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Sustainable citizenship as a methodology for engagement: navigating environmental, economic, and technological rationalities

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Abstract The emergence of more and more new technologies ranging from genetic modification to nanotechnology is significantly affecting the environment in many different ways. Yet, policy making has not been able to keep pace with the rapid development of these technologies because of deeply entrenched divisions among stakeholders who prioritize different, often radically opposed, sets of values associated with technological interventions. Drawing on a theoretical framework of "sustainable citizenship" and a methodological platform of Q-surveys, this article identifies the shared values embedded in the overtly polarized positions of stakeholders to provide policy makers a common ground to work on. The article highlights a novel form of public engagement that interweaves socio-ecological rationalities with those of the economic and the technological. Mapping the values and beliefs of a variety of stakeholders and finding what is common to them paves the way for more inclusive policy responses to the challenges of new and emerging technologies.

Keywords Sustainable citizenship · Public engagement · Nanotechnology · Q-methodology · Ecological rationality · Technological rationality

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Introduction

As a growing number of contested new technologies emerge with the potential to have significant impacts on the environment, policy making on such technologies is being stymied by polarized, and often intractable, positions taken by a range of stakeholders. Such technologies, including nanotechnology, genetic modification, and transgenics, pose particular dilemmas for policy making given the challenges of determining socially and politically acceptable policies. This article offers a way of identifying the different discourses underpinning key stakeholders' perspectives on new technologies, which can inform policy making for environmental sustainability. It draws on a framework of "sustainable citizenship" (Kurian et al. 2014a) to explore the efficacy of a method of public engagement that allows the articulation of environmental, economic, and technological rationalities in order to forge a path forward for policy making.

The sustainable citizenship framework, developed at the intersections of the discourses of citizenship and sustainability, rests on negotiating a range of deliberative dialectics that emerge as "major nodes of discursive tension between understandings of citizenship and sustainability" (Kurian et al. 2014a, p. 438). These dialectics include rights and responsibilities, rationality and emotion, human and non-human nature, universal and particular, and democracy and capitalism. The dialectics of rights and responsibilities, for example, swing from a focus on individual and community rights on access to resources for economic survival to a focus on responsibilities, both individual and collective, to present and future generations, for issues such as climate change, waste minimization, and over-consumption of resources. Similarly, there are tensions between technical rationality with its goal of economic development driven by resource exploitation, often through the use of new technologies, and ecological

rationality, "a rationality of living systems, an order of relationships among living systems, and their environments," which is "a way of thinking about actions, about organisations, and about ultimate ends or values" (Bartlett 1986, p. 229; see also Dryzek 1987). Where technical and economic rationality are inherently driven by short-term thinking and a utilitarian approach to decision making, ecological rationality is focused on ensuring planetary sustainability and human well-being (Kurian 2000).

The dialectical tension between human and non-human nature is evident in the differences between those who take an anthropocentric view of nature, viewing humans as separate from nature, and others who view humans as interdependent with nature, and see the undermining of nature as undermining human beings. Another dialectical tension of the sustainable citizenship framework is that between the universal and particular. Classical notions of the universality of citizenship as an expression of "general will" and "equal treatment" have been challenged by scholars as exclusionary and based on assumptions of a homogenous citizenship (see Young 1989). Instead, there has been a powerful argument for special rights based on group differences as an integral part of citizenship (Young 1989). Thus, "sustainable citizenship invokes a commitment to seemingly universal principles of justice, equality, and sustainability refracted through the lens of the local and the particular" (Kurian et al. 2014a, p. 445). A final dialectical element of the framework is focused on the contradictions and tensions between democracy and capitalism. Capitalism by its nature privileges individuals and business which can trample local ways of being and undermine sustainable livelihoods. At a more fundamental level, capitalism is predicated on economic growth, which comes up against planetary limits. The singular focus on ever-increasing growth and unfettered consumption can contribute to creating a society where the primary identity of individuals is that of a consumer, undermining democratic ideals of responsible citizenship. Yet, as Kurian et al. (2014a) note, capitalism requires some degree of individual liberty and freedom, which are necessary for democratic politics as well. Given these tensions, sustainable citizenship views the greening of capitalism as essential.

The complexity of the dialectical framework is also evident in the tensions within categories deemed to be homogenous. For instance, worldviews on environmental sustainability range from one that positions ecological rationality as having "lexical priority" (Dryzek 1987) at one end of the spectrum to one that assumes that technological and economic rationalities should guide environmental, social, and political problem solving, and that a technological fix is possible within current relations of production. The former can be termed "socio-ecological sustainable citizenship" as it challenges the positivist modes of thinking and the ideology of progress, and calls for changes in dominant social relations of production so that ecological values drive environmental decisions (Bartlett 2005; Eckersley 1998; Torgerson 1990). At the other end of the spectrum is what can be termed "technological sustainable citizenship" which takes an anthropocentric and utilitarian view of nature, the assumption being that environmental and sociocultural risks can be determined through instrumental means (Bartlett 1986; Dryzek 1997). To find a common ground between this polarity of positions on the use and impact of new and emerging technologies, we used a methodology specifically geared toward productive engagement—Q-methodology.

Q-methodology

Q-methodology, involving the use of Q-sort surveys, has been in use since the 1950s and has been applied extensively to contested and complex policy domains (Brown 1980, 1993). The strength of Q-methodology over traditional survey techniques is that it requires participants to prioritize their beliefs in relation to other beliefs. Life choices are always a trade-off and capturing how priorities relate to each other is important to move contentious groups toward constructive conversations. Q-methodology recognizes

> …that policy problems are matters of interpretation and social definition; they allow participants to articulate their subjective positions but also require them comparatively to rank some subjective positions over other positions instead of choosing one response (Kurian et al. 2014a, p. 447).

