Paper 3. The Continuous Improvement and Innovation Process

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Abstract. Continuous Improvement and Innovation (CI&I) is both a management process and a management strategy. In this paper we aim to provide some background on the development of CI&I as a management concept and to describe the steps involved in implementing the CI&I process in the Beef CRC project. There are six key steps in the CI&I process: Situation Analysis; Impact Analysis; Action Design; Action Implementation; Results Assessment; and Creation and Synthesis. Focus and Refocus steps are added at the front and back respectively. We also describe how to use CI&I as rapid improvement and innovation.

Keywords: Accelerated adoption; continuous improvement and innovation; rapid improvement and innovation; process; strategy.

Background

Continuous Improvement and Innovation (CI&I) is both a management process and a management strategy. It had its origins in business R&D writings almost 80 years ago, and has since been linked to the philosophical writings of Dewey (1938, 1962) and others and the human behaviour literature such as Lewin and Grabbe (1945). For example, Dewey (1938, 1962) defines the personal need for continual refinement and improvement as 'growth', where growth is "a self renewing process through action upon the environment". Lewin and Grabbe (1945) identified three things required for humans to change: (1) the need to think differently; (2) the need to judge and value differently; and (3) the need to behave or act differently. Relating the concept to business growth, Terziovski and Samson (2000) found one of the most significant predictors of high performance in small to medium sized enterprises to be the adoption of a CI&I management strategy.

In this paper we aim to provide some background on the development of CI&I as a management concept and to describe the steps involved in implementing the CI&I process.

Continuous Improvement

Schroeder and Robinson (1991) claim the first modern continuous improvement program occurred in 1894 at National Cash Register in Dayton, Ohio, while Radawski (1999) states that continuous improvement has its origins in research done by Walter Shewart at Bell Laboratories in the 1930s. According to Imai (1986) the form of continuous improvement called 'kaizen' was developed in Japan in the 1940s (Ishikawa 1985; Deming 1986, 1993; Juran 1988, 1992). It is well-known that the Toyota Motor Company is a committed practitioner of continuous improvement principles. So while there is some debate about when the first recognised, concerted continuous improvement effort occurred, there is ample evidence that continuous improvement is not simply a fad or a 'flash in the pan'. Not only does it have at least a 70 year history, it has been built on tried and tested approaches (Radawski 1999) and applied in a wide range of contexts. Some recent examples of the application of continuous improvement programs across different sectors of the economy can be seen in Table 3.1. There are now a number of academic texts and a range of international peer-reviewed journals dedicated to the principles and practice of continuous improvement. Clark (2008) provides a valuable summary of the concepts, principles, processes, tools and techniques associated with continuous improvement.

A number of authors propose that innovation is also integral to both the concept and process of continuous improvement (Anderson, Rungtusanatham and Schroeder 1994; Winter 1994; Bessant and Francis 1999; Bessant 2003; Bessant and Francis 2005). Bessant and Francis (1999) define continuous improvement as an organisation-wide or system-wide process of focused and sustained incremental innovation. Shortell (1995) argues that culture either inhibits or supports continuous improvement, and that a culture that fosters openness, collaboration, teamwork and learning from mistakes is optimal for sustaining improvement and innovation. Thus, there is an inextricable link between continuous improvement and continuous innovation.

Continuous Innovation

Innovation is a widely researched phenomenon. Wolfe (1994) found nearly 2,000 papers on 'organisational innovation' (Walker 2004). Rogers (1995) reports over 3,000 papers on the 'diffusion of innovation'. Birkinshaw, Hamel and Mol (2005) found 11,548 peer-reviewed articles on 'technological innovation'. According to Wolfe (1994) the innovation literature is very fragmented, and is built on contributions from a diversity of disciplinary backgrounds and a variety of philosophical positions. While the phenomenon is undoubtedly complex and multidimensional, Bryant and Wells (1998) conclude that innovation primarily involves social processes - matters of technological hardware are a secondary aspect.

