A model to achieve sustainable improvement and innovation in organisations, industries, regions and communities

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Abstract. The achievement and measurement of improvements and innovations is not often an overt practice in the design and delivery of government services other than in health services. There is a need for specific mechanisms proven to increase the rate and scale of improvements and innovations in organisations, communities, regions and industries. This paper describes a model for the design, measurement and management of projects and services as systems for achieving and sustaining outcomes, improvements and innovations. The development of the model involved the practice of continuous improvement and innovation within and across a number of agricultural development projects in Australia and internationally. Key learnings from the development and use of the model are: (1) all elements and factors critical for success can be implemented, measured and managed; (2) the design of a meaningful systemic measurement framework is possible; (3) all project partners can achieve and sustain rapid improvements and innovations; (4) outcomes can be achieved from early in the life of projects; and (5) significant spill-over benefits can be achieved beyond the scope, scale and timeframe of projects.

Keywords: Continuous improvement; networks; partnerships; project systems; sustainable improvement and innovation.

Introduction/Context

The need and challenge for governments is to provide goods and services to achieve sustained prosperity, and improved human, social, economic and natural capital in a resource limited world. Public funded research and development (R&D) projects are being called into question for less than desired achievement of outcomes (Davidson 2006; Perrin 2006), and lack of ongoing (sustainable) improvement and innovation during and after the end of projects (Clark 2008). There is a need for improvements in the 'return on investment' (ROI), and in ROI measurement and management in publicly funded agricultural R&D in projects (Esterhuizen & Liebenberg 2001). The advocacy for, and achievement of, improvement and innovation is not often an overt practice in government services other than in human health (Berwick 1996; Shortell, Bennett & Byck 1998; Ovretveit 2005). In the context of agricultural research, development and extension (R&D&E) (in which the authors work) there is a need to develop, apply and continuously improve mechanisms that achieve: (1) project design and management for sustainable outcomes, improvements and innovations; and (2) a greater return for project partners and investors from improvements and innovations within, and across, projects and services (not just 'from the end' of projects). This paper describes the research and development of the Sustainable Improvement and Innovation (SI&I) Model, and its mechanisms, to achieve outcomes that fulfil the two needs described above.

The authors found the context (C), mechanism (M) and outcome (O) (C-M-O) configuration and its principles (Pawson & Tilley 1997) useful in constructing and communicating real causal relationships between: (1) the outcomes of projects and the conditions under which they take place; (2) the specific mechanisms utilised in the initiative's context; and (3) the multifaceted context that is operational at a number of levels (i.e. political, organizational, individual and society) (See also Stame 2004; Befani et al. 2007). In the context of agricultural R&D&E there are a number of specific issues and needs that must be addressed to achieve more desirable outcomes:

- Current mechanisms used in agricultural R&D&E design and management achieve and sustain few outcomes. Penna and Emmerson (2003) identified two problems: (1) the lack of clear definition of terms and expectations; and (2) the lack of clear logic connecting assumptions with anticipated impacts.
- The lack of pragmatic theory and practice-based models to achieve and sustain outcomes and ongoing improvements and innovations (Madzivhandila 2007; Timms & Clark 2007; Clark 2008).

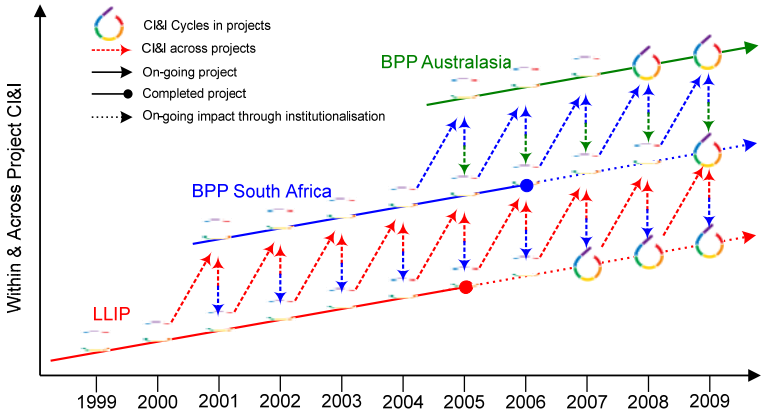
- The prominent traditional planning of 'research' (as apposed to 4th Generation Research and Development; Miller and Morris 1999) initiatives. Assumptions criticized about 'research' projects are: (1) once outputs are delivered, the achievements of outcomes requires little effort; (2) outcomes are achievable only at the end, or after the life of a project rather than throughout its life; and (3) issues, needs, outputs and outcomes can be well defined and agreed in the planning phase, and be achieved without ongoing adaptation and improvement (Gieskes & ten Broeke 2000, and Grabher 2004 in Clark 2008).
- Other issues associated with the design, measurement and management of agricultural R&D projects include: lack of accepted and tested criteria for quality (Levin-Rozalis 2000); lack of useful measurements (and data) to appraise outcomes or impact (Hughes & Trainer 2000); the cursory attention paid to the problems of attribution (Bhola 2000); the multiple dimensions of project outcomes (Barnes et al. 2003); and the time scale necessary to bring about change (Kautto & Simila 2005).

