Dunbar 1996). The network needs to be large enough to support the achievement of the target outcomes of the network, yet small enough for everyone to feel part of a purposeful, mutually supportive network. In an improvement and innovation network it is critical to encourage creativity and to stimulate new thinking, in which case each team in the network needs six or more people. However too many people in network teams or the network as a whole have negative impacts on the effectiveness of conversations and personal interactions. Bigger groups require more time servicing their relationships and social groupings larger than 150 to 200 become increasingly hierarchical in structure. Dunbar (1996) suggests the optimum size is approximately 150 members.

While each member in a network is equal within the network, networks do involve a division of labour where members have specialised functions, tasks and skills (Alter and Hoge 1993). Wellington (1999) suggests that some form of network leadership is necessary to ensure the network's activities support the outlined purpose and target outcomes, to maintain momentum, to coordinate activities, and to secure participation and increase membership when appropriate. Various authors have emphasised the importance of leadership to the success of improvement and innovation networks (Feigenbaum 1961; Crosby 1979; Deming 1986; Manz 1992; Godwin, Neck and Houghton 1999).

Fawcett et al. (2000) suggest that the network is highly vulnerable when there is a change in leadership or a loss of key leadership. This suggests that some form of succession planning can be of value in networks. Few authors recognise the need for leaders to practice self-leadership and to equip and empower others to practice self-leadership. According to Manz (1992), 'self-leadership' is the missing link. Our society has been especially good at fostering a sense of external control and other responsibility. Self-leadership is similar in concept to 'self efficiency' (Bandura 1977, 1986) and 'personal mastery' (Senge 1990).

Rounthwaite and Shell (1995) emphasise the need to develop shared processes in partnerships to achieve outcomes. Developing a shared language is critical for effective and efficient communication and relationship building. As Dewey (1981) claimed, the role that language plays in simultaneously deepening individual understanding and allowing that understanding to be shared with others is 'truly wondrous'.

3. Technology and Information – Integration, Valuation and Diffusion

It is critical in BPP that there is a shared understanding of the following key terms: 'technology', 'information', 'innovation', 'adoption' and 'diffusion'. In BPP we distinguish between innovation as (1) the creation/invention, development and achievement of innovations, and (2) the marketing, adoption and diffusion of innovations.

In a well-planned and sustainable society, it is not simply the availability of new technologies that fuels economic growth and sustained productivity, but more the wise

adoption, adaptation and application of those technologies (Queensland Innovation Council 2001). The real benefits, and therefore the return on investment from technologies, depend on: (1) the size of the outcomes flowing from the adoption of the technologies per enterprise (e.g. improvement in profit, efficiency or the environment); (2) the rate of adoption; and (3) the extent or scale of adoption. These factors have been reviewed extensively in both the scientific and economics literature (Alston, Norton and Pardey 1995; Pannell 1999; Marshall and Brennan 2001; Griffith and Vere 2006). The simple fact is that a new technology has no actual economic value to an individual until it is adopted by that individual end-user, or to an industry until it is adopted by a large number of industry end-users (Griffith and Vere 2006).

As Hamilton (1997) points out, technology has proven less and less able to provide the quick fixes that agriculture requires and which had been delivered in the past. In the past, the simple problems of agriculture had been solved by technological innovations that addressed simple cause and effect relationships. Increasingly, problems being addressed are more complicated, moving from simple cause and effect relationships to more complex, multiple cause-multiple effect relationships (Hamilton 1997).

Pannell et al. (2006) claim that, rather than farmers being information deprived and relatively passive recipients of knowledge, in reality they have excessive information and are almost never passive recipients. Hamilton (1995) suggests that under traditional approaches to facilitating change, information is disseminated via mass media approaches which are highly efficient but of questionable effectiveness. He proposes that the collective contribution of these types of approaches is "complicatedness and confusion".