There are two broad categories of innovation (Innovation Summit Working Groups 1999, Miller and Morris 1999): (1) 'Incremental Innovation' similar to 'Continuous Innovation', and (2) 'Radical Innovation' similar to 'Discontinuous Innovation'. 'Incremental Innovation' refers to any improvement made to existing products or processes (Innovation Summit Working Groups 1999). Continuous innovation is incremental and takes place within existing infrastructures. It builds on existing knowledge in existing markets without challenging underlying strategies or assumptions. Continuous innovation is characterised by convergent thinking - progressive refinements, sharper focus, and therefore increasing specialisation (Miller and Morris 1999). Continuous innovations are easier to achieve, as they draw on the existing market framework, infrastructure, and tacit knowledge of customers, suppliers and other stakeholders. As they are more narrowly and incrementally focused, they do not require conceptual leaps, massive amounts of new knowledge, nor the huge risks that accompany dealing with the unknown. Hence, they are also more comfortable innovation targets (Miller and Morris 1999).

'Radical Innovation' involves new ideas, developing or adapting new technology, or new ways of doing business (Innovation Summit Working Groups 1999). 'Discontinuous Innovation' brings forth conditions that emanate from fundamentally different new knowledge in one or more dimensions of a product or service compared with what has come before, offering significantly different performance attributes (Miller and Morris 1999). The difficulty in achieving successful discontinuous innovation is that it requires new knowledge, which is not available when you are looking only on the inside. Discontinuous innovation is characterised by lateral or divergent thinking, by looking outside defined boundaries and by discovery of new knowledge related to both market need and technological capability. Discontinuous innovations force major shifts in both architecture and capability (Miller and Morris 1999). Discontinuous innovations are successful in the marketplace only if a new value proposition offers a significant improvement on at least one of the three performance axes: features, benefits and costs.

The Business Council of Australia (2006) advocates understanding how businesses conceptualise innovation and the innovation task. They propose the focus should be on innovation from a business perspective. Their approach differs from neo-classical economics, new growth theory and/or science and technology policy views of innovation. Some areas of Government and other institutions have often equated innovation with R&D. This reflects a traditional view of innovation in which, until very recently, Australia's innovation capacity was defined around the technological capabilities of its primary and manufacturing sectors (Business Council of Australia 2006). This traditional view of innovation as simply R&D is no longer considered to be appropriate. Case studies gathered by the Business Council of Australia indicate that: (1) innovative activity extends across all parts of a business – it is not confined to research work; (2) the imperative to deliver customer value drives the need for, and nature of, innovation; and (3) innovation, in some circumstances, has more to do with human capital than with technology and invention (Business Council of Australia 2006).

The concepts and outcomes of "Continuous Improvement" and "Continuous Innovation" were combined into one process, the Continuous Improvement and Innovation process (CI&I), and described by Clark and Timms (1999). The essence of CI&I is a thinking process for 'focusing thinking and action for impact on performance'.

Shared Process

According to Deming (1986, 1993) "*If you can't describe what you are doing as a process, you don't know what you are doing*". Many authors note that for effective and efficient continuous improvement in teams, organisations, networks and partnerships, it is essential that the continuous improvement process (and its methods, tools and technologies) is a 'shared process' (Eidt

1992; Montana 1992; Gobeli and Brown 1993; Rounthwaite and Shell 1995; Barthezzaghi, Corso and Verganti 1997; Gieskes and ten Broeke 2000). The shared process of CI&I used in the BPP methodology is described in Timms and Clark (2007). It is represented by the diagram shown in Figure 3.1. The CI&I process, as applied in BPP, recognises as did Hamilton (1997), that each producer partner is dealing with a unique situation requiring unique decisions to improve the situation. Therefore the process is specifically designed to be used by individuals in teams, partnerships, networks and organisations. An alternative way of representing the CI&I process is as an 8-step staircase, which includes Focus and Re-Focus as integrated steps (Figure 3.2).

Focus – this is the first component of any CI&I process. "Focusing" thinking and action means identifying a clear need for improvement, choosing boundaries in which to concentrate effort, and setting the specific target outcomes required to meet the need. A clear, shared and agreed focus can save time, effort, money and other resources. The most important thing about a focus is that it should be SMARTT: **S**pecific, **M**easurable, **A**chievable, **R**elevant, **T**argeted and **T**ime-lined. The Focus influences all aspects of the CI&I process.