Methodology / Mechanisms

The research and development of the SI&I model was undertaken during the design and management of many agricultural R&D&E projects. The R&D&E projects used as the basis for this paper are: (1) the Leyte Livestock Improvement and Innovation project (LLIP) in the Philippines (Clark et al. 2005b); (2) the South African Beef Profit Partnerships (BPP) project (Madzivhandila et al. 2008b); and (3) the BPP project in Australasia (Griffith et al. 2008). Each of the projects were designed and managed to achieve and sustain outcomes, improvements and innovations from early in the project i.e. 'outcomes from the outset' (Clark et al. 2005a). Each project had three target outcomes: (1) to increase and sustain business profit and growth; (2) to achieve and sustain more rapid improvements and innovations; and (3) to accelerate the adoption of profitable practices, tools and technologies (Timms et al. 2009).

Each of the three projects was designed and managed using the well specified mechanisms of Continuous Improvement and Innovation (CI&I) (Timms & Clark 2007). Participative Action Research (Susman & Evered 1978) was used to enhance the R&D of the SI&I Model (Clark 2008). The process of CI&I enables every aspect of the project, including the process of CI&I, to be improved and innovated regularly and frequently (Timms & Clark 2008). This R&D also built on the evidence of the factors needed to be measured and managed to achieve sustainable improvement and innovation in a variety of contexts (Anderson et al. 1995; Sila & Ebrahimpour 2002; Terziovski 2006; Franco-Santos et al. 2007). Figure 1 shows the three large projects and the cycles of CI&I that were conducted every 30, 90 and 180-days within and between the projects for the outcomes specified above. The R&D was also focused on achieving improvements and innovations of value to project partners in the broader context of government and public funded services, and the associated organisational strategies, policies and politics i.e. 'institutionalisation' (Clark 2008).

Figure 1. The cycles of CI&I that were conducted every 30, 90 and 180-days within and between the projects for specified outcomes.



There is considerable evidence supporting the value of designing, measuring and managing projects using balanced, multi-dimensional, system frameworks (Kaplan & Norton 1992; Ghalayini & Noble 1996; Bourne et al. 2000; Bryde 2005). To use a systems approach it is essential to get some level of agreement among project partners on what a 'system' is (Clark 2008). In the context of this paper a system is defined as "a group of interrelated parts/elements and principles that are necessary to operate together for a common purpose". A

system must have clear boundaries between it and the meta-system within which it lies. All systems require inputs and have their resource limitations. To design and manage a system requires the effective use of system design and management mechanisms (Spedding 1988, 1996; Kim 1994; Sterman 2002). Systems (and system elements) do not function by chance. Every system (and its elements) is perfectly designed for the results it achieves – the worst thing is to invest effort in a poorly designed system (Berwick 1996).

In system design and management it is essential to recognise and use the following fundamental system concepts and principles: (1) vision and futuristic thinking (Ecimovic, Mulej & Mayur 2002); (2) holism and ecology (Capra 1995); (3) system dynamics (Sterman 2002); (4) system interactions with the environment/meta-system (von Bertalanffy 1968); (5) system values, ontologies, epistemologies and paradigms (Midgley 1995); (6) entropy (Peters 1994); (7) system responses to inputs (Checkland 1981); (8) clear system specification (Spedding 1988); (9) working on and working in the system (Kim 1994); (10) limits to growth (Daly & Townsend 1993; Madge 1997); (11) inverse thinking (Lang & Zhang 1999); and (12) counter-intuitive thinking (Kim 1994).