Brown and Coke (1977, p. 16) summarize well the substantive, analytical, and logistical advantages of Q-methodology: It focuses on the controversy from the standpoint of the stakeholder, i.e., it allows each person to model his or her own attitude in the form of a Q-sort; it requires very few subjects; it can be administered, scored, and analyzed within a relatively brief period of time and at a low cost; it can indicate the relative degree of significance of each single opinion with respect to all other statements by gathering statements in rank orderings; and it reveals in detail the major points of agreement and disagreement across entire segments of the population.

From a policy making perspective, the strength of Q-methodology is evident in that it focuses not on the individuals themselves but on identifying patterns across individuals. It also assumes that there are a finite number of discourses on any issue at any given time in society. Q-methodology allows the identification and analysis of such discourses and the possible common ground between contested discursive positions on issues. As Barry and Proops (1999, p. 339) comment:

> It is, therefore, particularly suited to studying those social phenomena around which there is much debate, conflict and contestation, such as the environment, for its express aim is to elicit a range of voices, accounts and understandings.

Q-sort processes

We undertook two Q-sort surveys in 2013 to identify and categorise stakeholders' beliefs and values about sustainable citizenship and about new and emerging technologies in New Zealand. This paper presents a critical analysis of the second survey. The survey statements were generated from the literature in the fields of sustainability and citizenship, and through interviews with key stakeholders on the use of new and emerging technologies, including people representing environmental, agriculture, business, and community interests as well as elected officials, researchers, scientists, and local and central government actors. The initial list comprised hundreds of statements, which was then distilled down to 41 statements for each survey. The process of identifying the final list of statements was informed by Dryzek and Berejikian's (1993) matrix of discourses and types of claims that helped us to select statements which captured the range of perspectives on new and emerging technologies.

The participants were chosen from across New Zealand based on their representative viewpoints and opinions and, therefore, constituted a non-randomly selected sample of people from across the spectrum of stakeholder groups concerned with sustainable citizenship and new and emerging technologies. The survey was piloted by additional people in the same categories and revised according to their feedback.

Potential participants received an email invitation that explained why they were invited to participate in the project and, once they agreed, were directed to a web link for the online survey which guaranteed anonymity. A total of 35 completed the survey out of a total of 66 invited. This response rate compares favorably with other online surveys targeted at specific population groups that receive a personalized "invitation" to participate (Couper 2000). Participants were asked to respond to the survey according to how strongly they agreed or disagreed with each of the statements in a set of 41 statements. Unlike regular surveys, Q-sort surveys require participants to "sort" statements on a continuum of extreme disagreement (−4) to extreme agreement (+4) but only three statements can be placed under each end of the scale (−4 and +4), three statements under −3 and +3, five statements under −2 and +2, six statements under −1 and +1, and the remaining seven statements under 0. The scale in Fig. 1 illustrates that there is a fixed number of statements allowed under each value.

The purpose of such a survey is to force participants to prioritize their beliefs and values about new and emerging technologies. They need to make subjective value choices according to what they perceive are the most important combination of concerns. Q-methodology is not intended to determine the proportional distribution of the discourses; only to identify substantively different types of discourses present in the data. Therefore, the number of people falling into a given discourse does not represent the prevalence of the perceptions within the stakeholder groups being surveyed.

To identify the key "discourses" around new and emerging technologies from the Q-sort survey, we used cluster analysis which is ideal for this study as it is a multivariate analytical strategy that seeks to find homogeneity among cases (Aldenderfer and Blashfield 1984). In particular, we used hierarchical cluster analysis which draws on a stepwise algorithm to merge two objects at step, with the two that are merged having the least dissimilarity (Romesburg 2004).

The participants were given the space to elaborate on why they ranked their statements as they did, particularly those at the extreme ends of the continuum. These comments were also drawn on to support the interpretation of the different discursive views. Each cluster that emerged can be understood as a discourse. Each of these discourses is shaped by different values, beliefs, and possible preferences for what constitutes best institutional practices. Membership within a discourse demonstrates similar priorities for each participant on new and emerging technologies.

Addressing inequalities in all forms is central to sustainable citizenship (Kurian et al. 2014a). Therefore, being able to ascertain the relationship of each of the different discourses to power is important. This is because policy making is socially mediated through discourse, and dominant discourses are understood to involve the exercise of power through giving credibility and legitimacy to some voices while marginalizing others (Fairclough 1996; Howarth et al. 2000; Laclau and Mouffe 1985; Stone 2012). To understand these power dynamics, we interpret the survey data drawing on discourse analysis (Fairclough 1989, 1992, 2003; Feindt and Oels 2005). Discourse analysis recognizes that this power dynamic can impact on who gets to determine environmental and sustainability outcomes. Before we turn to an analysis of the survey findings, we provide the context for the findings by summarizing the different discursive understandings of sustainable citizenship that emerged in the first survey on sustainable citizenship.

The survey on sustainable citizenship (Kurian et al. 2014b) revealed agreement among the participants on a commitment to look after future generations, the importance of participatory processes, and the need for businesses and individuals to take responsibility for the problems they cause to the environment. There was, therefore, strong agreement that sustainable citizenship requires the prioritizing of social responsibility over individual rights, and that social and economic inequality must be addressed. But there was also a tension among the range of understandings of sustainable citizenship. Of the five discourses on sustainable citizenship that emerged, four supported a holistic approach being taken when considering resource management concerns. The fifth discourse, however, saw the object of resource management as scientific problem-solving that should be managed by technical experts. This indicated an overarching dialectical tension between a socio-

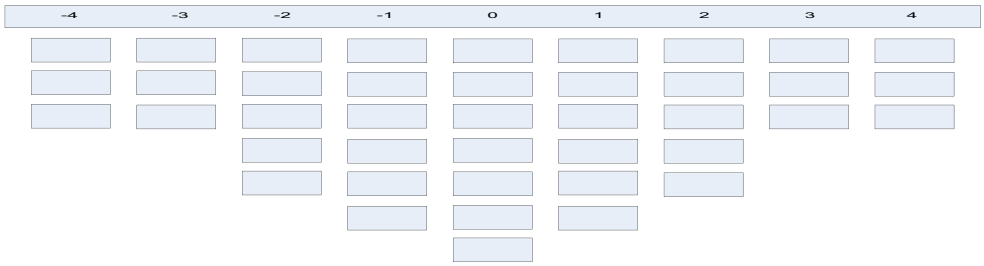

Fig. 1 Q-sort survey sorting scale

ecological and a technological worldview with regard to sustainable citizenship. For the socio-ecological sustainable citizenship discourse, a strong precautionary approach was seen as necessary to frame policy, whereas for the technological sustainable citizenship discourse, a utilitarian approach and technical solutions to social, environmental, and political problems was acceptable.