Situation Analysis – the purpose of this first stage is to analyse a context or situation in relation to the Focus and identify opportunities for improvement. The challenge is to identify or create opportunities that are based on actual needs rather than symptoms. It is important not to limit thinking and possibilities at this stage – opportunities can range from simple to complex, and short term to longer term options, as long as they appear to have the potential to contribute to the focus. Constraints, issues and problems can all be rethought of as opportunities for improvement. At the end of a situation analysis you have a list of opportunities for improvement.

Impact Analysis – here the opportunities developed in the Situation Analysis are analysed or evaluated to determine which ones to take forward to action. An effective Impact Analysis will help ensure resources are only invested in those opportunities that will have most effect or payoff in relation to achieving the Focus or target outcomes. Impact Analysis can also help to avoid investing time and effort in opportunities that are beyond your control. An effective Impact Analysis will also take into consideration issues such as risk, time to payoff, and the consequences of not investing in an improvement opportunity.

Action Design – in CI&I the need to "design" action is emphasised. The action design stage takes into account and includes planning, but is more than scheduling resources to complete tasks. Design can help you think about doing things differently, or doing different things, to achieve your focus and targets. Action design includes specifying Critical Success Factors (CSFs) and Key Performance Indicators (KPIs) to be able to tell if your action is working.

Action Implementation – There are three important components to this step: monitoring actions and results, regular feedback to stay on track, and support to maintain momentum and motivation.

Performance Assessment – This step involves analysing and interpreting the results achieved, and not achieved, in relation to the Focus and target outcomes. It also involves assessing which methods worked well and which did not. Performance Assessment is made easier if specific KPIs are established during Action Design and monitored during Action Implementation.

Creation and Synthesis – the last of the six key stages of the CI&I process is Creation and Synthesis. This involves two components: creating new questions and ideas about achieving improvement, and using the results from the Performance Assessment and the creative thinking to synthesise specific opportunities for improvements and innovations into the future.

Re-Focus – each time the process is completed a new situation has been created from which different improvements and innovations are possible.

Effective Tools

Several authors have highlighted that the selection and use of tools and techniques are fundamental to the use and success of CI&I processes (Taguchi and Wu 1979; Ishikawa 1985; Imai 1986; Harris 1994; McNulty and Canty 1995; O'Brien et al. 1995; Plsek 1999; Hyland et al. 2000, Benner and Tushman 2003; Plsek 2003). It is essential to the success of CI&I that tools are selected and integrated to connect each step for effectiveness and efficiency – the use of tools is not an 'end in itself'.

Table 3.2 lists some of the tools that have been chosen for use in the BPP CI&I process.

Each of these tools is described in detail in a workbook that every BPP partner receives.

Distinguishing Features of the CI&I Process

Table 3.3 offers a comparison between CI&I and several other approaches including Total Quality Management (TQM), Benchmarking, Action Research, Action Learning, Experiential Learning and Innovation. The comparison is made using attributes of the different approaches that are commonly referred to in the literature as being specific design features or outputs and outcomes from the approaches.

Implementing CI&I in the BPP Project

This CI&I process described in Figures 3.1 and 3.2 and the toolkit described in Table 3.2 helps all partners to scope, analyse, prioritise, achieve, report and support improvements and innovations, and promote the adoption of actions, methods and technologies that have greatest benefit. The process also helps re-focus thinking and action further improvements and innovations.

One of the key assumptions underpinning this process in the BPP project is that beef producers are interested in increasing profit. This assumption is the basis of the overall BPP project focus, and it is encouraged to be the focus for action of individual partners as well. A simple "profit driver tree" is used to focus attention on profit and the key drivers that beef businesses can manipulate to achieve improved profit (see Figure 3.3). A number of economic analysis decision support tools such as gross margin budgets, whole farm budgets, cost of production calculators, etc, and specialist economist assistance, are offered to the teams to assist in deciding on priorities for action and to monitor the financial implications of these actions at regular periods in the future.

A second assumption in relation to developing a focus is that each individual partner and each team may have several different focuses going at any one time. Figure 3.4 is provided to the teams to illustrate the types of focus that are appropriate. A range of shorter-term through to longer-term focuses is thought to be able to:

- more rapidly achieve improvements & rewarding results;
- more efficiently generate a greater range of improvements;
- more efficiently capture improvement ideas to share and learn about; and better maintain interest and motivation.