A key mechanism is the SI&I project design and management process (Table 1). This process enables the design of a clearly specified system, and the associated strategies and processes, to achieve target outcomes and the CI&I of the system. A range of tools are available at each stage. Figure 2 shows a generic systems map of the six interconnected, high-leverage elements that was synthesised from the regular application of the 'system-model design and management' methodology. Table 2 shows the system elements and the critical success factors (CSFs) researched and developed to measure and manage SI&I initiatives and projects (Timms et al. 2009). The cohesive description of each element of the SI&I Model follows – element by element.

Table 1. The SI&I Project design and management process

Step	Actions	Tools
1. SI&I concept specification	Specification (& shared understanding & agreement) of SI&I concept/s, context, boundaries, needs, target outcomes & outputs, principles, assumptions & values	• Concept diagrams • Focusing Frameworks • The Front-End tool • Glossary of key terms
2. SI&I system–model design	Conceptualisation of a 'simple' system to achieve SI&I target outcomes; understanding the system, in a system, in the real world & how to use it & measure & manage it as a system in a project	• System Design & Management • Inverse Thinking tool • Force Field Analysis • de Bono's Six Thinking Hats • System model development
3. SI&I project strategy / process design	Design key strategies & processes; identify & integrate key roles & resources, time & timing (inputs) required to achieve target outcomes effectively & efficiently; cost/benefit analysis; return on investment analysis; business case development; project performance management framework design	• Strategy Design & Management • Partnership Infrastructure design & management • Performance Management Framework (PMF) • Business case tools
4. SI&I project CI&I	Partner team & individual capacity-building, action design & action taking; partner team & individual CI&I; 30, 90 & 180-day CI&I sessions scheduled, conducted & supported at appropriate levels (including regional Network Forums)	• SI&I/CI&I project training • CI&I principles, process & tools

Element 1 – Focus

The purpose of Element 1 is to enable project teams, partners and individuals to develop clear, bounded project missions, target outcomes, CSFs (Table 2), and timely key performance indicators (KPIs) to focus their thinking and action on achieving and recording results linked to their partnership roles and target outcomes.

Figure 2. The SI&I Project system model, highlighting the six elements necessary to achieve and sustain outcomes, improvements and innovations

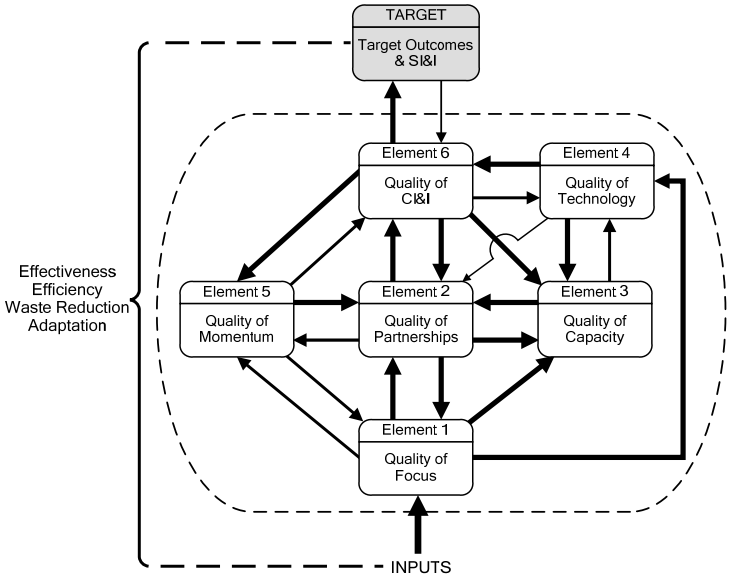


Table 2 The critical success factors required for each element to achieve sustainable improvement and innovation