We now look at an evaluation of the values and beliefs of the survey participants on new and emerging technologies.

Beliefs and values about new and emerging technologies

We start by exploring each discourse that emerged separately, and then look at the areas of convergence and divergence in values and beliefs among the discourses.

We then draw on the sustainable citizenship framework to assess the overall findings from the survey. The findings allow us to interpret the convergence and divergence in values and beliefs of the different discourses with regard to new and emerging technologies. It is the commonalities that serve as the basis for developing trust and respect for each other. In highly contested policy arenas, values and beliefs held in common can serve as the foundation upon which to build collaborative action.

The survey revealed four distinct combinations of beliefs and values around new and emerging technologies:

Discourse A: Anti-capitalist/anti-corporate
Discourse B: Animal rights
Discourse C: Techno-skeptics
Discourse D: Techno-optimists

The statement selection for each of these discourses from the Q-sort survey is presented in the summary in Table 12.

Discourse A: anti-capitalist/anti-corporate

The anti-capitalist/anti-corporate discourse prioritizes a combination of environmental, social, and cultural values as described below. For those who subscribe to this discourse, the public is not well informed about new technology risks. They believe that new technology developments will primarily benefit global companies and will do nothing to help society eliminate sickness and poverty or social inequalities. Likewise, given that there are already environmental problems with current industrial methods of food production, global corporate ownership of genetic modification (GM) patents for animals and grains will worsen food and environmental security. With technological innovation being a transboundary enterprise, ownership of new technologies will also restrict New Zealand's independence.

This discourse does not trust business or scientists to minimize the risks of new technologies to the public. If New Zealanders wish to be responsible, sustainable citizens and look after the environment for present and future generations, then the best means of doing so is through the development and support of organic and sustainable farming. This discourse challenges the contingency of scientific facts (Wynne 2001), and does not believe that scientists or businesses can be trusted to uphold the best interests of society given their close alignment with the market. Views expressed as part of these discourses are not anti-science, but emphasize the importance of developing innovative technologies focused on the greening of industry to make communities sustainable.

The anti-capitalist/anti-corporate discourse is shaped by the socio-ecological sustainability worldview, which sees the economy and ecology as being interdependent and calls for economic growth to be constrained by wise use of resources in order to guarantee inter- and intra-generational equity. In sum, this discourse supports a precautionary approach to new technologies.

The participants clustered in this discourse provided many comments to support their statement selection, examples of which are presented in Table 1. This is followed by the demographics for this discourse in Table 2.

Discourse B: animal rights

Like the previous discourse, the animal rights discourse prioritizes a combination of environmental, social, and cultural values but adds a unique concern for how GM affects animals.

Like the anti-capitalist/anti-corporatist discourse (Discourse A), this discourse believes that organic and sustainable farming methods are the most appropriate approach to meet

Table 1 Supporting comments anti-capitalist/anti-corporate

- The general public is largely unaware of how much GM is already entering our food chain. Also, it seems many of the risks are being minimized or covered up by corporations because of the high financial returns GM products offer them.
- Much confusing information gets into the public media because of competing agendas. The potential negative effects of new technologies are often difficult and time-consuming to prove and the precautionary principle gets short shrift.
- In a free-market system, business leaders are only serving their own interests and cannot be trusted to look after the well-being of the collective.
- Scientists are primarily interested in the pursuit of new knowledge. Their organisations, the Crown Research Institutes, are now driven by financial motives. Where in this generalised mix is there concern for society? There will be individuals who do care but the science culture and the research organisation culture are not supportive of that view.
- The corporate ownership of new technologies is perhaps the most concerning thing for me. Because the use and development of new technologies is driven by the market, it is likely they will be used to increase our dependence upon big corporations and therefore increase poverty and reduce social well-being.
- Business leaders will not set out to harm their clients but they do not accept responsibility for the wider environmental impacts—the externalities. They will do as little as is necessary to get approvals and product to market. That is what their shareholders demand of them. We need a system where proof of no harm is held in higher esteem than the other way around.
- Profit-driven, shareholder interests trump a more conservative approach. We need a system where proof of no harm is held in higher esteem than the other way around.
- History has shown that new technologies tend to aid the already rich and powerful, and often further marginalize marginalized groups.
- At the heart of any decision, the fundamental question should be "how does this decision affect the most vulnerable in our society?" The privileged and powerful have a responsibility to use their power for the collective good, not just to serve their own interests.

the economic, environmental, and sociocultural needs of New Zealand. Both discourses are critical of current industrial methods of food production as not being environmentally sustainable, and believe we have an insufficient understanding about the risks and benefits of new technologies.

The unique concern of this group is its focus on the harm done to animals. Members of this group not only see GM experimentation on animals as unnecessary for progress but also point to the reports of GM animals dying from grossly distended organs as proof the technology is not understood. Adherents of this discourse see no good in continuing with such experiments. They do not trust scientists or business leaders, and indicate a consequentialist ethical understanding of new technology risks with their concern about current GM experiments leading to the death of animals. The concept of sustainable citizenship for this discourse is inclusive of non-human nature, and they align with a consequential ethical view of the responsibility to minimize harm to animals and the environment (Kurian and Wright 2012). This discourse rejects that GM is merely a quicker way to traditional plant and animal breeding and sees proponents of GM as irrational in their belief in its safety.