Traditional agricultural industry development has been based primarily on 'technology transfer'. There is a large amount of literature on the constraints to adoption at the end-user (farmer) level of using this approach. Some of these constraints are: the extent to which the farmer finds the new technology complex and difficult to comprehend; how readily observable are the outcomes from adoption; the financial cost; the farmer's perception of the relevance of the new technology; the intellectual outlay; the loss of flexibility; the farmer's beliefs and opinions towards the technology; the farmer's level of motivation; the farmer's attitudes towards risk and change; and

culture and local subcultures (Vanclay 1992; Guerin and Guerin 1994). There are also numerous reports on the constraints to adoption at the whole of R&D system level (Russell et al. 1989; Macadam et al. 2003).

In addition to not dealing with constraints, the 'technology transfer' approach has the following important short and long term costs and opportunity costs: (1) it does not encourage collaborative innovation and technology development; (2) it is dependent on a small number of scientists and 'transfer' agents and therefore has limits to the rate, scale and throughput of technologies, improvements and innovations; (3) it does not build and sustain regional innovation partnerships; and (4) it does not build the capacity of people to achieve ongoing improvements and innovations in partnership with others within and across sectors. However, despite criticisms of linear technology transfer models, there is still a need for access to reliable scientific information and proven technologies (Black 2000).

Old thinking, paradigms, culture, policies and programs have promoted dependencies on governments and institutions for information, technologies, improvements and innovations. Nolan et al. (1996) emphasise that ideas for improvement can come from a variety of sources: critical thinking about the current system, processes and practices, creative thinking, an idea from the scientific literature, or an insight gained from a completely different situation. Statistical analysis reveals that customers have been shown to be a major source of new ideas and the source of the largest number of good ideas (Nayak 1991; Coates, Cook and Robinson 1996; Bryant and Wells 1998). In one study of 1,800 successful innovations, almost 75 per cent were reported as having been initiated as the result of perceived market needs, and only 25 per cent from perceived technical opportunity (Bryant and Wells 1998).

Rothwell (1994) presents a model of 'Fifth Generation Innovation' which more overtly incorporates the range of people involved in technology and innovation systems. Miller and Morris (1999) advocate 'Fourth Generation R&D' as a model for achieving: (1) proven products; (2) new products; (3) new products for new customers; and (4) greater efficiencies. This model is distinguished by: (1) the sharing of knowledge gained through trials which involve all the people in the outcome-achievement chain, and take place in the research process itself; (2) developing the

innovation capabilities of end-users, developers and researchers; (3) its emphasis on feedback and partnership as opposed to a linear R&D model; and (4) the fact that when an innovation reaches product development its value has already been proven to all stakeholders.

According to Rogers (1962) the diffusion of an innovation is contingent on five perceived attributes: (1) relative advantage; (2) complexity; (3) compatibility; (4) trialability; and (5) observability. The adoption of any new technology is likely to be influenced by these five attributes, with end-users accepting or rejecting the innovation in terms of how well it satisfies these criteria in various combinations. By contrast the 'Technology Acceptance Model' has only two perceived attributes: (1) usefulness; (2) ease of use (Davis, Bagozzi and Warshaw 1989).

4. Continuous Improvement and Innovation

Continuous improvement and innovation is both the key management strategy and the key management process for implementing the SI&I model. It is more fully described in Paper 3.

5. Capacity, Tools and Expertise

The intent of sustainable improvement and innovation is similar to the goal of the 'enabling state' (Botsman and Latham 2001) or the 'enterprising state' (Considine 2001), which is to support the transformation from passive, dependent and information-fed individuals and communities into proactive, self-making and empowered individuals who strive for self-improvement and community wellbeing. In BPP there are several areas of capacity required to achieve the targeted outcomes including capacity in continuous improvement, continuous innovation and partnership management.

