

# Evaluating a space for co-innovation: The practical application of nine principles for co-innovation in five innovation projects

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## Abstract

Primary Innovation is a five year collaborative initiative demonstrating and evaluating co-innovation, a systemic approach to innovation addressing complex problems, in five 'innovation projects' (active case studies) in different agricultural industries. In defining the elements of co-innovation, Primary Innovation has emphasised nine principles (based on those from Nederlof et al., 2011) which guide activity in the innovation projects. To understand how useful the nine principles were in guiding practice, and their influence on co-innovation, innovation project participants assessed and reflected on: how the principles were applied in practice; issues that arose; how each influenced the project; and how important each principle was perceived as being in influencing project outcomes. Data were captured and summarised in an on-line survey. While each principle added an important element to each innovation project, different contexts and barriers to implementation required them to be applied in different ways and to different degrees. The nine principles should be understood in each individual project's context because their appropriateness and usefulness were affected by the type of problem being addressed and the stage of the project. It was also evident that they need to be built into the process from the start.

## 1. Introduction

### 1.1 The need to innovate and how co-innovation fits the requirement

Agriculture is of importance to New Zealand's economy and one of the six key drivers needed to achieve the government's ambitious goal of doubling the value of New Zealand's exports is increasing business innovation (Ministry of Business Innovation and Employment, 2014). It was this driver that helped make the case for a new approach to innovation in the New Zealand agricultural sector. As a result the New Zealand Government is now investing significantly in strengthening the innovation system through a program called *Co-learning and Co-innovation to Achieve Impact in New Zealand's Biological Industries*, which is referred to as Primary Innovation (Botha et al., 2015).

### 1.2 Primary Innovation

The technology transfer approach, which encourages the adoption of agricultural research findings, has failed to address increasingly complex problems (Botha et al., 2014). Earlier attempts in New Zealand to encourage adoption of more systemic approaches such as farming systems and Agricultural Knowledge and Information Systems (Klerkx et al., 2012; Reid et al., 1993) were of variable success (Reid & Brazendale, 2014; Turner et al., 2016). Primary Innovation was therefore designed to demonstrate an alternative approach in New Zealand's primary sector that could successfully address complex challenges in modern agriculture. The intention is that problems are addressed through a co-evolution of technologies, practices, policies and market changes undertaken in processes of collaboration and negotiation involving multiple stakeholders in the problems. This is

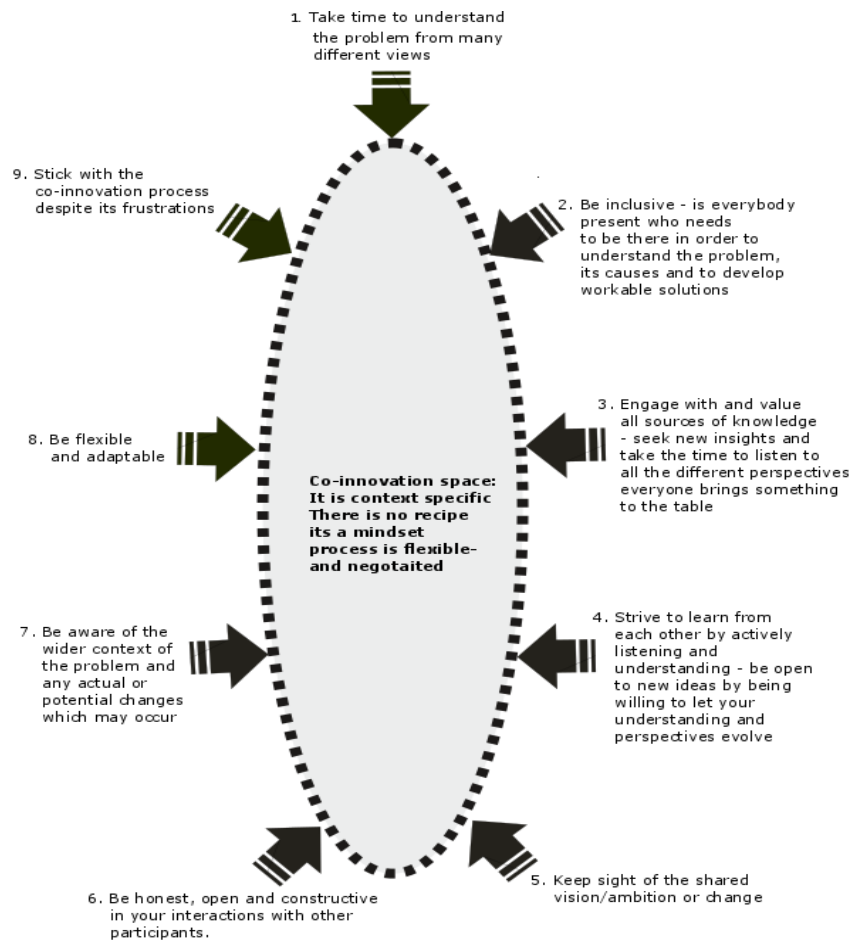
also referred to as 'co-innovation' (Dogliotti et al., 2014; Hall et al., 2001; Klerkx et al., 2012). Co-innovation is considered to be the result of a process of networking and interactive learning among a heterogeneous set of actors, such as farmers, input industries, processors, traders and researchers. There is an emphasis on organisational change (Kilelu et al., 2013), where: innovation is 'co-produced' by many stakeholders; researchers become part of a broader network of actors; and innovation is an emergent property of their interaction.