Table 2 Demographics: anti-capitalist/anti-corporate

75 % male, 25 % female; either under 40 or over 60; 86 % bachelor's degrees, and 50 % have graduate degree; majority in organizations that address sustainability concerns

The animal rights discourse too draws on a socio-ecological sustainability worldview supporting a precautionary approach to new technologies, grounded in their deep concern that non-humans are being greatly harmed and such unnatural experiments will ultimately harm all of nature, including humans. The supporting comments and demographics are presented in Tables 3 and 4.

Discourse C: techno-skeptics

The techno-skeptics discourse prioritizes a combination of environmental, social, and cultural values as described below. Like the previous two discourses, this discourse too is about taking a precautionary case-by-case approach to new technology risks because of a lack of thorough understanding of these technologies. Although the numbers are small (with only three people), this discourse is an important one as it represents the voice of Māori who are the indigenous people of New Zealand. Two of the three individuals in this discourse formally state their links to an iwi (tribe) or hapū (clan). In this discourse, the acknowledgment of special rights based on group differences, such as for Māori, is a core concern. Ethical factors are central and need to be prioritized in the development and assessment of new technologies. This is because new technologies (particularly new GMOs) pose ethical questions. Participants subscribing to this discourse do not trust scientists and business leaders to include ethical and cultural questions into their decision making. This discourse appears to draw on deontological ethics in their assessment of GMO risks. From this perspective, some actions should not be performed even if biophysical risks are low. For Māori, for example, the concepts of *whakapapa* (genealogy) and *mauri* (life force) are pivotal to their understanding of the world, and the mixing of species is deemed to be culturally unacceptable (McFarlane and Roberts 2005). In this worldview, there is no disjuncture between the spiritual and material worlds, and the environment and its resources are both ancestors and kin of human beings. Challenging the western dualistic approach which can separate elements into living/nonliving and nature/culture (Roberts and Fairweather 2004), adherents of this discourse do not see GMOs and other new technologies as enhancing New Zealand agriculture. Again, this is a socio-

Table 3 Supporting comments: animal rights

- From my point of view as a Maori, we are somewhat scared of change, especially with technology unknown to us and also with the understanding that any unnatural elements affecting our natural environment (papatuanuku) and all living things are perhaps compromised.
- It is fair enough to say that we do not understand enough the impacts of new technology. The kiwi green image is not a slogan; it is a necessity to sustain the important things in life.
- Most new tech research is driven by profit motive by corporations and their track record of caring for the natural world and public good is very poor.
- NZ could meet its own food needs by farming organically and sustainably and exporting this sort of expertise is a sound way to support and build our brand.
- NZ should develop a strong organic niche market to supply both local and international markets; organic production has the added benefit of being more sustainable and safe for the environment.
- Industrial methods of farming are reliant on high inputs of fossil fuels and chemicals and do not consider the health of soil, water and air over time. Organic methods of producing use natural processes to enhance production and work to increase the health of the soil for future use.
- GM crops are not created to reduce pesticide use. They are produced to give the company who developed them ownership of the seed variety and control over all crops.
- I do not think that the long-term benefits and risks of GM technology can be understood especially where modified plants are realised into the wider environment where they interact in a dynamic system.

ecological sustainability discourse with a particular focus on the inextricable links between human and non-human nature. This discourse too calls for a strong precautionary approach but specifically demands the consideration of social, cultural, and ethical values in any assessment of the risks of new technologies. Supporting comments, demographics, and statement selection are presented in Tables 5 and 6.

Discourse D: techno-optimists

The techno-optimist discourse is focused on a very different worldview from that of the previous discourses. Some of the perspectives are in direct conflict, but most of the defining characteristics are simply focused on a very different angle of the GM debate. In this discourse, GM holds much promise for addressing societal problems—from eradicating human diseases to creating a more sustainable food system in New Zealand.

Table 4 Demographics: animal rights

Female 85 % between ages of 30 and 50; 86 % bachelor's degrees; 29 % master's degree; 50 % employed in organizations that address sustainability concerns

Table 5 Supporting comments: techno-skeptics

- The true effects of nanotechnology and genetic modification are not known yet. The mixing of plant and animal forms is not acceptable to Māori; this goes against Māori beliefs.
- Environmental needs must be put before economic needs.

Because proponents see new technologies as neither good nor bad, and reject the idea that GM is immoral, the ethical concerns underpinning the other perspectives are absent in this discourse. Rather the issues of most concern to the techno-optimists center around not throwing out a scientific advancement out of fear. These people are fundamentally optimistic that societal and environmental good can come out of GM.

A "promethean worldview" (Dryzek et al. 2009) and strong techno-optimism shape this discourse. Like the other discourses, this discourse reveals little trust of business or the market; however, there is a strong belief in science. In this discourse, it is right and responsible to pursue the development of new technologies because they could "progress" the greening of the environment, and lead to better health outcomes for individuals. People subscribing to this view have a fundamental belief in science as a solution, and they see the risk of not proceeding as a problem. There is little concern for non-human nature or for ecological and precautionary perspectives. In sum, they reflect a technological sustainability worldview which supports technological solutions to social and environmental problems. Comments and demographics of this discourse are presented in Tables 7 and 8.

We next evaluate the commonalities, majority views, and differences across the discourses. The defining statements for each of these elements are brought together in the summary in Table 9.

Commonalities across all discourses

Although four distinct discourses emerge from the responses of a range of publics with unique perspectives on the use of new and emerging technologies, what is interesting is that there are important beliefs and values held in common. There are at least two areas of consensus among all the participants which connect to the notion of sustainable citizenship.

