What is sustainable agriculture? Empirical evidence of diverging views in Switzerland and New Zealand

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ABSTRACT

Public debates on sustainable agriculture tend to be shaped by dominant political stakeholders with a particular political agenda. They simultaneously contribute and respond to the formation of public opinion. In this paper, we investigate to what extent stakeholder attitudes and interests help explain national conceptions of sustainable agriculture and how these conceptions diverge between countries with different agricultural policies. For that purpose, we conducted two stakeholder perception surveys in Switzerland and New Zealand. The data analysis revealed that there are significant differences in perception between the two countries. While Swiss respondents felt that Swiss agriculture is already quite sustainable and that international trade and new technologies are likely to render it less sustainable, New Zealand respondents generally thought that economic and technological change is necessary to make agriculture more sustainable. The conservative Swiss attitude is in accordance with the country’s defensive agricultural policy while the more progressive New Zealand attitude is clearly linked to its need to reconcile agricultural sustainability with national competitiveness.

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1. Introduction

The general public in industrialised countries tends to associate ‘sustainable agriculture’ with a set of post-material values that put great emphasis on the conservation of the natural environment, safe food, animal welfare and economic support for farmers (VanLoon et al., 2005). Advocates of sustainable agriculture from diverse academic disciplines (Altieri, 1995; Shiva and Bedi, 2002; Davidson, 2007) start from the joint insight that agricultural modernization in the 20th century has undermined these values and therefore produced many negative externalities for society and the environment, which must be addressed by recognizing the public good character of agriculture (Van Huylenbroeck and Durand, 2003). The concept of multifunctional agriculture attempts to address this public good character by adopting a systems perspective that takes into account the needs of rural communities and food security, as well as the impact of agricultural practices on local ecosystem services and the global environment (Tilman et al., 2002; Prestegard, 2005, Cairl et al., 2008).

The concept is particularly popular among (sub-) urban dwellers in affluent societies and confirmed by surveys on stated preferences in favour of local and organic products and against genetically modified food (Chern et al., 2002; Siegrist, 2003; Eurobarometer (64.3), 2006). The support of this non-agricultural constituency for alternative farming practices and the dislike of modern industrial agriculture may also be related to a nostalgic view of the past when agriculture was still practiced in an extensive way (De Gregori, 2003). This emotional dimension of sustainable agriculture helps explain why many governments continue to provide generous financial support and protection for domestic farmers and regulate the introduction of new agricultural technologies in a very restrictive manner – invoking the Precautionary Principle and Non-Trade Concerns (Sampson, 2005). This type of agricultural policies may be popular with the public and still legitimate under the WTO Agreement on Agriculture (depending on a country’s schedule of commitment) (Desta, 2002); but there is not much evidence that would confirm its effectiveness in view of the real social, economic and environmental challenges of global agriculture (Kleijn et al., 2001; Whitfield, 2006; Ansell and Vogel, 2006). In fact, there is an increasing concern among environmentalists that a strictly value-based approach to sustainable development may be unable to meet the growing global demand for natural resources without undermining our joint cultural and natural resource base (Nordhaus and Shellenberger, 2007; Prins and Rayner, 2007; Paarlberg, 2008).

Moreover, these value-based agricultural policies tend to be very selective about the Principles of Sustainable Development as outlined in Agenda 21 and the Rio Declaration 1992. For example, Principle 9 of the Rio Declaration regards the development, adaptation, diffusion and transfer of technologies, including new and innovative technologies as an integral part of sustainable development. Principle 12 argues in favour of a supportive and open international economic system, and Principle 21 indirectly emphasizes the role of entrepreneurship by...
pointing at the importance of mobilizing the creativity, ideals and courage of the youth of the world. These principles implicitly aim at facilitating change to achieve a sustainable future. Yet, they are often not very popular in affluent societies that regard technological and economic change as a risk rather than an opportunity for the farming sector (Aerni, 2007; Paarlberg, 2008).

2. Theoretical background

Public opinion on sustainable agriculture in affluent societies tends to be affect-driven and is consequently a determining factor in explaining value-based agricultural policies (De Gregori, 2003; VanLoon et al., 2005). At the same time, there is no doubt that unsustainable farming practices are a reality that urgently needs to be addressed. In this context, the pioneering academic and civil society advocates of sustainable agriculture in the 1970s greatly contributed to more public awareness and tighter regulation of unsustainable agricultural practices. Yet, once these advocates have become established and legitimate stakeholders in the public debate, they also began to professionally compete for public attention and financial support, just like any other political actor. As a consequence, the idealism of the early stage often has to be abandoned due to political and economic necessity (Olson, 1965, 1994; Luhmann, 1993). This political economy perspective combined with insights gained in experimental research on affect heuristics is important to better understand the ongoing public debate on sustainable agriculture and how it influences public opinion and political decision making.

2.1. The political economy perspective: Public trust as a scarce private resource in politics

Many advocacy (or intervenor) groups on environmental issues were initially focused on the detection and disclosure of specific shortcomings and abuses of power by business and government (Luhmann, 1993). Yet, when successful advocacy groups eventually mature and become institutionalized, they are confronted with the temptation to neglect their role as investigative journalists and social watchdogs in favour of more symbolic campaigns with high media resonance (Aerni and Bernauer, 2006; Nordhaus and Shellenberger, 2007). Such campaigns tend to be more cost-effective when it comes to securing future funding and political support. In other words, protest becomes more professional.