SI&I system element	Critical success factors
1. Focus Partners have clear, shared & measurable target outcomes that fulfil the project needs or opportunities	1. Clear shared needs & / or opportunities to be fulfilled by the project 2. A clear, shared focus / mission 3. Specific, Measurable, Achievable, Realistic / Relevant, Targeted And Time-Framed (SMARTT) target outcomes 4. A clear, shared understanding of the values, principles & assumptions needed for effective operating & collaboration
2. Partnerships The project partnership infrastructure is in place & all partner types, roles & functions are operating well	5. A clear shared partnership infrastructure with appropriate numbers, types & proportions of partners 6. Partners have clear roles 7. Regular & responsive communication with, feedback to & support of partners
3. Capacity Partners have the necessary knowledge, skills & resources available to fulfil their roles & achieve the target outcomes	8. Partners have the knowledge & skills they require to fulfil their roles & to achieve the target outcomes 9. Partners have access to the resources they require 10. Partners have accesses to & use the best available tools
4. Technology Partners have the practices, tools, technologies & information they need to achieve the target outcomes	11. Partners are aware of, & focused on high return practices, technologies, tools & information 12. Partners are aware of, & can access information & tools that support their thinking & action 13. Partners are aware of, & can access the technical expertise they require
5. Momentum Partners are supported to take action that will sustain the achievement of outcomes, improvements & innovations	14. Understanding of, & linkages to relevant government, organisational & business systems, strategies & policies 15. Mechanisms that provide support, stimulate motivation & achieve satisfaction 16. Mechanisms & linkages to ensure institutionalisation 17. Effective marketing of project success & how it is being achieved
6. CI&I Partners are achieving the focus & target outcomes, & generating & implementing opportunities for ongoing improvement & innovation	18. Partners successfully achieving target outcomes 19. Partners achieving improvements & innovations 20. Partners continuing to achieve improvements & innovations over time

A number of authors have emphasised the value of being outcome focussed in achieving improvements and innovations. To achieve satisfying results it is important that people set outcome-based targets rather than activity-based goals (Smith 1999; Perrin 2006). When working in partnerships it is crucial that partners have a *shared* understanding of target outcomes and the key concepts and principles associated with achieving these outcomes (Sterman 2002; Timms & Clark 2008).

To sustain improvement and innovation it is essential to make success measurable so that people can see tangible results and be rewarded and motivated from their efforts. Performance measurement drives behaviour and behaviour change, supports the prioritisation of actions and enables comparing and tracking of performance changes and differences (Timms et al. 2009). The use of CSFs enables people to identify action and measure those factors critical to success. The measures of performance must align with the purpose of the measurement, thus the identification of KPIs with clear links to CSFs and target outcomes is crucial (Rockart 1979; Kaplan & Norton 1992).

Element 2 – Partnerships

The purpose of Element 2 is to enable people interested in achieving the focus and target outcomes from Element 1 to build a viable partnership and to operate effectively and efficiently as individuals, teams and networks.

The use of the concepts and principles of collaboration, partnerships, networks and networking can contribute to the rate, scale and sustainability of improvement and innovation. For change to occur in any organisation, each individual must think, feel or do something different (Duck 1993; Roberts & Sergesketter 1993). It is important to start with the individual (and the individual's sense of fulfilment), and the importance of collaboration, achievement and momentum required for SI&I (Crosby 1979; Thiagarajan & Zairi 1997; Duck 1993; Deming 2000).

The use of the concept 'partnership infrastructure' helps in the establishment of effective partnerships. Effective partnerships require necessary functions, roles and responsibilities to be clearly identified and fulfilled through the active involvement of partners in the most appropriate proportions and ways. Various authors advocate that the principles of self-management (Neck & Houghton 2006), self-leadership (Norris 2008), self-achievement and self-efficacy (Bandura 1977), and personal-mastery (Senge 1990), need to be applied to achieve sustainable improvement and innovation.

Our experience with implementing this model in different contexts suggests that the partnership infrastructure most appropriate for SI&I are networks of individuals and teams at local and regional levels. We estimate that an optimum size for a regional network is about 100 members. Effective regional networks need design and management. Figure 3 shows a typical regional network design and management concept. Three key groups are: Achievers i.e. all members of the network; Leaders i.e. about 15% of network members; and Managers i.e. about 5% of network members.