Primary Innovation has five innovation projects that are embedded in different primary industries, dealing with issues of differing complexity. The projects, in order of estimated complexity from least to most complex, are (Coutts et al., 2014): (i) Heifer Rearing Project (HR) - focused on improving the rearing of dairy heifers by third-party graziers; (ii) Tomato Potato Psyllid (TPP) – which is a vector of the bacterium *Candidatus Liberibacter solanacearum* (CLso) - with the aim to develop economically and environmentally sustainable control solutions for the TPP/CLso complex; (iii) Timber Segregation Project (TS) - working along the forestry value chain to better match forests to markets; (iv) Irrigation Water Use Efficiency (WUE) Project focused on provision of climate and soil moisture data to farmers to support water use decisions; and (vi) Nutrient Management Project (NM) – focused on increasing the implementation of farm nutrient management plans.

Each of the innovation projects sought to operationalise co-innovation to test the extent to which it enabled progress to developing successful solution to each of the five problems being addressed (Coutts et al., 2014). The practice of co-innovation has been informed by social research (Hall, 2005; Klerkx et al., 2012; Nettle et al., 2013), systems research (Adner, 2006; Adner & Kapoor, 2010; Rohrbeck et al., 2009) and business management research (Hueske et al., 2015; Rufat-Latre et al., 2010; Smart et al., 2007; Traitler et al., 2011) on how to tackle complex problems. This research has sought to understand the factors associated with successful (and unsuccessful) attempts to address complex problems in agriculture and natural resource management.

However, implementing co-innovation in practice does have challenges (Botha et al., 2014). Firstly, there is still not agreement in the literature on the specific characteristics of co-innovation, for example when operationalised as innovation platforms (Nederlof et al., 2011). Secondly, much of the literature on co-innovation is retrospective case study analysis (e.g. Amankwah et al., 2012; Batterink et al., 2010; Botha et al., 2014; Dogliotti et al., 2014; Klerkx & Nettle, 2013), i.e., diagnosing what co-innovation looked like in specific circumstances. These insights from specific cases (e.g. improving family farm profitability in Uruguay (Dogliotti et al., 2014)) need to be translated into practices for use in each new context (Thiele et al., 2007), such as the innovation projects described above, for the lessons to be operationalised. Thirdly, challenges to implementing co-innovation have been considered as simply barriers to progress instead of a major focus of research (Beratan, 2014). As a consequence there is limited insight into co-innovation practice in the face of barriers, such as insufficient resources, time or capabilities.

Co-innovation is therefore best described in terms of principles, as its practice is still being defined. Co-innovation is context-specific and adaptive, i.e., how co-innovation is implemented must be tailored to the particular situation, which will also change over time (centre of Figure 1) (Hall, 2005; Klerkx et al., 2010; Schut et al., 2014). In Primary Innovation, key principles for co-innovation were identified from the main principles identified by Nederlof et al. (2011) for agricultural innovation platforms. These were adapted for the context of innovation in the New Zealand primary sector based on the project team's previous experience of co-innovation in the New Zealand context. We used these nine principles to conceptualise the space within which actors can negotiate how co-innovation is implemented in practice over time in specific cases (Figure 1). The nine principles are listed and described briefly below.