Symbolic campaigns in the name of sustainable agriculture often cater to public fears of loss of identity as associated with structural change in agriculture – referring to a past when agriculture was not yet an industry and more in harmony with nature (De Gregori, 2003). Such images of loss are likely to resonate in affluent societies that long for meaning and orientation in times of increasing uncertainty and complexity (Luhmann, 1993). By framing ‘cooperation’ as moral and ‘competition’ as amoral, advocates of sustainable agriculture tend to accuse stakeholders that represent ‘money’ or ‘political power’ in agriculture for neglecting farmer and consumer interests in their eagerness to promote undesirable economic and technological change, which would serve their interests at the expense of society at large (Messik, 2006). Even though those who represent money and political power invest a lot in public relations, their efforts prove to be mostly ineffective in view of the absence of public trust. They may be able to improve their image slightly by publicly denying that they prefer competition to cooperation and demonstrating through Corporate Social Responsibility (CSR) activities that they share the values of trusted NGOs. Nevertheless, they remain in a competitive environment and are therefore perceived to be guided by their private interest, rather than the public interest (Aerni and Bernauer, 2006).

The successful political self-marketing of those who advocate alternative agricultural practices as the only solution to ensure sustainable agriculture in future may be explicable by the fact that they have gained public trust – not primarily for having performed well in competition with others, but for having revealed good motives through their cooperation with others. In a society that cares about values more than effective policy outcomes an advocacy group needs to be perceived first of all as having good motives and sharing similar social values in order to maintain public trust and remain competitive in an increasingly mature market for advocacy in the public interest (Caplan, 2007).

2.2. The marketing perspective: How stakeholders make instrumental use of affect heuristics

Having gained public trust as a scarce resource in politics is equivalent to having built up a very successful product brand that represents an alternative life-style (Brunso et al., 2003). Therefore, it is important to discuss first some insights gained from product marketing in order to better understand how political marketing shapes social preferences:

Zajonc (1980) concluded in a seminal paper that affective judgment precludes a thorough evaluation of the different product options available but nevertheless determines most of our choices (e.g. we buy the painting we ‘like’, we choose the meal we find ‘tasty’, we pick the flowers we find ‘attractive’). Subsequently, social and cognitive psychologists began to integrate affect and reason into what have become dual-process-theories (Chaiken and Trope, 1999; Stanovich, 1999; Sloman, 1996). In marketing research, the Elaboration Likelihood Model follows this dual-process approach (Cacioppo and Petty, 1981). It distinguishes between an investigative and a conscious central route to consumer decision-making (‘high involve-ment’) and a peripheral route that is more determined by surface characteristics that either elicit immediate positive or negative feelings toward a consumer product or the person that sells it (‘weak involvement’) (Petty and Cacioppo, 1986). The latter route is based on affective judgment. Researchers in affect heuristics do however not agree with the assumption that affective judgment merely represents a peripheral route. Instead they emphasize the importance of affects as the centerpiece of our experiential mode of thinking and the dominant mode of survival (Slovic et al., 2002). Yet, they nevertheless admit that affect heuristics can misguide us if our decisions are based on externally induced affects (Lichtenstein and Slovic, 2006) rather than the intrinsically developed somatic markers (affective response based on personal experience) (Damasio, 1994). For example, marketing researchers showed that consumer reliance on affect heuristics also makes them more prone to be deliberately guided in their choice by contextual clues (Ariely et al., 2003), priming (Mandel and Johnson, 2002) and affective tags (Lichtenstein and Slovic, 2006). An example for affective tags in the area of food marketing are the packages of food products that carry descriptions of content such as ‘natural’, ‘improved’, ‘low-fat’. They enhance attractiveness of the product and increase its likelihood of being purchased.

This ‘affect pool’ helps in the construction of consumer preferences and may also have a dominant influence in the creation of social preferences toward certain public policies; especially in policy areas in which most people feel only weakly involved because there are no significant immediate personal interests at stake.

In view of the trend that political opinions are increasingly seen as an expression of a personal life-style (Beck, 2000), product marketing and political marketing have moved closer together. Especially food retailers increasingly demonstrate how to effectively blend product and political marketing. In their advertising campaigns they portray themselves as political activists for improved food safety and sustainable agriculture and thus giving consumers the feeling of expressing a life-style in favour of a better world when buying one of its organic products, for example. This works well mainly because of the association of organic agriculture with positive emotional tags such as ‘natural’ and ‘fair’; while agribusiness-derived products are given negative tags such as ‘unnat-ural’ and ‘unfair’ (‘putting profit before people’). The good feeling of
having contributed to a better world by purchasing the ‘good’ instead of the ‘bad’ product has great economic value not necessarily in terms of increasing returns but in terms of a favourable public image. This helps explain why other stakeholders are as eager as retailers to bend the public affect pool in favour of their respective political and economic interests (Caplan, 2007).

Some economists in the areas of behavioral and welfare economics would however deny this blend of self-interest and moral intentions. Behavioral economists would refer to the non-selfish motives found in ultimatum games (Fehr and Fischbacher, 2004), and welfare economists (Brooks and Manza, 2007) would claim that social preferences are not related to self-interest but reflect a normative stance about how society should address social and environmental problems. Political scientists involved in social values research support this view. They argue that value-based political judgments are intrinsic and reflect the degree of human autonomy, which is supposed to evolve with a country’s move towards more political freedom and democracy (Inglehart and Welzel, 2005). Their view gave also renewed support to public opinion research that is based on the assumption that public opinion polls express a sort of collective rationality (Stimson, 2004; Page and Shapiro, 1992). Yet, the underlying assumption that idiosyncratic responses in polls tend to cancel one another and can therefore be treated as noise, is increasingly questioned (Sniderman, 2000; Althaus, 2004). Recent surveys, well summarized in Althaus (2004), demonstrate how framing, agenda-setting and priming effects, communicated through news coverage, can influence policy preferences. These empirical studies show that policy evaluation is strongly guided by the issues and frames of interpretation that are given prominent attention in the news discourse. Public opinion on topics that are mostly covered in the news but detached from people’s everyday lives may therefore have little to do with the expression of popular sovereignty and more with the respective influence of stakeholder views that are frequently covered in the media (Iyengar, 1991).