Rapid Improvement and Innovation

Langley et al. (1996) report on a model for rapid-cycle improvement that has been built to focus on accelerating the change process (Nolan et al. 1996; Plsek 1999). The model identifies four key elements of successful improvement, (1) specific and measurable aims; (2) measures of improvement that are tracked over time; (3) key changes that will result in desired improvement; and (4) a series of testing 'cycles' during which people learn how to apply key change ideas to their own systems.

In rapid cycle improvement, pace is crucial - it is better to run small cycles of change soon, rather than large ones after a long time. As Berwick (1998) notes, the more cycles, the more learning. Rapid-cycle improvement can be misunderstood if people assume that 'rapid' is analogous with 'careless', 'unscientific' or 'non-rigorous'. Alemi et al. (1998) studied improvement activities in several health care contexts and found that results were most quickly achieved when the focus was on testing changes rather than on detailed analysis of the current practice. According to Berwick (1998) small-scale trials are usually the best approach because systems are unpredictable and their dynamics are non-linear. Pannell et al. (2006) emphasise that innovations are more likely to be adopted when they are readily trial-able i.e. easy to test and learn about before adoption, and that for the information from a trial to have value for decision making, the trial needs to be indicative of the innovation's performance in the long run. Table 3.4 shows a comparison between traditional improvement and rapid cycle improvement.

Further, given the emphasis in the project on "accelerated adoption", on the evidence relating to rapid cycle improvement and on the opportunities for selecting a focus for action that has short as well as long term time frames (Figure 3.4), every individual partner is encouraged to select one focus which could be categorised as "rapid improvement and innovation".

This follows the broad CI&I process, but includes a sub-cycle across steps four to six where action design, action taking and action assessment are deliberately set up to cover smaller, quicker changes in practices or processes (Figure 3.5). Such changes can often be trialled over part of a paddock or

part of a farm and a simple comparison between the "with" and "without" change can generate sufficient evidence to expand the trial over a wider area or greater part of the herd.

Rapid improvement and innovation cycles can make a large impact on the industry growth calculations as shown in the top part of Figure 1.3 in Paper 1.

Finally, again in line with the overall focus on "accelerated adoption" and the specific encouragement given to partners to attempt to find a focus that fits in with "rapid improvement and innovation", each partnership is encouraged to meet at least every 90 days to follow the CI&I steps described in the figures above. Thus, teams are encouraged to meet, share results and support each other regularly (30, 90 & 180 days) (Figure 3.6). A critical issue for accelerated adoption is that if evidence is produced that technologies do not have value that feedback needs to be used by technology producers i.e. the R&D unit needs to CI&I the technologies (Caffyn 1997; Corso and Pavesi 2000; Kumar and Boyle 2001; Boer et al. 2001; Chapman and Hyland 1997, 2000; Wang, He and Tang 2008).

Conclusion

The CI&I process outlined here is the fundamental component of the SI&I model that is used as the basis for designing the Beef CRC's accelerated adoption project. We have described the elements of the CI&I process, and suggested how it can be implemented as a structured process with regular sessions to achieve rapid improvement and innovation as well as longer term improvements and innovations.

While CI&I has most often been applied to improve enterprise and organisation performance outside of agriculture (see Table 3.1), it has the potential of improving and innovation the thinking and actions of individuals, partnerships and networks in a wide range of agricultural contexts. CI&I could be equally as well applied to issues of environmental health, succession planning, family lifestyle choices, etc., and equally as well as to issues related directly to farm business productivity and profitability.

Appendix

Table 3.1. Recent examples of the application of continuous improvement across different sectors