Table 6 Demographics: techno-skeptics

Two females and one transgender; two under age of 30; two are affiliated with Iwi/hapu, variously employed or in education programmes that focused on sustainability concerns

Table 7 Supporting comments: techno-optimists

- We can actively pursue science and technology development and have a good environment. The two can work together.
- I believe it is important to protect society's interest in respect to new technology, but we should not hamstring scientific advancement.
- Every effort is needed to anticipate and negate risks but to yearn for a simpler less complex life is not realistic.
- It depends on what you define as biotechnology. Conventional plant and animal breeding are biotechnology that exploits natural mutations.
- I like living with the benefits of modern science. We should continue to explore ways of bringing these and future scientific advances to more of humanity. Who am I to deny that to future generations?
- Fire and chemistry have destroyed more human life than these new technologies. This kind of thinking is fiction and not based in reality.
- Was the new technology unleased on Hiroshima any worse than the old technology used on Dresden? It was not the science that caused the negative consequence it was the political and social situation.
- Business primarily strives to add to shareholder value so there needs to be checks and balances to ensure that no harm occurs to society and the environment by businesses.
- Since our economy is agriculturally based, failure to capture the advances would see us slipping into uncompetitive position and becoming a poorer society as a result.
- I do not believe that nanotechnology runs contrary to Māori values particularly that of "Mauri" or life force as long as the sacredness of nature is preserved and enhanced. Nanotechnology can enhance environmental quality and protection.
- I do not see the link between morality and the use of GMOs.
- There is a fat white middle class that believes in some past rural idyll. This never existed; their beliefs are driven by a fantasy view of the world and a belief in conspiracy.
- Some of the public are well informed, the great mass are not; there is a lot of zealotry and no amount of information will shift them.

The first is the consensus on the importance of protecting the environment. The second is the common concern with issues of democracy and capitalism, as participants across the spectrum recognize that businesses primarily serve the self-interest of companies which is separate from protecting citizen rights.

Shared values

The anti-capitalist/anti-corporate, animal rights, and techno-skeptics discourses view scientists with suspicion when it comes to ethical considerations such as upholding the best interests of society and the environment. For them, there is simply insufficient knowledge as yet about the benefits and risks of GM; therefore, the pursuit and promotion of such technologies is dangerous.

Table 8 Demographics: techno-optimists

94 % Male; two-thirds graduate degrees; one-third high school; 81 % employed in organisations that address sustainability concerns

Table 9 Defining statements

Consensus statements across survey

- As kiwis, we value clean air, clean water, open spaces. and our natural landscapes.
- Business leaders cannot be trusted to minimize the risks of new technologies to human health

Majority viewpoints across survey

- The benefits and risks of genetic modification technology *are not* yet well understood.
- Scientists *cannot* be trusted to uphold the best interests of society and the environment at all times.

Areas of direct conflict across survey

- New Zealand *should*/*should not* use GM technology in the interests of preserving its 'clean, green' international image.
- *Good*/*No good* will ever come from tinkering with the fundamental mechanisms of nature.
- Transferring any alien genes into any organisms *is*/*is not immoral* and *should*/*should not* be allowed.
- The benefits of science to society usually *do*/*do not* outweigh its negative consequences.

In addition to the doubts about GM and lack of trust in scientists, the anti-capitalist/anti-corporate and the animal rights discourses share several additional key common values and beliefs, which make them natural allies. First and foremost, they share a similar worldview about food systems. They see the current industrial method of food production as unsustainable and, at least for New Zealand, organic and sustainable farming methods are seen to be appropriate to meet its low-population food needs. They also reject the idea that New Zealand must pursue genetic modification of crops and livestock in order to remain competitively globally. In fact, they see New Zealand's competitive advantage in its "green, clean" image, which will be irrevocably damaged by New Zealand pursuing a GM agenda.

Differences

The commonalities notwithstanding, there are five areas of direct conflict across the discourses. These are clashing beliefs and values that are difficult to resolve. But knowing and understanding the different perspectives in conjunction with learning about their shared values allows for stakeholder groups to address conflicting perspectives in a more productive way, including simply the ability to agree to disagree. In high stakes policy arenas, meaningful deliberation among groups holding diverse and conflicting perspectives is an essential step toward developing constructive compromises.

The areas of conflict span a range of sustainable citizenship concerns. These include conflict over the rights of non-human nature, the rights to a clean environment, the rights to

minimize harm to the economy through preserving the clean green image, and conflict over whether the use of GM crops and livestock will improve New Zealand's global competitive advantage or not. An important difference is also whether new technologies need ethical consideration in determining risks.

The summary in Table 10 presents the overarching beliefs and values for each of the above discourses. In the next section, we evaluate how the different sustainable citizenship dialectics have shaped the four discourses on new and emerging technologies.

Sustainable citizenship dialectics and new and emerging technologies

Rights and responsibilities

Rights and responsibilities for sustainable citizenship are concerned with individual and community rights and what this means for responsible citizenship. For all discourses, there is a consensus on a citizen's right to a clean environment. In the anti-capitalist/anti-corporate, animal rights, and techno-skeptic discourses, social responsibility should come before individual rights, and social inequality is a problem that needs to be addressed. Group rights are seen as important. This value also translates into what these discourses believe is a responsible approach to new and emerging technologies. The majority view is that new technologies are ill-equipped to address inequality or help eliminate sickness and poverty and that the public is not well informed about the risks of new technologies. However, the techno-optimist discourse supports the individual right of scientists to pursue science, and improve individual well-being through technological and medical advancement. This view mirrors the scientific rationalist discursive view in which scientific knowledge is value-free and therefore new technologies cannot be viewed as good or bad (Regal 1996).

Rationality and emotion

There has long been a bifurcation of rationality and emotionality in western thought (Cheney et al. 2011), and this tension between rationality and emotion is evident in the different discourses, beliefs, and values about new and emerging technologies. On the one hand, the techno-optimists see the use of the precautionary principle and constraints being put on scientists to pursue the development of new technology as irrational, and believe that "tinkering with the fundamental mechanisms of nature" is a good thing. Drawing on technological rationality, they emphasize instrumental goals and technical efficiency as the basis for decision making on new and emerging technologies. The following supporting comments made by participants who hold a scientific rationalist view summarize well this belief:

> 'science should inform decision making'; 'some policies are driven by the public based on a false and medieval understanding of the world'; 'environmentalism is not a science and its practitioners are usually philosophical zealots who know the truth rather than evaluating the information'; 'science is neutral it does not damage the environment, it is the economic use that damages the environment'.