2.3. Investigating national public debates on sustainable agriculture

Based on the above-mentioned theoretical and empirical observations, it is not surprising that the social preferences, revealed through opinion polls on sustainable agriculture in Europe (Special Eurobarometer, 2008), express the view that agricultural policy should primarily ensure a safe and stable income for farmers. This defensive view is also endorsed by the trusted political stakeholders that frame the public debates on sustainable agriculture in European countries. Even though, regular public opinion surveys on that subject are not carried out in New Zealand, several recent reports point out that New Zealanders do not believe that sustainability problems can be effectively addressed by returning to a heavily subsidised agricultural system (PCE, 2004, Pinonchet-Chateau et al., 2005). This view is largely in line with the government’s agricultural policy to promote sustainable change through innovation.

In view of the influence of stakeholder attitudes on social preferences, we investigate the attitudes of the relevant stakeholders in the national public debates directly in order to get a better understanding of the construction of social preferences toward sustainable agriculture in the respective country. Moreover, stakeholder attitude surveys have the additional advantage of being able to count on well-informed opinions (Aerni, 2002).

3. Agricultural policy in Switzerland and New Zealand

New Zealand and Switzerland are economically highly developed countries, have a similar degree of human autonomy in terms of political freedom and share similar social values. Yet, New Zealand represents the new and Switzerland the old World – and this matters in agriculture. They therefore pursue very different agricultural policies and address the problems of sustainable agriculture in different ways.

3.1. The situation in Switzerland

Switzerland decided to fully embrace the multifunctional approach to sustainable agriculture in 1996 when the so-called ‘agricultural article’ was adopted in the Swiss constitution by referendum. This article provides the legal basis for the promotion of multifunctional agriculture, which is based on such a systems perspective, and can be seen as an explicit contract between agriculture and society to ensure the sustainability of agriculture.

The Swiss government spends around US$ 3.3 billion to support Swiss agriculture in general and multifunctional agriculture in particular (roughly 20% are production-tied subsidies, 60% direct payments, 12% other support, 5% research and extension) (BLW, 2006). Many of these agricultural support instruments are however still outside the legitimate Green Box (minimally trade-distorting measures) of the Agreement on Agriculture (AoA) of the World Trade Organisation (WTO) and therefore considered to be actionable subsidies and thus subject to further reduction commitments (Desta, 2002). Yet, together with other highly protectionist countries such as Norway, Japan and South Korea, Switzerland argues that green box support measures may not be sufficient to properly address its non-trade concerns related to the viability of a fair, equitable and sustainable agricultural sector (Prestegard, 2005; Sampson, 2005). The generous support for non-trade concerns explains why the OECD producer subsidies equivalent (PSE) for Switzerland in 2006 still amounts to 66 (OECD, 2007), one of the highest in the world. This stands in strong contrast to agriculture’s share of total Swiss exports receipts (2.65%) and its contribution to GDP (less than 1%) (BLW, 2006).

3.2. The situation in New Zealand

The numbers look quite different in New Zealand which had a PSE in 2006 of no more than 1 (one of the lowest in the world) (MAF, 2003). This low number dates back to New Zealand’s decision in the mid-1980s to radically cut agricultural subsidies and expose its farmers to international trade competition. As a result, New Zealand has become a competitive exporter of agricultural products. Agriculture makes up 50% of the total export receipts and 6.1% of the GDP (15.7% if all food and forestry-related businesses are included) (MAF, 2003). At the same time, New Zealand is equally committed to the goals of sustainable agriculture and its government is anxious to preserve the country’s image of being ‘clean and green’. However, it tries to achieve sustainability in a different way. Rather than following the conventional social planning approach of multifunctional agriculture, the New Zealand government sees itself as a facilitator of sustainable change through the promotion of technological innovation and rural entrepreneurship, strict biosecurity control as well as incentives to adopt sustainable farming practices. The Resource Management Act (RMA), passed in 1991, pursues a decentralized bottom-up approach in environmental policy. It authorizes the federal government to issue national environmental standards, but it is up to the local authorities (Regional Councils) to design an effective approach to implement them. There is a growing concern that this decentralized approach is too slow in view of the rapidly increasing environmental problems especially in dairy farming (PCE, 2004). New Zealand can however not afford to promote sustainable agriculture at the expense of agricultural competitiveness but must reconcile these two foundations of its agricultural economy by investing in innovation and best practices. The greatest share of government support therefore goes into the promotion of applied agricultural research and development.

4. Survey and methodology

The survey in New Zealand was carried out between May and August 2006 and the one in Switzerland between November 2006 and February 2007. In both countries, the relevant stakeholders were selected by means of key informants who were familiar with the national debate on sustainable agriculture and its participants. In addition, literature and
media coverage related to national sustainable agriculture was screened in search for additional relevant political actors. This method of stakeholder selection was adopted from the policy network approach as developed by Laumann and Knoke (1987). The stakeholders contained representatives from academic, government, and legislative institutions, as well as business leaders, journalists and public interest group representatives. The overall method to investigate stakeholder attitudes follows the approach designed by Aerni (2002).

4.1. Questionnaire

A semi-standardized questionnaire was designed in collaboration with the Department of Applied and International Economics at Massey University in New Zealand and the Institute of Environmental Decisions, ETH Zurich in Switzerland. The data obtained through the questionnaires was to reveal the different stakeholder views on sustainable agriculture as well as their position within the national debate on sustainable agriculture.