Context	References
Education	Chaffee and Sheer 1992; Harris 1994; Siegel and Byrne 1994; Wild 1995; Sallis 1996; Kanji, Malek and Tambi 1999.
Government and community	Hamilton, Crompton and More 1991; Bunning 1992; Swiss 1992; Offner 1993; Smith 1993a, 1993b; Morgan and Murgatroyd 1994; Anschutz 1995; Berman and West 1995; Kaboolian 2000; Fryer, Antony and Douglas 2007.
Healthcare	Berwick, Godfrey and Rossener 1990; McLaughlin and Kaluzny 1990; Berwick 1998; Langley et al. 1996; Blumenthal and Kilo 1998; Plsek 1999; Radawski 1999; Ferlie and Shortell 2001; Wilson, Berwick and Cleary 2003.
Large product organisations	Crosby 1979; Ishikawa 1985; Deming 1986; Imai 1986; Garvin 1986; Juran 1988; Harrington 1995; Misterek, Anderson and Dooley 1990; Bessant and Francis 2005.
Service organisations	Parasuraman, Zeithaml and Berry 1985; Silvestro 1998; Lingaraj and Khamalah 2004.
Small to medium enterprises	Gibb and Davies 1990; Rizzoni 1991; Sebora, Hartman and Tower 1994; Anderson and Sohal 1999; Chapman and Hyland 2000; Sohal and Terziovski 2000; Gibson 2003.
Research and development	Francis 1992; Miller 1995; Sharman 1996; Caffyn 1997; Gieskes et al. 2000; Vermaercke 2000; Zhou 2001.

Table 3.2. CI&I toolkit

Focus	Focusing Frameworks (e.g. Profit Driver Tree), Focusing Questions, Front End tool, SMARTT Focus, Specialist Questioning Technique
Step 1 – Situation Analysis	Benchmarking, Brainstorming, Concepts maps (mind maps/causal maps), Cost of Production, Fishbone, Flow charts, Focusing Frameworks, Futuring, Gross Margins, How-How Diagram, Inverse Thinking, Nominal Group Technique, Practice Design and Analysis, Process Design and Analysis, Specialist Questioning, System Design and Analysis, Timelines/Timing Analysis/Seasonal timelines, Value chain analysis, Whole Farm Budget, Why-Why Diagram
Step 2 – Impact Analysis	Cash Flow Budgets, Cost of Production, Decision Support Systems, Eight Dimensions Tool, Force Field Analysis, Gross Margins, Impact and Influence, Pareto Principle (80:20 rule), Partial Budget, Sensitivity Analysis, Specialist Questioning, Systems modelling
Step 3 – Action Design	4 Ws and 1 H, Critical Success Factors (CSF) Framework, Front End Tool, Gantt Charts, How-How, Meeting Design, Performance Management Framework, PERT Diagrams, Practice Design, Process Design, SMARTT Role Focus, Specialist Questioning, System Design, Timelines/Schedules/Calendars, OQIO to Support Action Design
Step 4 – Action Implementation	Action, KPI and CSF Checks, Reporting Frameworks, Support Frameworks, OQIO for Supporting Action, Charts, Graphs, Pareto charts
Step 5 – Results Assessment	Charts, Cost of Production, Critical Friend, Graphs, Gross Margin, OQIO for Supporting Reporting, Partial Budget, Performance Management Frameworks, Reporting frameworks, Round Robin OQIO, Specialist Questioning, Support frameworks
Step 6 – Creation and Synthesis	Brainstorming, Inverse thinking, Nominal Group Technique, OQIO, Round Robin OQIO, Six Thinking Hats

Table 3.3. Comparison between CI&I and other approaches based on key attributes, design features, outputs and outcomes

Attributes, Design Features, Outputs & Outcomes	CI&I	TQM	Benchmarking	Action Research	Action Learning	Experiential Learning
For individuals	✓	✓	✓	✓	✓	✓
For groups and teams	✓	✓	✓	✓		
For networks, partnerships, projects, organisations, industries and regions	✓			✓		
Achieves learning	✓	✓		✓	✓	✓
Achieves continuous improvement	✓	✓				
Achieves continuous innovation	✓					
Explicitly works at and achieves continuous improvement and innovation at the systems, processes and practices levels	✓					
Builds the capacity of practitioners and partners so that they can achieve improvement and innovation now and in the future	✓				✓	
Describes set and sequence of steps with associated techniques and tools	✓	✓	✓	✓	✓	✓
Analyses the potential impact of opportunities for improvement before investing time, effort and resources in implementation	✓					
Supports demand-pull for technology, and the effective selection, integration and adaptation of technologies that support outcome achievement	✓					
Specifically uses the support and specialist knowledge of others	✓		✓	✓	✓	
Designed to enable improvement and innovation of the process itself and is therefore continually improving	✓					