On the other hand, the other three discourses see the blind pursuit of new technologies as irrational because of the underlying limitations of science, and cultural and ethical concerns. For these discourses, environmental values should be the driver for decision making because ecological rationality should have priority over other forms of rationality. From an ecological rationality view, societal goals such as protecting the environment should drive decision making even if this may be against an individual's material self-interest (Baber and Bartlett 2005; Pham 2007). Tinkering with the fundamental mechanisms of nature is not seen as a good thing by these discourses. Participants' comments in support of this view include:

> 'environmental decision making has long term consequences that are often irreversible'; 'whoever is impacted should have a chance to submit in public processes'; 'different cultures and ethnicities have different priorities and will be impacted in different ways'.

There is also a clear divide here as to what constitutes a responsible approach to a clean green environment and how to achieve this. The techno-optimist discourse does not see the development of GM technologies as undermining New Zealand's "clean green image" and indeed vouches for the ability of these technologies to enhance the country's economic well-being. The other discourses take the opposite view and call for a precautionary approach to such technologies.

Human and non-human nature

For the discourses that reflect socio-ecological sustainability, nature and society are seen as interdependent. They recognize that economic growth can threaten survival. In these discourses, the notion of citizenship extends to non-humans and, therefore, takes into account the possible impacts of genomics and other technologies on ecosystems and animal species. For the techno-skeptic discourse, in particular, there is a deeply held ethical value that GM experiments are immoral and ethically wrong and their use and development could

Table 10 Beliefs and values of discourses on the role and place of new technologies (n=35)

Discourses	Defining Statements	Shared Values	Commonalities across all Groups
Techno-Optimists (n=16)	• Society should not turn it back on nanotechnology and other complex new technologies. (3.31) • New technologies like nanotechnology will not destroy human life and society as we know it. (3.25) • The use of new technologies to eradicate human diseases should be pursued. (3.19) • Good can come from tinkering with the fundamental mechanisms of nature. (2.75) • Transferring alien genes into organisms is moral and should be allowed. (2.06) • Used properly, biotechnology can help NZ agriculture become more sustainable. (2.06)		Business leaders cannot be trusted to minimise new technology risks to human health. (2.66) As Kiwis, we value clean air, water, open spaces and our natural landscapes. (2.23)
Beliefs	**Defining Statements**	**Shared Values**	
Techno-Skeptics (n=3)	• Genomics and new reproduction technologies do not offer useful and unique ways to enhance NZ crops and livestock. (3.33) • The use of genetic modification will affect our cultural identities. (2.67) • The risks of nanotechnology should be considered on a case by case basis. (2.67) • Transferring any alien genes into any organism is immoral and should never be allowed.(2.33) • The benefits of science to society do not usually outweigh its negative consequences. (2.0)	Scientists cannot be trusted to uphold the best interests of society and the environment at all times. (2.53) The benefits and risks of genetic modification technology are not yet well understood. (2.21)	
Beliefs	**Defining Statements**	**Shared Values**	
Anti-Corporate/ Anti-Capitalist (n=8)	• New technologies do not generally help society achieve greater equality. (3.0) • The public is not well-informed about the risks of new technologies. (2.75) • Global corporate control of genetic modification patents restricts NZ independence. (2.5) • New technologies like nanotechnology will not eliminate sickness and poverty (2.38)	It is not necessary for NZ to use GM to be globally competitive. (2.88) Organic & sustainable farming methods can meet the food needs of NZ. (2.88) Current industrial methods of food production are not environmentally sustainable. (2.63)	
	• Good science and innovative technology contribute to increased economic productivity (2.13) • Creating GM crops to reduce harmful pesticides is not to the overall benefit of the environment. (2.13) • Products using new technology mainly benefit the company selling them (2.0)		
Animal Rights (n=8)	• NZ does not need to use genetic modification of crops and livestock to improve its global competitive edge. (3.5) • Genetic modification experimentation on animals is not necessary for progress. (2.38) • Most of those opposed to new technologies are rational and in touch with reality (2.25) • GM animals dying from grossly distended organs shows that we do not understand the technology enough. (2.25) • GM is not just a quicker way to breed better crops and livestock. (2.21) • No good will ever come from tinkering with the fundamental mechanisms of nature (2.13)		

Defining statements for each discourse have an absolute mean of 2.0 or higher on a scale of −4 to 4. The mean for each defining statement is shown in parentheses. In this chart, all statements have been presented in the affirmative to facilitate understanding of the discourse

impact on the cultural identities of indigenous people. These values, however, are in stark contrast to those of the techno-optimists who do not see GM or nanotechnology experiments as being immoral or unethical but view them simply as useful ways to enhance New Zealand crops, livestock, and economy. From their utilitarian view, the use and development of GM technologies could lead to better sustainable agricultural outcomes or medical products for individuals.

Universal and particular

The majority view in the sustainable citizenship survey is that it is essential to respect diverse cultures and ethnicities in environmental decision making. Recognising the special rights of Māori because of their group differences is particularly important to the techno-skeptics discourse. As indicated above, the techno-skeptics discourse sees the transferring of genes as immoral and not permissible because this could affect the cultural identity of people. This deontological ethical approach is in contrast to the techno-optimists who believe that subjective concerns of a particular group should not be included in decision making that is deemed to be of benefit to the larger society.

Democracy and capitalism

The democracy and capitalism dialectic focuses on the contradictions and tensions between democracy and capitalism. There is a consensus among all the discourses that businesses and individuals need to be held accountable for any problems they cause. This demonstrates a common concern about citizens' rights being undermined by the self-interest of businesses. But there is a clear tension as to the most effective way to address this. For those classified as anti-corporate/anti-capitalist and animal rights, sustainability involves the greening of capitalism through a support for organic and non-corporate farming. This means challenging the industrial approach to agriculture. The anti-corporate/anti-capitalist discourse particularly recognizes that the increased neoliberalization of global markets has seen governments increasingly protect corporate interests over people's democratic rights. They challenge the view that the economy can be seen as separate from politics, ethics, and ecology (Zachary et al. 2011). These changes mean ethical deliberation is even more important now for a robust democracy. The socio-ecological sustainability discourses advocate for environmental concerns to trump unfettered economic growth, and feel that economic growth should be compatible with environmental and community responsibilities. In contrast, the technological sustainability discourse of the techno-optimists believes that new technologies could also help achieve more sustainable farming. Adherents to this discourse do not view these technologies as any riskier than other technological approaches to agriculture.