The content of the questionnaire in New Zealand and Switzerland was identical apart from its translation into German and French language in Switzerland.

Part I of the questionnaire consisted of four sections. In Section 1.1, the respondents (stakeholder representatives) were asked to assess the importance of 20 problems in sustainable agriculture. The list of problems was defined in collaboration with the partner institutions in Switzerland and New Zealand. Subsequently, they had to assess the best approaches to solve each of these problems in Section 1.2. Altogether five broad approaches were listed that comprised all policy measures discussed or applied in the two countries. In Section 1.3, they were asked to judge the potential impact of 6 different agricultural practices on sustainable agriculture; and in Section 1.4, they had to indicate how sustainable they consider the state of domestic agriculture. In Part II of the questionnaire, the stakeholder representatives were asked to judge 14 statements related to sustainable agriculture. These statements implicitly contained different world views. Table 1 shows examples of the formulations of the
questions and statements and the scales that had to be applied for assessment (for the detailed wording of the remaining questions, answers and statements in Part I and II see Appendix A in Supplementary data).

4.2. Methodology

The perception analysis of the questionnaire data consists of a comparative descriptive analysis and a perception pattern analysis for each country. The perception pattern analysis consists of a cluster analysis and a discriminant analysis that identify the different perception groups in the two countries. Moreover a biplot macro (visualisation technique of the principal component analysis) was applied to identify each single perceptions. The biplot macro portrays the perception variables as vectors and the stakeholders as letters in a two-dimensional scale (Gabriel, 1981). The primary objective of the perception pattern analysis was to identify groups in Switzerland and New Zealand that have a large similarity in perception expressed by means of the statements and answers that were rated in the questionnaire. Prior to that, we conducted a descriptive analysis that mainly discusses the mean values and standard deviations of the respondent ratings. As such it contributes to a better interpretation of the results obtained in the perception pattern analysis. Finally, we used parametric and non-parametric ANOVA (Analysis of Variance) to test whether the differences in perception between Switzerland and New Zealand are statistically significant.

Table 2

<table>
<thead>
<tr>
<th>Problem</th>
<th>New Zealand</th>
<th>Switzerland</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Water</td>
<td>3.64 ± 0.53</td>
<td>3.41 ± 0.71</td>
</tr>
<tr>
<td>2. Nitrogen</td>
<td>3.63 ± 0.57</td>
<td>3.25 ± 0.78</td>
</tr>
<tr>
<td>3. Nutrients</td>
<td>3.47 ± 0.67</td>
<td>3.10 ± 0.83</td>
</tr>
<tr>
<td>4. Greenhouse</td>
<td>3.19 ± 0.82</td>
<td>3.00 ± 0.82</td>
</tr>
<tr>
<td>5. R&amp;D</td>
<td>3.12 ± 0.74</td>
<td>3.00 ± 0.67</td>
</tr>
<tr>
<td>6. Energy</td>
<td>3.05 ± 0.86</td>
<td>2.98 ± 0.72</td>
</tr>
<tr>
<td>7. Trade</td>
<td>2.99 ± 0.81</td>
<td>2.90 ± 0.74</td>
</tr>
<tr>
<td>8. Biodiversity</td>
<td>2.84 ± 0.81</td>
<td>2.90 ± 0.94</td>
</tr>
<tr>
<td>9. Protection</td>
<td>2.80 ± 0.90</td>
<td>2.88 ± 0.78</td>
</tr>
<tr>
<td>10. Incentives</td>
<td>2.62 ± 1.29</td>
<td>1.00 ± 1.03</td>
</tr>
<tr>
<td>11. Price</td>
<td>2.53 ± 1.04</td>
<td>2.71 ± 0.78</td>
</tr>
<tr>
<td>12. Support</td>
<td>2.52 ± 0.96</td>
<td>2.63 ± 0.87</td>
</tr>
<tr>
<td>13. Change</td>
<td>2.44 ± 0.99</td>
<td>2.50 ± 0.99</td>
</tr>
<tr>
<td>14. Innovation</td>
<td>2.34 ± 0.95</td>
<td>2.43 ± 0.84</td>
</tr>
<tr>
<td>15. Tilling</td>
<td>2.33 ± 0.80</td>
<td>2.37 ± 0.89</td>
</tr>
<tr>
<td>16. Monoculture</td>
<td>2.20 ± 1.05</td>
<td>2.24 ± 0.92</td>
</tr>
<tr>
<td>17. Quality</td>
<td>2.20 ± 1.06</td>
<td>2.20 ± 0.71</td>
</tr>
<tr>
<td>18. Debts</td>
<td>2.12 ± 0.88</td>
<td>2.10 ± 0.98</td>
</tr>
<tr>
<td>19. Culture</td>
<td>2.01 ± 0.82</td>
<td>2.02 ± 0.79</td>
</tr>
<tr>
<td>20. Tradition</td>
<td>1.76 ± 0.72</td>
<td>1.98 ± 0.82</td>
</tr>
</tbody>
</table>

4.3. Participants and response rate

After the initial testing of a draft questionnaire with students, questionnaires were finalized and sent out around mid-May 2006 in New Zealand. By August 2006, 39 respondents completed and returned the questionnaires. They represented 33 different institutions. The response rate of questionnaires was 81%. In Switzerland, 41 questionnaires were completed and returned until February 2007 by respondents that represented 36 different stakeholders. The response rate was 86%.