**Figure 1: A space for innovation project participants to co-innovate, defined by the practical implementation of nine principles**

**1.2.1 Take time to understand the problem from many different views**

By taking the time to fully understand the nature of the problem, and building a shared vision (or ambition for change) solutions will be more likely to succeed. If you begin by assuming you understand the problem and already have a preconceived solution you may not get the changes you desire. Be prepared to consider a variety of solutions.

**1.2.2 Be inclusive – ensure everybody is present who needs to be there in order to understand the problem, its causes and to develop workable solutions.**

Ensure everyone is there who can help to understand the nature of the problem and its causes, influence the implementation of any potential solutions. Include those who take ideas to the market or create the rules, as well as those who may potentially block solutions. It is easier to develop a solution together than to try and sell a solution after it is formed.

**1.2.3 Engage with and value all sources of knowledge – seek new insights and take the time to listen to all the different perspectives – everyone brings something to the table.**

Be respectful of other views, experiences and ideas, while at the same time challenging ways of thinking in a constructive manner. Sources of knowledge could be local and tangible or scientific but are not limited to these sources of knowledge.

**1.2.4 Strive to learn from each other by actively listening and understanding - be open to new ideas by being willing to let your own understanding and perspectives evolve.**

How we work together and the roles we have may change over time. Active listening is a way of listening and responding to another person that improves mutual understanding. Over time, learning

goes to a deeper level, where mutual understanding can impact on attitudes and values and views on what is important.

*1.2.5 Keep sight of the shared vision or 'ambition for change'.*

Agree on the nature of the problem, its causes and the desired outcome of the project, and regularly review this outcome and progress toward achieving it.

*1.2.6 Be honest, open and constructive in your interactions with other participants.*

Remember we are all in this together and no one group can solve this problem on their own.

*1.2.7 Be aware of the wider context of the problem and any actual or potential changes which may occur.*

We may need to change our solutions and goals as a result of external influences (natural disaster, legislative changes, world markets, unexpected setbacks).

*1.2.8 Be flexible and adaptable.*

How we work together and the roles we have may change over time.

*1.2.9 Stick with the co-innovation process despite its frustrations.*

Be prepared to be uncomfortable and for setbacks to occur – we may have to work through historical tensions, current tensions and although this is not fun it is a necessary part of negotiating shared and workable solutions. Things will take time, but this investment will pay off.

Figure 1 illustrates how these principles together create a 'space for co-innovation' in innovation projects. The concept of 'learning spaces' and 'collaboration spaces' have been used elsewhere to describe either characteristics of physical environments that encourage social learning (Kolb & Kolb, 2005; Matthews et al., 2011; Temple, 2008) or online platforms for collaborative activities, such as software development (Geyer et al., 2001; McComb et al., 2010; Morán et al., 2004). Here we conceptualise a 'co-innovation space' as being characterised by the extent to which combinations of the nine principles are present. We hypothesise that when more of these principles are perceived by actors in an innovation project as present and strong, co-innovation is more likely to occur, leading to successful innovation.

### **1.3 Aim of the paper**

With Primary Innovation in its final stages, research was undertaken on how well the nine principles were perceived as being applied in practice in the five innovation projects, how these principles were adapted to each project's context, and the extent to which the project teams believed the principles influenced innovation and impact. This paper presents the results of this inquiry and provides grounded experiences in the use and usefulness of these nine principles and also raises questions for on-going theory development around the practice of co-innovation.

## **2. Methodology**

This paper is based on the results from a survey of the five Innovation Project teams' use of the nine principles. Each of the project teams was made up of three to five individuals, including the project leader, a Reflexive Monitor, researchers and extension agents, who together implemented co-innovation principles in the project. Each of the project teams were facilitated as a group by the second author in a structured discussion of the questions on the use of the 'nine principles' and a group consensus of responses recorded. During the group process responses were directly inputted into a web-based survey format to reduce double handling of the data and to enable quick access for analysis. Sessions were audio recorded to enable the research team to return to the conversations for any points of clarification. The questions asked in relation to each principle were:

1. How have you applied this principle?

2. What difficulties/issues have you encountered in trying to apply this?
3. How did you address these difficulties?
4. How do you feel that this principle has benefited/added to/changed the project?
5. From your perspective, to what extent have you applied this principle in relation to what you think would be ideal for your project? [rating 0-10]
6. From what you have found to date, how important would you rate this principle in terms of its contribution to a successful project outcome [rating 0-10]
7. General comments about the principle.