Macadam et al. (2003) define 'capacity building' as, "externally or internally initiated processes designed to help individuals and groups associated with rural Australia to appreciate and manage their changing circumstances, with the objective of improving the stock of human, social, financial, physical and natural capital in an ethically defensible way". Continuous improvement in the alignment within and between capacity building initiatives, institutional arrangements and mind-sets is the key to on-going improvement in the stock of capital (Macadam et al. 2003). Hemmati and Whitfield (2003) highlight that to achieve

sustainable development, programs should: (1) equip stakeholders to design and manage partnerships; (2) increase the effectiveness of partnerships; (3) improve networks; and (4) improve the quality of policy decisions.

'Capacity' has been viewed as the potential to activate or acquire a set or, as it has been termed, a bundle of capabilities (Davison and Hyland 2002). 'Capabilities' are integrated resources that an organisation deliberately draws together. These resources include tangible and intangible assets ranging from behaviours and skills to information systems (Gieskes and Langenberg 2000). 'Competences' are described by "repertoire of experiences, skills, and beliefs" (Karnoe 1995). Competences are dynamic and enable the operationalisation of organisational capabilities (Teece, Pisano and Shuen 1997). Teece, Pisano and Shuen (1990) define competencies and capabilities as: 'a set of differentiated skills, complementary assets, and routines that provide the basis for a firm's competitive capacities and sustainable advantage in a particular business'.

Hyland and Boer (2006) explain that competences exist at different levels e.g. the individual, team or network levels, and are the skills and behaviours that are exhibited in carrying out operational and innovative tasks. Competences build capabilities by drawing together the skills and behaviours required to carry out a task. The development of competences and subsequent generation of capabilities by bundling the competences in differing ways adds to an individual or organisation's capacity. The key to capacity is the organisation and management of capacity, capability and competencies in a dynamic way to achieve continuous improvement and innovations. Just as organisations use their capabilities to add to their operational and innovation capacity, they need to apply a set of capabilities to build and enhance their strategic capacity (Hyland and Boer 2006).

A number of authors highlight the need to build competency, capability and capacity (through education, training and development) in continuous improvement values, principles, methods, techniques and tools (Jha, Noorie and Michela 1996; Plesk 1997; Shortell, Bennett and Byck 1998; Wilson, Berwick and Cleary 2003). Numerous authors have highlighted that collaborators in continuous improvement require planned 'capacity' through education and training in learning specific knowledge, skills and abilities (Feigenbaum 1961; Ishikawa 1985; Crosby 1984; Bessant and Francis 1999) The

types of skills have been identified by numerous authors (Bank 1992; Carman 1993; Westbrook and Barwise 1994; Oakland and Beardmore 1995).

The capacity development process involves learning and fine tuning of the mechanisms used to enable continuous improvement behaviour. These mechanisms are likely to include: (1) training in basic problem finding and solving process (Rickards 1988; Westbrook and Barwise 1994); (2) training in basic continuous improvement tools and techniques (Kobayashi 1990); (3) setting up relevant vehicles (e.g. improvement teams and networks) to enact continuous improvement (Lillrank and Kano 1990; Dale 1995; Berger 1997); (4) development of an idea management system to receive and respond to ideas (Schuring and Luijten 1998); and (5) development of an appropriate reward and recognition system. The idea management system needs to identify and manage different types of ideas: (1) ideas that are acknowledged but not directly implementable; (2) ideas which can be implemented directly by the suggesting individual or group; (3) ideas which may require additional support from specialists; and (4) ideas which represent major projects which might be taken forward by a larger and more specialised group (Zairi 1997).

Training should be designed to meet the specific context and need as opposed to using 'generic nature, off-the-rack education and training materials' (Smith and Tee 1990; Oakland 1993; Zairi 1997). In the design of instructional processes there are five major tasks (Gage and Berliner 1998): (1) choosing objectives (content and performances); (2) understanding participants' characteristics; (3) understanding and using ideas about the nature of learning and motivation; (4) selecting and using appropriate methods and practices; and (5) evaluating learning.