Fig. 1 shows that the distribution of stakeholders in Switzerland and New Zealand was not characterized by equal shares for the different institutional groups. There was a higher share of representatives from academia and business in New Zealand. In return, the participation of government representatives and politicians (legislature) was higher in Switzerland. Yet, the different shares reflect the overall weight and importance of these institutional groups in the national public debates. Moreover, representing business or academia does not necessarily reflect a technology–friendly world view; e.g. retailers and organic producers in business as well as environmental and social science departments in academia often reveal sceptical attitudes towards technological change in agriculture. In order to give participants later the opportunity to object to the participation ratio of the different stakeholders or the interpretation of the survey results, they received a summary of the survey results together with an invitation to participate in a one-day workshop to discuss the results of the survey. Those who attended the workshops in Bern (Switzerland) in September 2007 and Wellington (New Zealand) in October 2007 did however neither object to the share of the different institutional groups nor to the results obtained in the survey. The discussion about the potential implications of the survey results was nevertheless lively.

5. Survey results

5.1. A comparative descriptive analysis

5.1.1. Problems in sustainable agriculture and possible solutions

In Section 1.1 of the questionnaire, respondents in New Zealand (NZ) and Switzerland (CH) were asked to rate the importance of 20

1 In a few cases, the contacted stakeholder representatives were initially not prepared to complete the questionnaire. We were then able to persuade them to find a substitute within their institution.

2 Important stakeholders that represented different local institutions in the country (e.g. Regional/District Council in NZ and Kantone Landwirtschaftsämter in CH) or different institutes at a university (e.g. Lincoln University, ETH Zürich) contained up to 3 respondents.

3 CH is the official abbreviation for Switzerland and stands for 'Confederatio Helvetica'.

Fig. 1. Number of participants and shares of the different stakeholder groups.

Fig. 2. The appropriateness of approaches to solve selected problems in agriculture.
problems in sustainable agriculture in a scale from 1 (not important at all) to 4 (very important).

Table 2 represents the mean values (average ratings) and standard deviations of the assessed importance of the problems in CH and NZ. The most conspicuous differences in the perception of the importance of the problems were related to ‘international trade competition’ (trade), ‘wrong incentives’, lack of R&D, and high water consumption. Swiss respondents perceived trade to be the most important problem in agriculture, followed by wrong incentives in agricultural policy. High water consumption, high use of nitrogen, nutrient pollution and lack of R&D, in turn, were of much higher concern in New Zealand. Interestingly, high energy consumption appeared to be a more important problem in Switzerland while the greenhouse gas emissions of agriculture are rated higher in importance in New Zealand. The greenhouse gas problem in New Zealand is related to methane emissions of its livestock-based agricultural sector (dairy/meat production) rather than energy consumption (livestock management does not require energy-intensive in-door feeding in winter). Finally, institutions that prevent change are considered to be a relatively unimportant problem in NZ; whereas, CH stakeholders regarded lack of support services to be a completely unimportant problem.

The differences in stakeholder perceptions between Switzerland and New Zealand are statistically significant at 5% and below for incentives, nitrogen, nutrient, R&D, support, water, trade, change and, to a lesser degree greenhouse gas emissions (see first table in Appendix A).

In Section 1.2, stakeholders were asked to express their preference with regard to five different approaches to solve each of the 20 problems listed in the previous question. The five approaches were: ‘Integrated Pest Management’ (IPM), ‘Biotechnology Tools’ (Biotech), ‘Ecological Payments’ (Eco-pay), ‘Instruments of Environmental Economics’ (Env. Econ.) and ‘Devolution of Power to Local Government’ (DV) (see Footnote in Table 1 for the more detailed explanations of the approaches in the questionnaire). In case that respondents thought that several approaches apply they had to rank them accordingly.

The three approaches that often reached top ratings and showed interesting differences between the stakeholder perceptions in NZ and CH are Biotech, Env. Econ, and Eco-Pay.

Fig. 2 shows how respondents assessed the potential of these three approaches to solve selected problems of sustainable agriculture (nitrogen, greenhouse gas emissions, trade, and food quality). The y-axis shows the sum of the average rankings\(^4\) given to the different approaches to solve the different problems in NZ and CH listed on the x-axis.

The figure reveals that the instruments of environment economics are generally perceived to be more appropriate in NZ to solve the selected problems in agriculture, while in CH, ecological payments are getting higher ratings. A striking difference is the assessment of the role of biotechnology to solve the selected problems in agriculture. Respondents in NZ believe that biotechnology can make an important contribution to address the nitrogen and the greenhouse gas problem; furthermore, they think that it is by far the best approach to address the problem of low food quality. This is a significant observation because the role of technology in agriculture is usually associated with productivity increases rather than food quality and environmental improvements.

Biotechnology may be considered an important tool to solve problems in agriculture in NZ but that does not mean that New Zealanders endorse the use of genetic engineering. In fact, NZ has still not approved any commercial release of GMOs; similar to Switzerland, which passed a highly restrictive law on the use of genetically modified organisms, topped up by the approval of a national referendum in 2005 to put a five year ban on the use of GMOs. The reasons for keeping GMOs out of agriculture may however be more pragmatic in export-oriented New Zealand in view of the fact that Europe is one of the major importers of its agricultural products. This is somewhat confirmed in Section 1.3, where respondents were asked to assess the impact of six agricultural practices on sustainable agriculture (including genetic engineering).

The spider web in Fig. 3 shows the average assessments of the impact of these six agricultural practices given by the respondents in NZ and CH, again rated in a scale from 1 (negative impact) to 4 (positive impact). The angles represent the different practices and the ratings are reflected by the respective position on the concentric rating scale (average ratings above 2.5 represent a perceived positive impact). It turns out that NZ respondents did not rate the impact of genetic engineering as negative as their Swiss counterparts. NZ respondents were however highly critical of taxing food miles and direct payments as ways to improve sustainable agriculture, while the Swiss strongly endorsed it.