Data were collated and the authors analysed the data in a group workshop with the purpose of developing a succinct summary of the feedback around each principle. The rating data was also analysed to provide a context around the qualitative feedback. Synthesised lessons from application of principles were also drawn across the five cases.

### 3. Results

The results are organised by each of the nine principles, with each described in terms of: (i) was the principle perceived as important to the outcomes of the innovation project and what were the benefits of applying the principles; (ii) to what extent was the principle applied in each innovation project, (iii) how was the principle applied in practice in the innovation projects; and (iv) what were barriers to putting the principles into practice and how were these barriers overcome?

#### 3.1 Understand the problem from different views

##### 3.1.1 Perceived importance and benefits

This principle was rated as highly important to outcomes by all projects, however there was some variation in extent to which projects were able to implement the principle in practice. The TPP project for example found it more difficult to implement this principle as it has a strong science focus and the project was contracted and planned before co-innovation was considered. The NM project reported that, by seeking these wider views, “*It has got people on board and given them an opportunity to have more conversations.*” It was also noted that they employed a more controversial way to include different views: “*Ignored nay-sayers and organised meetings anyway – they now are supporters*”. They also acted to bring newcomers ‘up to speed’ noting that ongoing nurturing was needed.

##### 3.1.2 Application, challenges and responses

The projects focused on farmer practice – WUE and HR – on the other hand deliberately brought in farmer views early in the project. The WUE project posed the question ‘how could we manage irrigation better’ rather than ‘irrigation is not well managed’. This resulted in expanding the project focus from soil moisture and irrigation to include soil water drainage element. In the HR project results from farmer focus groups were combined with advice from a technical reference group and input from the funder. This resulted in a broader scope looking at regional differences and non-traditional solutions – moving from weight-gain contracts as the only solution to HR to a broader emphasis on relationships between dairy farmers and graziers.

Although the HR project tried to incorporate different views it did not mean that the stakeholders always were willing to understand each other’s’ views: “*Initially the technical advisory group sort of made their own solutions, they were not really interested in what we were doing and in how we were arriving at solutions.*” And to find out which views to include sometimes took a while as the HR project did not have graziers involved from the start. The TS project experienced similar difficulties with getting people on board and understanding each other’s’ views, taking the project a year to consult with stakeholders and set up ‘clusters’ for stakeholder input. The clusters consist of a mix of growers, academics, processors and suppliers and were described as providing an opportunity for taking time to listen to others’ views – and to put a focus on the timber customers rather than just the grower

(seen as a 'game changer'). It was noted that *"this is the first time that some of the growers and processors have sat in the same room together to have these conversations"*.

## **3.2 Be inclusive**

### *3.2.1 Perceived importance and benefits*

Inclusiveness was rated as very important by the HR project (10) and less important by the others (range from 7-10) with the NM and TS projects the lowest (7). This engagement with stakeholders helped researchers to understand operational challenges and provided a greater legitimacy to the innovation project. Role modelling inclusiveness, as well as persistence of the project team, helped to capture the interest of researchers and science managers and convinced them that being inclusive could be beneficial to them and the project later on.

### *3.2.2 Application, challenges and responses*

Science based research projects found it particularly difficult to achieve (score 6) because scientists preferred to work in the traditional mode, difficulties with getting everyone together and increased contestability associated with increasing the number of stakeholders. In contrast, in the project with a small number of participants (WUE) it was easy to include all participants through face-to-face interactions. In two projects, TS and HR, value chain analysis and stakeholder analysis were used to help ensure all stakeholders were identified and included. Commercial interests in the dairy industry made it hard to include some stakeholders, while in TPP many scientists did not believe an inclusive process was beneficial or necessary to achieve project goals.