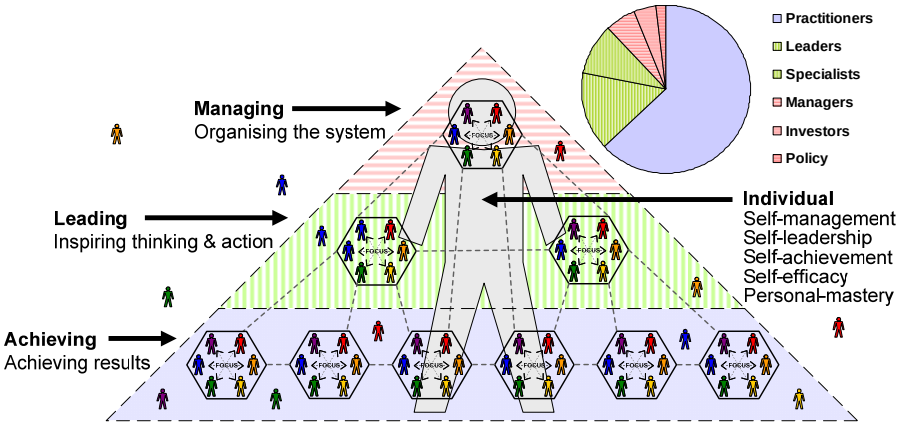
Attrition of vital role-players (and teams) in networks is to be expected and succession should be planned for. The role of local, provincial, national industry, government and academic agencies is crucial for network vitality. It is best if local teams and regional networks are interdependent with, not dependent on, one another.

Element 3 – Capacity

The purpose of Element 3 is to equip all partners in SI&I projects and networks with the necessary capacity (knowledge, mechanisms, skills and support) to: (1) achieve their focus and target outcomes, and sustain improvements and innovations; (2) enhance the use of relevant well specified mechanisms, information and expertise; and (3) fulfil their functions and roles in the project. Also, for sustainability, people in communities and organisations need to be equipped to design their own systems and processes – not have these done *to* or *for* them (Hemmati & Whitfield 2003).

Capacity building needs to be timely and progressive — not repetitive. It needs to be designed and planned to meet estimated rates of project personnel and network participant 'attrition'. The level of investment in capacity building is often a potential weak point in a project.

Figure 3 A Regional Improvement and Innovation Partnership and Network Infrastructure



Element 4 – Technology

The purpose of Element 4 is to ensure timely development, provision, use, feedback, and improvement of needed practices, tools, technologies, information, expertise, products, and services by partners, teams and networks to achieve and sustain outcomes, improvements and 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 development, adoption, adaptation and application of those technologies. To achieve sustainable improvement and innovation, the on-going generation and use of new knowledge, information and technology is required from all partners (not just 'white coated scientists').

The research and provision of technologies does not ensure their effective and efficient use, or return on investment. To enhance the return on investment from R&D outputs, Element 4 must be closely linked and integrated with capacity building and the practice of CI&I (Elements 3 and 6). This approach is fundamentally different from the transfer or diffusion of technology; it aligns with the principles of "Fourth-Generation R&D" (Miller & Morris 1999), "Fifth-Generation Innovation" (Rothwell 1994), and "Continuous Improvement and Innovation" (Timms & Clark 2007).

Mechanisms of 'value-pull' / 'user-pull' need to be used rather than those of 'technology-push'. Focusing Frameworks and profitability analysis tools like gross margins enable the potential value of technologies for focuses to be identified and assessed (Timms & Clark 2007). This enhances CI&I (Element 6).

Element 5 – Momentum

Momentum can be considered as the level of 'impetus' that sustains the growth of, and impact from, the partnerships. This impetus is dependent on the number of partners in the network, and the rate and value of improvements and innovations per partner. However, because growth and momentum are achieved through people, efficiency is a vital part of leadership for sustainability. Momentum and growth need to be achieved with efficiency and optimum return on investment, and agility and flexibility can play a role in this. This is supported by Element 6 (CI&I).

'Institutionalisation' can be used to sustain outcomes of projects (Clark 2008). When a new model, process, technology or innovation is used in a routine manner and is accepted as something normal that is expected to continue, it is incorporated into discipline, project, organisational or industry systems frameworks and their procedures as a natural pattern. Clark (2008) highlights that in addition to institutionalisation, it is important to improve the interface of the project system with the broader meta-system (program, strategy, policy, governance) in which the project and the institutions associated with the project, sits.