The impact of organic farming and labelling eco-friendly agriculture were ranked top in CH. The NZ respondents regard the impacts of these two practices to be positive as well, but they rank the impact of labelling to be more positive than that of organic farming. The impacts of Precision farming and labelling were ranked top in New Zealand.

In order to conduct the perception pattern analysis, the practices organic farming, labelling eco-friendly agriculture, food miles and direct payments were combined in the variable ECOPRODUCTS_REDISTN, whereas genetic engineering and precision farming were combined in the variable TECHNOLOGY (see Appendix A). It turns out that stakeholder perceptions in the two countries are statistically significantly different at 1% for both variables (see Appendix A), with NZ stakeholders being more positive about the role of technology in sustainable agriculture.

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\(^4\) The average value is based on the specific ranking. If a problem was ranked most important (ranked as number one), it received 5 points, second most important 4, third most important 3, and so on. The numbers were added up for each of the selected problems and then divided by the number of participants that assessed it.
agriculture, and CH stakeholders favoring measures of conservation through redistribution and incentives for organic and labelled eco-friendly agriculture.

In the last section of Part I (Section 1.4), respondents were asked to rate the overall sustainability of domestic agriculture.

Fig. 4 shows that Swiss respondents seemed to be more confident that domestic agriculture is sustainable. NZ respondents are less certain and the higher standard deviation indicates that they agree less among themselves (NZ:0.8, CH:0.6). The difference between the two countries is statistically significant at 5% (see variable SUSTAIN in the third table of Appendix A).

5.1.2. Assessment of statements related to sustainable agriculture

Part II of the questionnaire consisted of 14 statements that reflected different views about sustainable agriculture (the exact wording of the statements can be found in Appendix A). The statements alternated between those that tended to emphasize the potential risks of technological and economic change and those that tended to point out its opportunities for sustainable agriculture.

Each statement had to be judged in a scale from 1 (I totally disagree) to 4 (I totally agree).

Fig. 5 shows the mean values of the statement ratings in CH and NZ. Public Service obtained the highest rating (consent) in Switzerland. The statement epitomizes the concept of multifunctional agriculture. The most favoured statement in New Zealand was the statement FarmScale. It argued that sustainable agricultural practices are unrelated to farm size. In strong contrast to their Swiss counterparts, NZ respondents tended to reject the Precautionary Principle (PP) as an effective instrument to manage the potential risks of new technologies in agriculture. The assessment of the three statements also turned out to be statistically significantly different in the two countries (see second table in Appendix A). However, respondents in both countries generally agreed that sustainable agriculture is a frequently abused term (Abuse), and disagreed with the statements that science & technology (SustainabilityS&T) and the private sector (Private Sector) are not conducive to sustainable agriculture.

Interestingly, both countries slightly disagreed with the statement that ‘free trade in agriculture forces farmers to pursue profits at the expense of sustainable practices’ (Free Trade) and slightly agreed that international trade should not be blamed for the problems of sustainable agriculture but lack of domestic agricultural reform (Reform). This contrasts with the Swiss view, expressed in Part 1.1., that ‘international trade competition’ is the most important problem of sustainable agriculture. It seems that free trade is not the issue as such in Switzerland, but rather wrong policy incentives in Swiss agricultural policy that make farmers less competitive in international trade. Overall, these rather pragmatic views indicate that respondents in both countries tend to generally have a positive rather than a normative view of sustainable agriculture.

5.2. Perception pattern analysis

5.2.1. Procedures

The goal of the perception pattern analysis was to identify particular perception groups in the two countries. For that purpose, 13 variables were created from the selected answers and judgments given to the questions and statements in Parts I and II of the questionnaire (see Appendix A for the statements that each of these variables contain). The statements in Part II of the questionnaire were difficult to categorize. A principal-component analysis (PCA) was therefore carried out to identify, which statements explain sufficient variance to be combined in one variable. Apart from the variables that contained similar types of problems in sustainable agriculture and a default variable, all other variables were tested and proved to be significantly different between the two countries (see third in Appendix A).

A Cluster Analysis using the Ward’s minimum-variance method combined with a Canonical Discriminant Analysis (CDA) was used to identify perception groups in the two countries. The statistical tests related to the CDA (Square Distance, F-Statistics, NDF, DDF, Mahalanobis Distance for Squared Distance, Wilk’s Lambda, Pillai’s Trace, Hotelling-Lawely Trace and Roy’s Greatest Root) showed all a probability of less than 0.05 (of not being different). That allows us to conclude with a high degree of confidence that the clusters are different.

Table 3

<table>
<thead>
<tr>
<th>CH</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>L</th>
<th>M</th>
<th>N</th>
<th>IN</th>
<th>Total</th>
</tr>
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<td>1</td>
<td>3</td>
<td>0</td>
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<tr>
<td>Total</td>
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<td>5</td>
<td>8</td>
<td>6</td>
<td>5</td>
<td>7</td>
<td>2</td>
<td>41</td>
</tr>
</tbody>
</table>
The clustering procedure grouped respondents into different groups that share a similar perception. Subsequently, the cluster results were then visualized by means of a Biplot graph that allows the identification of each single perception within each cluster in an undiscriminated two-dimensional space.\(^5\)

The Cluster Analysis revealed three main perception groups in both countries.

5.2.2. Perception groups in Switzerland

The first perception group in CH (Cluster 1) consisted of 13 observations (see Table 3). This group contained all six politicians that participated in the survey as representatives of the legislature (L). In addition, it had one representative from an international NGO (IN) and business (B) respectively, two from the mass media (M) and three from government institutions (G); yet none from national NGOs (N) and Academia (A).