In the NM project one-on-one conversations were used to deal with commercial sensitivities and being respectful helped to get and keep stakeholders on board, while in the TS project a strong mix of one-on-one and group interactions helped to address the difficulty of getting all stakeholders in the same room. The HR project experienced challenges around the practicality of including everyone and observed how participation changed over time due to disagreements.

## **3.3 Engage with and value all sources of knowledge**

### *3.3.1 Perceived importance and benefits*

This principle was rated as 'central' to the innovation projects, with an average score of 8.5/10 regarding importance. Most teams were able to invite a wide range of stakeholders into the project, because they valued the knowledge others would bring in terms of understanding the nature of the problem and co-developing solutions. The commitment to this principle was reported widely to result in different stakeholders effectively engaging with and listening to each other, broadening understanding of the issues.

### *3.3.2 Application, challenges & responses*

In practice several challenges arose; first, how to navigate the relative value placed on science knowledge and experience based or industry knowledge, e.g. *"Our scientists use experiments and others experience"* (HR). Reconciling these views when working towards solutions has been difficult because of what different groups believe constitutes "data" or "evidence" or demonstrates cause and effect. In the TPP Project *"...there are not too many people that are engaging with people outside of their science bodies"* meaning dialogue with stakeholders was a new way to operate.

Second, creating bridges between different disciplines or practices to promote understanding also posed challenges: *"We had difficulties understanding what each other were on about"* (HR). The TS project mentioned that *"you often trade away a bit of control as well as some budget and resource as the number of collaborators has increased."* The solution for all cases was *"just do it anyway and let everyone be heard"* (NM) largely through creating forums for dialogue.

### **3.4 Strive to learn from each other**

#### *3.4.1 Perceived importance*

Providing platforms and processes for interaction, discussion and sharing experiences was seen as important to the learning process with resulting changes to planned actions. Teams in the innovation projects felt that they had been doing a lot of listening as part of their projects, and were then able to adapt future actions.

#### *3.4.2 Application, challenges and response*

However they identified that the link between listening and learning was tenuous if people involved already felt they knew what the problem was. In the HR project the team explained; *“We listened at the focus groups, we took it away, developed a strategy and then went back into the regions and said this is the strategy we'd come up with, is this what you meant, is this right? What the focus groups told us did not align with our ideas - we were willing to let our own understanding evolve. It ended up being wider than what we started with.”* In comparison, the NM team commented; *“People can be respectful but actually still not listening... which makes it hard to actually achieve ... this is something that will be noticed over time.”* The TS project continued in this theme; *“This is one of the harder ones for the sector and academics to implement. They have to be willing to change their practices of the past and these can be quite entrenched.”* Moreover organizational boundaries and peoples' personal comfort zones could get in the way of learning too (TS).

### **3.5 Keep sight of the shared vision or ‘ambition for change’**

#### *3.5.1 Perceived importance and benefits*

Innovation project teams agreed that having a shared vision or ambition for change was important. While a shared vision was important there were tensions about the means of achieving the vision.

#### *3.5.2 Application, challenges and response*

There were some tensions apparent in this principle as not all innovation projects had a shared vision. The innovation projects that had a shared vision had some mechanisms for helping the project teams keep it ‘top of mind’. For example, the NM team have a series of management group's discussions informing the vision, and milestone and deliverables based on this vision to keep track of what is happening. The TS team commented *“... the way change should occur was much more contested”*. For the HR project, there was a process of getting to a shared vision, where the vision was refined until they *“... ended up with one that is a win-win for everyone”*.

### **3.6 Be honest, open and constructive**

#### *3.6.1 Perceived importance and benefits*

Team members across the projects felt that this principle required on-going work. It started a process of building trust, with the long term aim of getting those within the project to a point where they could be honest, open and constructive.

#### *3.6.2 Application, challenges and responses*

Some teams did this by utilising the structures that had been put into place, for example in the TS project the team commented that *“... having a levy that supports research has levelled the area – everyone gets equal value from science”*. Most projects struggled initially to build trust, the TPP project for example were working on building trust *“... by suggesting that more interactions would be good”*, but at the same time they also noticed that *“Sometimes there are honest comments but not always put across in a constructive way.”* A particular challenge for a number of projects was the need for hidden agendas to be brought into the open so that real interactions could take place. In the NM project the team said, *“You never really know what the hidden agendas in a group may be”*. In the HR project the commercial competition between some stakeholders initially stood in the way of building trust, and this remains an ongoing issue.