The function of Element 5 is to ensure that SI&I partners, teams and networks receive, create and provide high value support regularly and frequently (e.g. every 30, 90, 180 and 360 days) (Timms & Clark 2007). Achieving momentum (support from partners, organisations and policy) requires whole-of-system leadership for sustainability; hence the interconnections between this element and focus, partnerships and CI&I (Elements 1, 2, 6).

Element 6 – Continuous Improvement and Innovation

The concept of Continuous Improvement and Innovation (CI&I) is based on the assumption that, with an appropriately designed 'process' i.e. a set and sequence of steps, practices and well specified mechanisms, it is possible to achieve targeted improvements and innovations (Clark & Timms 2007). There is a large amount of literature and evidence of the pragmatism and value of achieving both improvements and innovations (Imai 1986; Shortell 1995; Radawski 1999; Bessant & Francis 1999).

The function of Element 6 is to ensure the SI&I system-model and SI&I project partners, teams and networks achieve and sustain outcomes, improvements and innovations. A 'shared process' of CI&I supported with a wide range of mechanisms to integrate each essential step of the process (Timms & Clark 2007) is used as the main method in Element 6. CI&I is used to continuously improve and innovate the dynamic SI&I system-model, SI&I projects and the CI&I process itself. CI&I principles, steps and tools are applied at the systems model level, the project strategy/process level, and at the individual practice level. The frequency, timing and timeliness of CI&I steps and activities are crucial to achieving high rates of improvements and innovations per year, high levels of impacts and therefore high rates of growth in value (Clark 2008).

Results/Outcomes

This section presents some of the results (a case study) of the implementation of the SI&I model in the South African Beef Profit Partnerships (BPP) project – a partnership that officially ran from mid-2001 to mid-2007. Partners in the original project included previously disadvantaged farmers in the Limpopo, North West, Gauteng, Kwa-Zulu Natal and Mpumalanga Provinces, municipal, provincial and national governments, the Agricultural Research Council and universities in South Africa, the Australian Centre for International Agricultural Research, and the Cooperative Research Centre for Beef Genetic Technologies and its partner organisations in Australia. The Focus of the project was to achieve rapid improvements and innovations for impact on beef enterprise, community and industry productivity, efficiency, profit, growth and sustainability. Project data were regularly (every 30, 90 and 180-days) collected, analysed and assessed for outcome achievement, and improvements and innovations. The elements and factors specified in the systemic performance management framework (Table 2) supported the measurement and management of the SI&I model. Given our space constraints, here we can only summarise the results from the BPP project in relation to each of the elements of the SI&I system model (Table 3). These results provide indications that each element of the SI&I model has been measured and improved over the life of the project, although interpretation and use of these results in a systemic manner is still being developed.

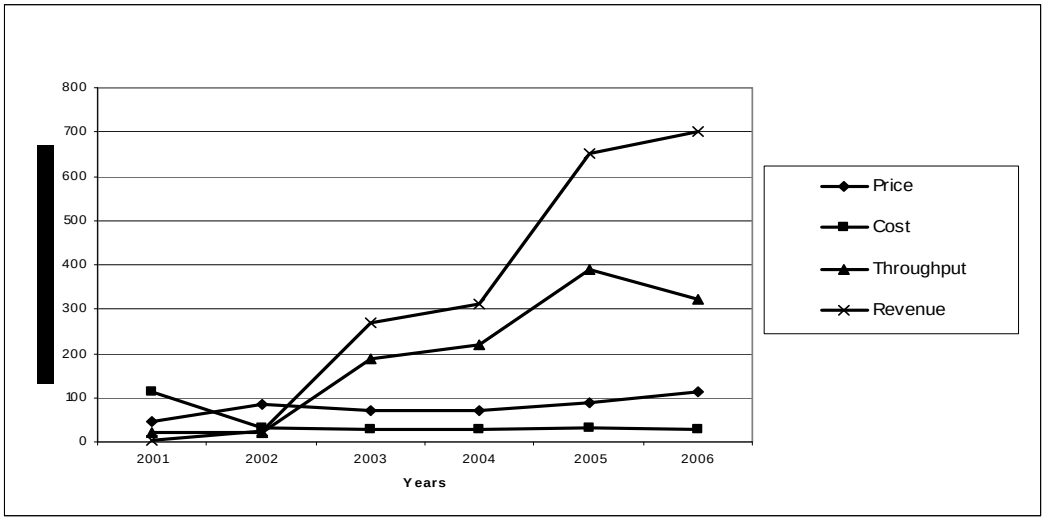
Data on beef enterprise KPIs such as growth rates, reproduction rates, death rates, carcase weight, numbers sold, price received, and costs incurred were also collected. Madzivhandila (2007) has described how the above data were collected and analysed. Clark et al. (2007), Madzivhandila et al. (2007), and Madzivhandila et al. (2008 a,b) have calculated that through the actions undertaken because of the project, gross revenue to the emerging farmers involved in the project increased by more than 1.95 million Rand over the period 2001-2006 (Figure 4). For the average farmer, this is about 20 times greater than the income they were receiving before the project commenced.