Summary of the dialectical tensions

There is a range of different discursive positions with regard to sustainable citizenship and new and emerging technologies and, while there are some shared concerns, there are also many differences. The findings of the survey suggest that there are two overarching discourses shaping the values and beliefs of the participants. The first is a socio-ecological sustainable citizenship discourse and the second a technological sustainable citizenship discourse. We next summarize the key elements of these discourses in turn as well as the shared values between them.

Socio-ecological sustainable citizenship discourse

The socio-ecological sustainability worldview shapes an understanding of what it means to be a sustainable citizen based on the interdependency of humans and nature. While for some, the environment should always come first, for others it is possible to balance environmental and economic goals. Those who draw on this discourse feel that resources should be used wisely to meet present and future needs. Inter- and intra-generational equity, distributive justice, and environmental protection are fundamental for this discourse. In line with these views, deliberative democratic processes are seen to be the best way to consider the role and place of new technologies. Such technologies are seen as having environmental, economic, and sociocultural dimensions which all need to be addressed. Because of the distrust of business and scientists to act in anything but their own interest, market mechanisms and hierarchical processes are not seen as appropriate for determining the risks of new technologies. In calling for a precautionary approach, this worldview is supportive of strong government leadership, public participation, and performance targets to assess progress toward environmental protection.

Technological sustainable citizenship discourse

In contrast to the ideas of the socio-ecological sustainable citizenship, the values and beliefs of the technological sustainable citizenship are based on a technological approach to technology risks. This worldview sees technological innovation as enhancing economic growth and believes that technology should be developed to make agriculture more sustainable. A reductionist view of the social world shapes this discourse which means that social, cultural, and non-anthropocentric values can be ignored. Emphasizing that facts are objective and values subjective, this worldview holds that regulatory action should only be undertaken when scientific certainty demonstrates harm, and not because of the community's subjective desire to take a precautionary approach. While there is concern that businesses act in their own interest and should be constrained, the same constraints should not be put on scientists. Similarly, while there is support for public participation, adherents of this worldview argue that processes of public engagement should focus on objective, not subjective, problem solving. Tables 11 and 12 present the key differences

across these two dominant understandings of sustainable citizenship and new and emerging technologies.

Shared values for sustainable citizenship

All the discourses agree that economic growth should be constrained by wise use of resources to meet present and future needs and that public opinion should have an influence on determining what is or is not a risk. Sustainable development needs a balance between economic and environmental goals, and businesses and individuals should be held accountable for the externalities they cause. While the two worldviews indicate that there is a divide between the discourses, there is also some common ground. There is consensus on the high priority New Zealanders place on clean air and water and on open spaces. There is also total agreement that the business world should not be entrusted with mitigating risks of new technologies on human health. Similarly, most respondents agree that the benefits and risks of GM technology are not yet clearly understood and that scientists are not necessarily equipped to understand or manage social and environmental impacts of new technologies. These consensus statements demonstrate that there are already some guiding values and processes that would be mutually acceptable in thinking about new and emerging technologies.

Conclusion

The range of discourses around the beliefs and values about new and emerging technologies come into sharp relief in the Q-sort survey of a sample of key stakeholders. Seen through the lenses of sustainable citizenship, these discourses reflect the dialectics of rights and responsibilities, rationality and emotionality, human and non-human nature, the universal and the particular, and democracy and capitalism. The Q-survey also shows the efficacy of engaging the public and providing an avenue for their views and values to be considered when policy is being made about new technologies. Despite the perceived polarities of opinion among the stakeholders, there is a general agreement in all the discourses on the need for people to be held accountable for their impacts on the environment. There is a general skepticism about businesses acting in the best interest of the community and the environment and, for at least some groups, there is also skepticism about the effectiveness of scientific rationality in managing technology risks. The survey also demonstrates that there is an overarching value of a clean environment, and this value is important to all New Zealanders regardless of where they are situated in debates around sustainability.

The majority of discourses sit within the socio-ecological sustainability spectrum of environmental worldviews which

Table 11 Sustainable citizenship: technological sustainable citizenship and socio-ecological citizenship

Sustainable citizenship dialectics	Technological sustainable citizenship	Socio-ecological sustainable citizenship
Rights and responsibilities	Rights of individual and advancement of science has highest priority New and emerging technologies do not need ethical or moral consideration	Rights of public, diverse groups and environment have highest priority New and emerging technologies need ethical and moral consideration
Rationality and emotion	Technological and economic rationality comes first; Framed by belief that development of new technologies is necessary for progress, and self-interest will benefit all	Ecological rationality comes first; Environmental protection is fundamental; therefore ecological imperatives should drive decisions. It is irrational and socially irresponsible not to take a precautionary approach to new technologies
Human and non-human nature	Humans outside of nature; Utilitarian and anthropocentric view of environment and citizenship; Technology risks can be managed through instrumental means and scientific expertise	Humans interdependent with nature; Holistic approach with citizenship extended to non-human nature; Acceptability of technology risks must be determined by community in conjunction with technical experts
Universal and particular	Technology is impartial with everyone's interests given equal standing; so, there is no need to evaluate social or cultural contexts	Technology is not impartial and can serve dominant interests; therefore, to ensure diversity of views, need to ensure that special rights based on group differences are given consideration
Democracy and capitalism	Ensuring the success of the market, businesses and individual interests will benefit all; Technological fix for sustainability problems is possible within current modes of production; New technologies will ensure progress toward more sustainable farming	Recognizes the contradictions and tensions between democracy and capitalism; Seeks to ensure that capitalism does not undermine local contextualized knowledge or exacerbate existing injustices; Organic and sustainable farming will ensure long term sustainable communities