### **3.7 Be aware of the wider context of the problem**

#### *3.7.1 Perceived importance and benefits*

This principle allowed the projects to remain anchored in reality and provided a “...*much wider perspective of what the findings meant and what it meant for different people - kept the system in perspective*” (WUE).

#### *3.7.2 Application, challenges and responses*

An awareness of the wider context within which the project operates was obtained largely “...*by involving all the stakeholders and valuing their points of view*”, by doing this “*you naturally end up looking at the wider context*” (WUE). The principle was seen as important because it “...*informs the project as it develops and we understand if priorities change. Need to be aware that things can change and that projects will need to adapt*”.

The changing context affecting an innovation project is demonstrated both within the HR and the NM projects, both led by DairyNZ, a dairy farmers levy based organisation. Lower global prices for dairy products resulted in a reduced pay-out to farmers triggering an internal reprioritisation of DairyNZ resources towards efficient financial management campaigns. At the project level, this meant greater constraints on staff time and resourcing. Each project team recognised this and altered their plans to suit. For example, the HR project slowed the pace of the project and openly discussed the challenges with other stakeholders.

### **3.8 Be adaptable**

#### *3.8.1 Perceived importance and benefits*

Flexibility and adaptability was rated as very important by all the projects with scores varying between seven (HR) and ten (NM). However, both projects indicated that they had applied the principle very well with scores of nine and ten respectively.

#### *3.8.2 Application, challenges and responses*

Projects overall described the application of the principle in a range of ways. For example, team adaptability and flexibility while being faced by inflexible research goals (TPP), changes to how the project was run (NM), changes in participants' perspectives (WUE and TS), and project role and participation changes that had occurred over time (HR).

Research focused programs experienced difficulties in being flexible and adaptable because of predetermined research contracts, goals, deliverables and budgets that lead to lock-in and disciplinary silos. Changing contracts have significant implications for researchers and cause hassles for science and contract managers which discourage flexibility and adaptability. In one project, difficult relationships contributed to inflexibility and reluctance to change. Continuously communicating openly with funders and participants was mentioned in research focused projects to promote flexibility. In the HR some participants left the project because they felt confronted by the requirement to change. The NM team reported that applying the principle created the “...*ability to respond to new knowledge and changes in context*.” Better utilization of resources occurred because “...*you don't waste resource on things that don't work, for example, we have introduced new tools that weren't thought of at the start of the project*” was an advantage to the TS project. The WUE team indicated that the principle “...*has underpinned the project and the way it has evolved*,” and it also created buy-in from farmers and engaged “other players” like the regional council.

### **3.9 Stick with the co-innovation process despite its frustrations**

#### *3.9.1 Perceived importance and benefits*

Most projects reflected that this was an important principle that all were implementing because they “*are still doing it*”. However, it was not seen as necessarily easy with the nine principles all being



closely connected and so the need for co-innovation to be “a mind-set not a recipe”. The HR project argued that context was critical rather than persevering with all principles once they have achieved their benefits.

### 3.9.2 *Application, challenges and responses*

The TPP project spent effort adapting the co-innovation approach to the context that worked for the different stakeholders – in terms of language and methods. The TS project reported that while they remained committed to active engagement through innovation clusters, they were aware of a need to be flexible, e.g. moving from six monthly to twelve monthly meetings to avoid ‘meeting fatigue’ and using distance communication tools. The NM project reported the need to deal with setbacks and “...working in spaces where we are out of our comfort zones and keeping the shared vision in front of us”. A number of projects referred to how application of the principles resulted in “...slowing down the process”, and a loss of some control by researchers. However, TPP noted that the approach has “...put the team in a better place for other projects going forward (trust building)”, and “...it’s an investment in the future”.

## 4. Discussion

### 4.1 Relevance or importance of principles

All of the innovation projects rated all of the principles highly (on average 8.6/10, range across principles 8.2-9.4) in terms of their importance to achieving outcomes regardless of context. The highest rating of 9.4 was being honest, open and constructive (6).