According to Kirschner, Sweller and Clark (2006) any instructional procedure that ignores the structures that constitute 'human cognitive architecture' is not likely to be effective. The relations between working-memory and long-term memory, in conjunction with the cognitive processes that support learning, are of critical importance to effective learning and cognition. Everything we see, hear, and think about is critically dependent on and influenced by our long-term memory. The aim of all instruction is to alter long-term memory. If nothing has changed in long-term memory, nothing has been learned. Any instructional recommendation that does not or cannot specify what has been changed in long-term-

memory, or that does not increase the efficiency with which relevant information is stored in or retrieved from long-term memory, is likely to be ineffective (Kirschner, Sweller and Clark 2006).

Understanding and use of ideas about the nature of learning and motivation are essential to good education, training and learning of individuals and collaborations/organisations (Gage and Berliner 1998). Clark and Harrelson (2002) describe four critical processes that mediate the transformation of sensory data into retrievable knowledge in long-term memory: (1) attention; (2) rehearsal in working memory; (3) retrieval from long-term memory; and (4) meta-cognitive monitoring. Instruction should help the learner to leverage the cognitive processes and minimize their disruption.

Individual skills, abilities, attitudes and habits contribute to achieving innovations i.e. both 'hard' skills (technical skills) and 'soft' skills (problem-solving, effective communication, teamwork, self-management, entrepreneurship) (Bryant and Wells 1998; Hofer and Polt 1998; Department of Industry, Science and Resources 2000; Renzulli 2003; Smith 2003). Renzulli (2003) has shown that the necessary ingredient for innovative accomplishment is to ensure interaction among three clusters — ability, task and commitment.

6. Momentum, Culture Development and Institutionalisation

Hill (2002) emphasises the need to institutionalise the participation of partner organisations in networks to develop a sustainable process. Evaluating the network's effectiveness and activities is important in developing and managing institutional support because "few can argue with success" (Weiner, Alexander and Zuckerman 2000). Weiner, Alexander and Zuckerman (2000) emphasise the need to celebrate successes, even small ones. 'Quick wins' and small successes early on build confidence among participants and provide motivation for subsequent accomplishments (Mays, Halverson and Kaluzny 1998; Mitchell and Shortell 2000).

All six elements of the BPP project system need to be managed to ensure vitality and sustainability. The architecture surrounding projects, policies and organisations can influence sustainable improvement and innovation systems and processes so that they do not achieve outcomes or

sustainability. The architecture can be managed by proactive action to achieve proof-of-concept and proof-of-value. This proof-of-value can be used to market, promote and achieve institutional, organisational, industry and government support through the 'institutionalisation' of policy, protocols and investment.

As stated in the Background section above, the BPP project is designed and managed as a system. Bosch, Ross and Beeton (2003) propose that "systems thinking" provides people with a mechanism to help understand the causes and effects in systems and to identify and refine goals. Systems thinking can also bring in factors outside the focus and enable recognition of different opportunities. The 'systems' level provides the highest point of leverage for performance improvement (Kim 1995; Sterman 1999). This last element of the BPP system provides the opportunity to measure, monitor and evaluate the performance of the project system, and to use high leverage actions to ensure project progress, momentum and sustainability. Various authors support this type of approach (GOAL/QPC Research

Committee 1990; Chang 1993; Cupello 1994; Holzer 1994; Walsh 1995).

Conclusion

In this paper the science underpinning the Beef Profit Partnerships project methodology was reviewed. To be congruent with the systems-based approach used to design and manage the project, the science underpinning each of the six key elements of the project system methodology was described separately. These elements are: (1) Focus, targets, outcomes and key measures; (2) Partnerships, networks, social infrastructure and capital; (3) Technology and information – integration, valuation and diffusion; (4) Continuous improvement and innovation process and tools; (5) Capacity; and (6) Momentum, culture development and institutionalisation.

The key message from this review is that there is a very strong scientific foundation for each and all of the elements of the sustainable improvement and innovation methodology, used as the basis for designing and managing the BPP project.