Table 12 Statement selection for new and emerging technologies survey

	Anti-capitalist / anti-corporatist	Animal rights	Techno-skeptics	Techno-optimists	ANOVA	
					F	Sig.
1. Organic and sustainable farming methods can meet the food needs of a low-population country like NZ	A	A			15.46	.000
2. Products using new technology mainly benefit the company selling them	A				5.45	.004
3. Good science and innovative technology contribute to increased economic productivity	A				4.86	.007
4. Conventional agricultural practices should continue as the basis of the NZ economy					4.40	.011
5. Used properly, biotechnology can help NZ agriculture become more sustainable				A	3.41	.030
6. NZ must use genetic modification of crops and livestock to improve its global competitive edge	**D**	**D**	**A**		**10.94**	**.000**
7. Genomics and new reproduction technologies offer useful and unique ways to enhance NZ crops and livestock			D		11.40	.000
8. Environmental and human health risks of GM are not different from those of conventional agriculture					3.78	.020
9. New technologies like nanotechnology will destroy human life and society as we know it				D	16.19	.000
10. Society should turn its back on nanotechnology and other complex new technologies				D	12.25	.000
11. The public is not well informed about the risks of new technologies	A				2.38	.089
12. Business leaders can be trusted to minimize the risks of new technologies to human health	*D*	*D*	*D*	*D*	*1.02*	*.400*
13. Scientists can be trusted to uphold the best interests of society and the environment at all times	D	D	D		2.30	.046
14. The benefits and risks of genetic modification technology are not yet well understood	A	A	A		3.06	.043
15. New technologies generally help society achieve greater equality	D				12.18	.000
16. New technologies like nanotechnology will eliminate sickness and poverty	D				1.58	.213
17. The benefits of science to society usually outweigh its negative consequences			**D**	**A**	**5.67**	**.003**
18. New technologies like nanotechnology offer unlimited opportunities for the improvement of society					1.81	.166
19. New technologies such as bio and nano technology run counter to the spiritual beliefs of Maori					5.21	.005
20. Global corporate control of genetic modification patents restricts NZ independence	A				3.98	.017
21. As Kiwis, we value clean air, clean water, open spaces and our natural landscapes	*A*	*A*	*A*	*A*	*.18*	*.908*
22. The use of genetic modification will not affect our cultural identities			D		2.59	.071
23. NZ should not use genetic modification technology in the interest of preserving its clean, green international image		**A**	**A**	**D**	**12.88**	**.000**
24. Genetic modification will inevitably result in the loss of biodiversity and degradation of our habitat					8.35	.000
25. GM animals dying from grossly distended organs show that we do not understand the technology enough		A			4.89	.007
26. Transferring genes within a species is more acceptable than transferring them across species					.75	.530
27. Current industrial methods of food production are not environmentally sustainable	A	A			7.97	.000
28. GM is just a quicker way to breed better crops and livestock		D			8.58	.000
29. Creating GM crops to reduce harmful pesticides is to the overall benefit of the environment	D				9.81	.000
30. Nanotechnology can be used to develop environmentally sustainable industries					4.45	.010
31. Humanity cannot control the effects of technology					2.67	.065
32. Transferring any alien genes into any organism is immoral and should never be allowed			**A**	**D**	**17.23**	**.000**
33. Genetic modification experimentation on animals is necessary for progress		D			3.92	.018
34. No good will ever come from tinkering with the fundamental mechanisms of nature		**A**		**D**	**23.26**	**.000**
35. New technologies should only be deployed if the interests of the poor and the vulnerable are protected					1.17	.338
36. There is nothing intrinsically good or bad about any technology, just with what we do with it				A	1.87	.155
37. The risks of nanotechnology should be considered on a case-by-case basis			A		4.16	.014
38. Codes of ethics for nanotechnology should keep pace with the development of research in the area					.50	.685
39. There is a lot of scaremongering about new technologies					9.8	.000
40. Most of those opposed to new technologies are irrational and out of touch with reality		D			3.04	.043
41. The use of new technologies to eradicate human diseases should be pursued				A	7.55	.001

Survey statement selection for all discourses. *A* agree, *D* disagree, where statements had an absolute value of 2 or higher; bold = consensus issue; italic = contentious issue

assert that economic, environmental, and sociocultural values must be considered when assessing new technology risks. In these discourses, social responsibility comes before individual rights, and there is a call for social and economic inequality to be addressed. In contrast, the techno-optimist discourse, framed by a technological sustainability worldview, draws on technological and scientific rationalities in determining risks around new technologies. Although this is just one discourse, it is dominant and powerful in the New Zealand context. For example, institutional actors such as the Environmental Risk Management Authority (now superseded by the Environmental Protection Authority) have demonstrated a bias toward technological and scientific rationalities in their assessment of GMO risks, a position most closely aligned with the "techno-optimists" discourse that emerged in the survey (Kurian and Wright 2012). Such a bias has translated into decisions that failed to acknowledge the overwhelming public opposition to issues such as genetic modification of plants and animals. The Q-sort survey does, however, reveal that there is scope for deliberation across these positions and that there is already some movement between these discourses. It also points adherents of different discursive views to the use of a sustainable citizenship lens to assess what beliefs and values are critical, and thereby mediate inequalities and the inequitable power relationships on which they are based.

Understanding the values and beliefs of stakeholders can pave the way for arriving at more inclusive policy responses to the challenges of new and emerging technologies. Yet, for this to happen, it is also important to recognise that policy making is inherently political. Current institutional frameworks, the neoliberal economic priorities of government, and a limited openness to public participation all pose significant barriers to genuinely democratic decision making. But the goal of ensuring environmental sustainability requires a greater degree of public control over the governance of science and technology. As Kathlene (2006, p. 21) states, "Success depends upon adapting to new approaches, working with new coalitions, and finding previously unknown common ground." Our Q-sort survey demonstrates that such coalitions of actors with common concerns across all discourses are possible and can challenge dominant discourses to find alternative pathways in decision making on new and emerging technologies.

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