A common theme on how these principles benefited projects, was that they created buy-in by a wider group of stakeholders and improved problem understanding. The TS project’s reference to a mix of stakeholders in the room focusing on the timber customer was described as a ‘game changer’. Other projects reported that this facilitating conversations with different groups and seeing stakeholders effectively engage with one another resulted in a broader understanding of what was needed. There was consistent feedback about how this inclusion ‘got stakeholders on board’ with what the project was trying to achieve.

Improved problem understanding as a result of being inclusive, valuing multiple sources of knowledge and striving to learn from each other also reshaped solutions. For example: the HR project moved from a focus on ‘contracts’ to that of strengthening relationships between dairy farmers and contract ‘rearsers’; the WUE project moved from a focus on water application only, to the inclusion of soil moisture monitoring that highlighted drainage issues; the TS project included new timber processing tools that weren’t thought of at the start of the project; and the NM project was able to stop some planned activities because they were wasting resources.

Some principles were rated much lower by individual projects. The HR project for example, rated sticking with the process (9) and engaging with and valuing all sources of knowledge (3) as only 5/10 each. In their case, the problem area was a lot more defined with the focus on the two groups with a stake in the problem. It seemed that from their perspective once the issue had been teased out and an alternative approach identified, on-going and broad engagement was less needed.

Even though all principles were rated as very important by the projects, the average rating of the extent to which they had applied the principle was lower at 7.8/10 – with flexibility (8) having the lowest average rating (7/10). Comments around flexibility related to the context issues raised earlier – contracts already in place; timelines and milestones already set; and lack of resources. This was particularly the case with research focused programs – and particularly where the attempt to implement co-innovation occurred after the project had commenced. Application of adaptability (8); wider context (7); and different views of the problem (1) were rated in one project as two, three and four out of ten. There was flexibility in the way different projects applied and adjusted implementation

of the principles. For example, the NM project focused on individual farmer collaborators while the HR project used farmer focus groups to gain input and feedback.

#### **4.2 Challenges encountered**

A number of projects made reference to the process of applying the principles around engagement as having 'slowed the process down'. The need to communicate, negotiate, organise meetings, follow-up and other logistical issues around engagement added cost in terms of time and resources. This was particularly an issue where contracts and timing and milestones were in place and there was little scope to act on what emerged from the extra engagement. One project that also reported this 'slow down' as well as some loss of control by the project team saw long term benefits of the process in positioning the research team 'in a better place for projects going forward.'

There were also issues around mind-sets and agendas that some individuals/groups brought with them to the table – and skill was needed to develop a truly collaborative/cooperative approach in some instances. This impacted on gaining the 'shared vision' (5), but also on the way that the vision was enacted. This raises the question about the extent to which all stakeholders need to share the same specific vision.

#### **5. Conclusions**

The responses to the survey showed that the nine principles should be understood in the context of the individual projects. Teams provided examples of where they have applied these principles, where they have had problems applying them and how they view them in terms of influence on outcomes. Despite the apparent overlap, each principle added a different aspect around the underlying application of co-innovation. Although there is scope to review these principles and consolidate some, care needs to be taken not to lose each specific facet of the diamond.

The application of these principles within these innovation projects demonstrated that their appropriateness and usefulness were affected by the type of problem being addressed and the stage of the project. Clearly, it is difficult to meaningfully bring in broader perspectives, flexibility and extra engagement when contracts have already been written with explicit activities, outputs, and tight deadlines. Also, where projects are directed at very specific management practices or boundaries, there are limits to the value of broader stakeholder involvement and slow down a process for little gain. It is clear that they need to be built into the process from the start – with the appropriate room to move within the project time frame. Also, the application of these principles needs to be considered in the context of the complexity of the problem or scope of the opportunity, and recognise that not all projects require the same degree of application.

The principles have been shown in these examples to assist in implementing co-innovation in practice, and appear to have supported project teams in reflecting on, learning about, and improving their own co-innovation practice. The principles, in themselves though, do not ensure that project teams have the skills or tools they need to be able to apply them. It was evident that when engaging a broader group of stakeholders, skills such as facilitating learning, negotiation (with funders and stakeholders) and conflict management are needed. Tools are also needed to support teams in terms of selecting the stakeholders with whom to engage (for example, stakeholder analysis, social network analysis), in capturing complexity (for example, systems mapping), looking at alternatives and in evaluating progress. Extra time and resources are also needed to fully enact some of these principles.

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