The Biplot Macro in Fig. 6 shows that this Cluster 1 is placed between Clusters 2 and 3. With a few exceptions, most representatives in this cluster were found close to the vector variable sustain indicating that they judged Swiss agriculture to be quite sustainable. Its tendency to be located in the lower part of the graph indicates that the respondents in the cluster tended to support direct payments, taxing food miles and organic agriculture (vector: ecoproducts_redistn), while they rejected the use of new technologies in agriculture (vector: technology). At the same time, their relative distance to the vector variables policy, pragmatic, innovation and progressive reveal that they did not show much enthusiasm for reforming Swiss agricultural policy, even though they tended to acknowledge to some extent the importance of certain problems in sustainable agriculture (vectors: climate, input).

The second perception group (Cluster 2) contained 14 observations and was dominated by NGOs (national and international), business (mostly organic producers) and academic representatives (mainly representing social scientists and agro-ecologists). They expressed concern that agriculture is not very sustainable (sustain) and rated the importance of the different problems in Swiss agriculture (climate, input, culture2, food) as quite serious. They strongly believed that wrong policies and lack of change through innovation help explain many of the sustainability problems. Yet, they tended to associate change through innovation with a move towards organic agriculture (ecoproducts_redistn) rather than technological change (technology).

The third perception group (Cluster 3), containing also 14 observations, represented stakeholders from academia, government, and business (mostly retailers). They believed that Swiss agriculture is generally sustainable (sustain) thanks to Swiss agricultural policy. The concentration of the cluster in the lower left part indicates that they were least worried about the problems (climate, input, biodiv) and policies (polices, innovation) of sustainable agriculture in CH. Even though they expressed a less negative view about the role of technology, they rated the alternatives (ecoproducts_redistn) even more positively than the other two groups.

A more detailed analysis of the clusters in relation to the variables (see Table 4) revealed that all the three perception groups endorse the variable values. They therefore seem to share the view, implicit in this variable, that applying the Precautionary Principle (PP), educating consumers (Educating) and promoting multifunctional agriculture (Public Service) are most appropriate to ensure sustainable agriculture; which confirms the results of the descriptive analysis. Overall, the Swiss perception groups revealed that there is no political lobby that would push for more technological innovation and economic change in CH agriculture.

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\(^5\) The Biplot is based on the idea that a data matrix \(Y \times n \times d\) can be represented approximately in \(n\) dimensions as the product of two matrices, one based on observations \(A \times n \times d\) and one based on variables \(B \times p \times d\). A singular value decomposition (SVD) allows to reduce the \(n\) dimensions into two dimensions (Aitchison & Greenacre 2002). The biplot uses covariances, which are the same in computing for principal components (not losing any single information of the variables used). In the geometric representation, the variable vectors emanate from the origin of the space and go through a point with coordinates that are the coefficients of the variables on the first two principal components. The length of the vector represents the eigenvalue of the variable while the angle between the vectors represents the correlation between them.
5.2.3. Perception groups in New Zealand

The cluster analysis in New Zealand also produced three perception groups (see Table 5). Cluster 1 is dominated by academic representatives (A). Government (G) and NGO (N) representatives (together with academics) make up largest share in Cluster 2 and Cluster 3 contains a high share of politicians (L). Business representatives are evenly distributed across the three clusters.

Fig. 7 shows that the vector variables sustain, progressive and technology are closely correlated. This indicates that those respondents that believed that New Zealand is quite sustainable thought so because its policies promote technological innovation and agricultural reform. The first perception group (Cluster 1) consisting of only 9 respondents, confirmed this view of sustainable agriculture. In addition, the respondents in this group also thought that values matter in the sense that farmers must be personally committed to the goals of sustainable agriculture (Bottom-up), and that agriculture is multifunctional in the sense that it produces more than just food (Public Service).

Cluster 2 is the largest one (19 respondents) covering government officials, NGO representatives, business executives, and academics.

Table 4
The results of the cluster analysis (using WARD and CANDISC procedure)

<table>
<thead>
<tr>
<th>NZ clusters</th>
<th>CH clusters</th>
<th>Clusters combined</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cluster</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Frequency of cluster</td>
<td>9</td>
<td>19</td>
</tr>
<tr>
<td>Root-mean-square standard deviation</td>
<td>0.52</td>
<td>0.49</td>
</tr>
<tr>
<td>Maximum distance from cluster seed</td>
<td>2.57</td>
<td>2.26</td>
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<tr>
<td>Nearest cluster</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Distance to nearest cluster</td>
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<td>1.88</td>
</tr>
<tr>
<td>Sustain</td>
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<td>2.84</td>
</tr>
<tr>
<td>input</td>
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<td>3.17</td>
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<td>climate</td>
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</tr>
<tr>
<td>policy</td>
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<td>2.18</td>
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<td>biodiv</td>
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<tr>
<td>food</td>
<td>3.13</td>
<td>1.61</td>
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<tr>
<td>innovation</td>
<td>2.59</td>
<td>2.41</td>
</tr>
<tr>
<td>culture2</td>
<td>1.83</td>
<td>1.51</td>
</tr>
<tr>
<td>values</td>
<td>2.94</td>
<td>2.54</td>
</tr>
<tr>
<td>pragmatic</td>
<td>2.28</td>
<td>2.17</td>
</tr>
<tr>
<td>technology</td>
<td>3.01</td>
<td>3.03</td>
</tr>
<tr>
<td>ecoproducts_redistn</td>
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<td>2.39</td>
</tr>
<tr>
<td>progressive</td>
<td>3.48</td>
<td>3.41</td>
</tr>
</tbody>
</table>

Table 5
The number of observations in each NZ cluster in total and by institutional group

<table>
<thead>
<tr>
<th>NZ</th>
<th>A</th>
<th>B</th>
<th>G</th>
<th>L</th>
<th>M</th>
<th>N</th>
<th>Total</th>
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</thead>
<tbody>
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<td>4</td>
<td>2</td>
<td>7</td>
<td>39</td>
</tr>
</tbody>
</table>

Fig. 7. Biplot representing the NZ perceptions by cluster affiliation (5 missing values).
The prevailing perception of this group is similar to Cluster 1 but its respondents generally perceived the problems of sustainable agriculture in New Zealand to be less serious (especially with regard to food, policy, and biodiversity).