Table 3.4. Rapid cycle improvement

Disadvantage of traditional quality improvement	Advantages of rapid cycle improvement
• Usually collect large numbers of records (monthly or quarterly) before planning a change • Data from long periods of time may make it more difficult to effectively determine what intervention actually caused the change • Testing ideas for change takes a long time • If tested intervention is unsuccessful, quality improvement has been delayed	• Can test pilot ideas quickly • Can test ideas for change side by side with existing process • Can test many ideas • Provides opportunity for "failures" without impacting performance • Minimizes resistance upon implementation of successful changes

Figure 3.1. The six key stages of CI&I designed to achieve improvements and innovations

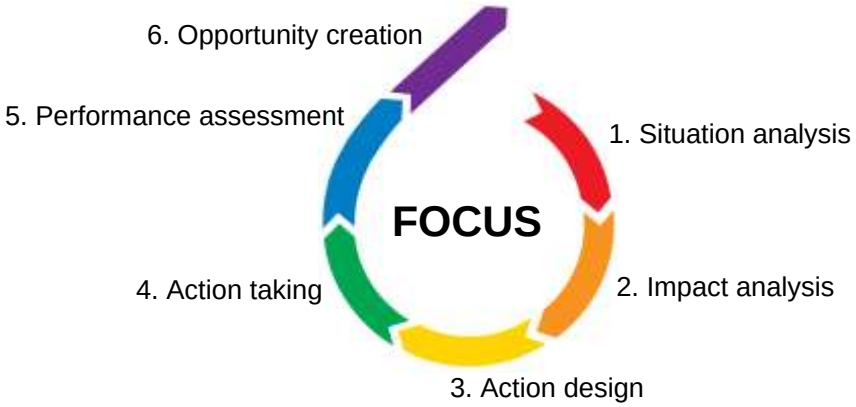

Figure 3.2. The eight steps of CI&I designed to achieve improvements and innovations

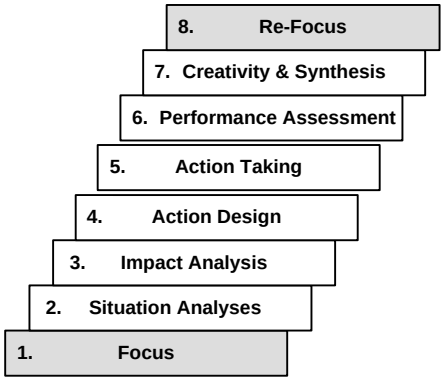

Figure 3.3. A simple profit driver tree

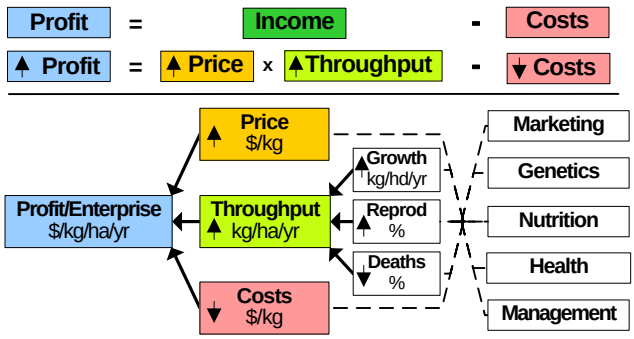

Figure 3.4. Types of focus

Figure 3.5. Rapid improvement and innovation

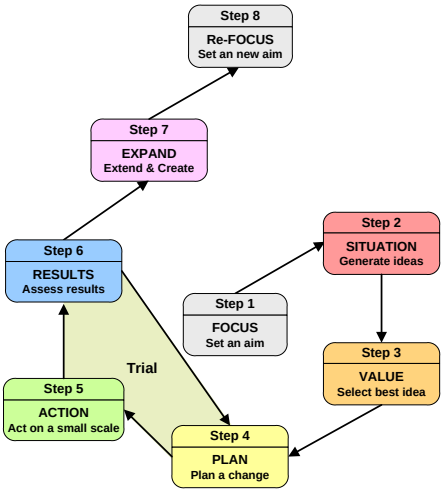

Figure 3.6. Suggested BPP team schedule