It is clear that significant outcomes were achieved during the course of the project and hence that the application of a SI&I model approach to project design and management worked. Further, in more recent years the approach has achieved institutionalisation in the beef industry as a result of the project, and has secured support from the National Department of Agriculture to continue the project until 2013 and to expand it across South Africa.

Table 3. Key Performance Indicators for Each Element of the SI&I Model in the South Africa Beef Profit Partnerships Project

SI&I Model KPIs	2001	2002	2003	2004	2005	2006
Element 1 – Focus						
• Estimated % of Partners using Focus, CSFs & KPIs	20	40	60	80	90	100
Element 2 – Partnerships						
• BPP Project Partners total	154	295	274	220	424	520
• Network Teams	15	15	14	13	24	24
• Network Leaders	23	23	24	26	28	30
• Network Managers	4	8	8	10	12	19
Element 3 – Capacity						
• Training of Leaders (sessions/people)	1/30	0/0	2/46	1/14	1/18	2/40
• Training of Managers (sessions/people)	1/3	0/0	1/13	0/0	0/0	1/5
Element 4 – Technology						
• Technology products used	3	3	3	5	5	6
Element 5 – Momentum						
• Media communications/year (Editions/number)	1/250	1/300	2/600	1/300	1/400	2/600
• Major Institutional Support (Supportive policies)	0	0	0	0	1	1
• Biennial/Triennial Partnership Forums	0	0	0	0	0	1
Element 6 – CI&I						
• CI&I meets/year	2	45	61	73	94	52
• 180-day reporting & support	1	2	2	2	2	1
• CI&I concepts & tools used	10	11	12	13	14	15

Figure 4. An analysis of the additional, price, throughput and income, and reduction of costs (in thousands of Rand), achieved year by year from 2001 to 2006 in the South African BPP project



Conclusions / Learnings

A general model for designing and managing projects to achieve sustainable improvement and innovation has been developed. The SI&I model has been applied in a variety of contexts, and each of these contexts has also led to further improvements and innovations of the model (Griffith et al. 2008). The model has been validated by reporting results from an application in a South African R&D project. More recently, results have begun to be available from other projects (Timms et al. 2009)

The CSFs, KPIs and Critical Failure Factors (CFFs) that have been identified through the ongoing research and development on SI&I, have been found to be relevant in all the contexts in which the model has been applied, thereby adding to the rigour of the model. The most valuable KPIs to maximise the return are: (1) the number (of partners); (2) the rate (per partner); and the scales (i.e. short, medium and long-term) of improvements and innovations per region (and per project).

The model has been applied to more effective and efficient delivery of government R&D services in relation to the agricultural industries, communities and regions that are being serviced. The model contributes to higher rates of improvements and innovations in government services. The results achieved from employing this approach highlight the mechanisms which do contribute to achieving sustainable improvement and innovation, and mechanisms which provide meaningful measurement for management of sustainable improvement and innovation projects (Timms et al. 2009). The implication is that the model is also suited to more widespread use across a range of delivery systems for government goods and services.

Key learnings from the development and use of the model are: (1) all elements and factors critical for success can be implemented, measured and managed; (2) the design of a meaningful systemic measurement framework is possible; (3) all project partners can achieve and sustain rapid improvements and innovations; (4) outcomes can be achieved from early in the life of projects; and (5) significant spill-over benefits can be achieved beyond the scope, scale and timeframe of projects.

As a last thought we ask you to think about a question we believe is just as important as the value to be gained from the application of the SI&I model: What is the 'cost of not' implementing a clear, shared model for the design and management of projects to achieve sustainable outcomes, improvements and innovations?

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