Cluster 3 consisted of 11 respondents. They believed that NZ agriculture is not sustainable at all and considered all the problems of sustainable agriculture to be very serious. They were not happy with NZ agricultural policy (policy) and rejected new technologies (technology). Unsurprisingly, they tended to favour the use of European measures to promote sustainable agriculture (ecoproducts_residists). Apart from academics and NGO activists, this perception group contains the highest share of politicians that participated in the survey. This can be explained by the fact that they were mainly representing opposition parties (Green Party, Maori Party).

6. Discussion and conclusions

The results of the stakeholder perception surveys in Switzerland and New Zealand indicate that national definitions of sustainable agriculture are highly dependent on a country’s respective position in the international agricultural trading system.

New Zealand is a competitive exporter of agricultural goods and therefore forced to reconcile competitiveness with sustainable agriculture through innovation and incentive-based policies. On average, NZ respondents therefore tended to oppose direct payments, the Precautionary Principle, and a tax on food miles as measures to promote sustainable agriculture. They acknowledged the valuable contribution of organic farming and eco-labelling but thought it was not sufficient to ensure sustainable agriculture on a large-scale. They believed it has to be combined with precision agriculture, biotechnology and adequate policy incentives for farmers, researchers and the private sector to contribute to the public good character of sustainable agriculture.

Swiss agriculture, in turn, is less competitive and its agricultural policies more protective. This helps explain why Swiss respondents saw international trade competition as the most important problem of sustainable agriculture, endorsed the concept of multifunctional agriculture and had reservations about the use of new technologies. The perception pattern analysis revealed that New Zealand also contains one perception group that has more in common with the dominant Swiss view. Yet, there is no Swiss perception group that would share the view of the dominant New Zealand attitude.

These results mainly confirm the assumption that political stakeholders tend to make use of affect heuristics in order to gain more influence in the public debate on sustainable agriculture, especially in countries such as Switzerland where most people have jobs outside the business of agriculture. In such a situation it is relatively easy for stakeholders to create emotional support for farmers in the public sphere and thus ensure that public spending for agriculture does not decrease. It is however more difficult to generate this affect-driven view of agriculture in a country like New Zealand where agriculture is still an important business that creates many jobs in urban and rural areas. Solutions to sustainable agriculture in New Zealand therefore tend to be based on a continuing process of trial and error. This adaptive approach allows to experiment with new approaches and learn from experience (Stokstad, 2005). Such an approach to sustainable agriculture frames the challenge of intergenerational equity not as a trade-off between present and future consumption of natural resources, but as the need to produce relevant knowledge and technologies today in order to better enable future generations to effectively address the social, environmental and economic problems of tomorrow.

Despite their many differences, the survey participants in Switzerland and New Zealand tended to agree that free trade, the private sector and technology as such, are not undermining the goals of sustainable agriculture. If this perception is applied to agricultural policy, it would mean that, in addition to monitoring and regulating sustainable agriculture, governments need to create more incentives for academia, the private sector and the farming community to collaborate more actively in efforts to facilitate sustainable change in agriculture. The case of New Zealand already illustrates how this could lead to a better integration of the agricultural sector into the global knowledge economy.

Many stakeholders in Switzerland would however argue that New Zealand policies are not applicable to the Swiss context. The fact that the prevailing New Zealand view is hardly represented by Swiss stakeholders seems to confirm this. However, Switzerland used to pursue an adaptive approach to sustainable agriculture in the 19th century when it decided to set up agricultural research institutes in order to help farmers coping with increasing international competition in agricultural production (Brugger, 1956). At that time, the focus was on assisting farmers in their efforts to solve agronomic problems. Such assistance also included incentives for researchers, the private sector and farmers to jointly develop new agricultural products, services and technologies. This collaboration made Swiss farming more innovative and competitive and empowered the rural regions by strengthening their economic base. After two World Wars in Europe, the situation substantially changed. Domestic support for agriculture and market access restrictions increased the role of government in agriculture substantially and decreased the incentives for farmers to collaborate in the development of new goods and services. This did not change after the switch from production-tied subsidies to direct payments after the Cold War.

Today, there is a general agreement that growth in sustainable agriculture must happen through added-value products and the more efficient use of input rather than mere output increases. Since the use of new technologies is mainly associated with productivity increases, it is not seen as a contribution to sustainable agriculture in Switzerland. Instead, added-value agriculture is mainly associated with organic farming practices. Yet, the case of New Zealand demonstrates that new technologies can be applied to increase food quality and reduce the environmental impact of agriculture. Switzerland might learn from this experience and thus partially return to the successful roots of Swiss agricultural policy in the 19th century. That does not mean that the Swiss government should stop supporting the farmers – but to support them in different way. Rather than just assuming the role of a rational social planner that aims at allocating public resources in accordance with social preferences, it could focus more on its role as a coach that supports farmers and agricultural researchers in their efforts to become innovation-driven entrepreneurs that seek to address economic and environmental problems in the countryside.

The objectives of multifunctional agriculture could thus be achieved more effectively by returning more decision-making power to farmers. Farmers that feel to be in charge of their lives and able to successfully participate in the global economy may contribute to social empowerment in rural areas (social dimension), generate more income and employment in the region (economic dimension) and become more interested in managing their scarce environmental resources in a sustainable way (environmental dimension).

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