

Assessing the diversity of values and goals amongst Brazilian commercial-scale progressive beef farmers using Q-methodology



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ARTICLE INFO

Article history:

Received 13 February 2015

Received in revised form 18 January 2016

Accepted 20 January 2016

Available online xxxx

Keywords:

Beef farming

Farmer objectives

Farmer typology

Farming orientations

Technology adoption

ABSTRACT

This paper analyses the diversity of goals and values amongst 26 Brazilian commercial-scale beef farmers previously identified as exhibiting progressive technology adoption behaviours, and considers the implications for the agricultural innovation system (AIS). Following the Q-methodology guidelines, four main sets of goals and values were identified and labelled: the Professional Farmer (PF), the Committed Environmentalist (CE), the Profit Maximiser (PM) and the Aspirant Top Farmer (ATF). All farmer types believed in operating the farm as a business and agreed with the notion that cattle production and nature conservation are compatible. The PF aimed to run the farm professionally, based on sound technical and managerial practices. The CE put a particularly strong emphasis on the long-term sustainability of the farming system. The PM focused on technical issues to pursue economic returns and efficiency, thereby also creating space for lifestyle objectives. The ATF sought physical farm and livestock excellence, was growth oriented, and sought recognition by peers. These four typologies have implications for the farmers' technology adoption and its promotion, e.g. they are likely to influence the uptake of particular types of innovations, and reinforce the importance of considering AIS within a social systems framework. This is the first Q-methodology study to demonstrate considerable diversity of values and goals within a subset of technology-adopting progressive farmers, with implications within agricultural innovation systems for the integration of goal diversity and adoption theory.

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1. Introduction

It is now widely recognised within the literature on agricultural innovation systems (AIS) that technology adoption depends on a range of personal, social, cultural and economic factors, as well as on characteristics of the innovation itself (Pannell et al., 2006). In essence, farming is a social activity, and technology adoption has a socio-cultural basis (Vanclay, 2004). It is also recognised that agricultural innovation systems embody a network of actors spanning the agrifood value chain (Klerkx et al., 2010; Lamprinopoulou et al., 2014). This social-systems perspective is in contrast to the traditional linear or pipeline model of technological knowledge transfer from research through extension services to farmers (Roling, 2009). Nevertheless, our own experience in a range of developing and developed countries is that many formal innovation systems remain grounded predominantly within a researcher to farmer technology transfer paradigm. We consider this to be the situation in Brazil, which is the focus of this study.

Farming in Brazil has major geographical and socio economic diversity; the farming population ranges from poorly educated farmers operating small farms largely outside formal markets, to tertiary educated large-scale farmers operating commercially focused businesses (IBGE, 2006). In this study, our focus is on a group of relatively large-scale commercial beef farmers who by their prior behaviour had shown a commitment to adopting new technologies, but not necessarily the same specific technologies. As such, it might be hypothesised that these progressive farmers would be more strongly driven by economic values and goals than the overall farming population. Our aim was to explore the diversity of goals and values to be found within this sub group, using Q methodology. In a future paper, we will explore the relationships that link these goals and values to specific behaviours and farming styles.

Given that sociologists and economists have different paradigmatic foundations to their disciplines, it is not surprising that the two groups tend to frame farmer decision-making somewhat differently. Specifically, sociologists typically assume that diversity of behaviour is expected deriving from the diversity of goals and values. Sociologists also make no normative assumptions that specific behaviours are inherently superior to others. In contrast, economists typically undertake their formal modelling analyses within a dominant normative framework of profit maximisation constrained primarily by resource availability. However,

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despite the dominance of the profit maximisation paradigm within normative economics, there has also been an ongoing stream of economically-focused empirical literature over many years that has explicitly acknowledged and focused on the importance of both multiple and conflicting goals, and how this impacts on exhibited behaviour (Gasson, 1973; Gladwin, 1989; Featherstone et al., 1995; Wallace and Moss, 2002; Garforth and Rehman, 2006; Greiner et al., 2009; Pereira et al., 2011; Howley, 2013; Wilson et al., 2013).

From this paradigmatic basis that recognises both the relevance and limitations of economic drivers to farmer decisions, this paper adds to the body of literature on farmers' values and goals,¹ through the use of Q-methodology. This methodology groups farmers according to their selection and ranking of value and goal-related statements, and thereby creates synthetic farmer types that encapsulate the diversity of the modelled farmer population.

The novelty of the work reported here is that it specifically addresses the diversity of goals and values amongst beef farmers whose previous behaviour has identified them as being progressive. This contrasts with previous Q methodology studies that have focused on farmers in general rather than a progressive subset of early adopters. These early adopters are known to play an important role in the innovation system, particularly in the diffusion of technologies by displaying them to other farmers who may be slower to adopt (Rogers, 2003; p. 283). Whereas previous research has implicitly or explicitly associated goals and values with willingness to adopt, we believe our research is the first Q-methodology study to specifically target diversity of goals and values within the early adopter category. By doing so, we address the notion that values and goals diversity amongst progressive farmers is likely to influence the adoption of particular types of innovations as well as the overall willingness to adopt new technology. We contend that an understanding of these farmers' value systems is of fundamental importance to stakeholders within AIS, including policy makers, agricultural scientists, extension practitioners and rural consultants interested in the determinants of farmers' behaviours, and with the farmer types used to assist farmer-focused policies and research, as suggested by Wilson et al. (2013).

2. Methodology

2.1. Selection of participants

Farmers from *Mato Grosso do Sul* State, Brazil, were purposively selected based on their self-enrolment in two initiatives that promote 'good' farming practices: the Good Agricultural Practices Programme (BrazilianGAP) and the Association of Producers of Young Steers (APYS). The BrazilianGAP requires farmers to comply with a checklist to have the farm ranked as golden, silver or bronze. The list includes good practices in farm administration, personnel, infrastructure, use of natural resources and animal management and welfare, inducing technological improvements. Compliance with the Programme helps farmers to market and promote their production, and facilitates access to public credit. APYS, in turn, ensures premium prices and access to niche markets for members who comply with the requirements of their processing partners, i.e. cattle age, weight and finishing at slaughter. To meet the requirements and finish a young steer, farmers need to invest in modern technologies and sound management practices. Given the lack of objective parameters to define 'progressive', farmers' participation in these programmes was taken as a proxy for farmers' progressiveness. The validity of this assumption is confirmed by results reported in Pereira (2011, pp. 165–6) who showed these farmers had significantly higher levels of technology adoption than the average Brazilian beef farmer. This suggests that progressive farmers are more

rapid in adopting technologies than other subsets of farmers and, thus, could be considered as predominantly early adopters, with some also being genuine innovators, in relation to Roger's categories of technology adopters (Rogers, 2003; pp. 282–3).

The BrazilianGAP programme was very small at the time of this study and all 15 farmers enrolled were invited to participate. In contrast, the APYS programme had 120 members. Accordingly, to ensure diversity in farm structure and resources, a stratified random sampling based on herd size was used to select 30 beef farmers from APYS's member list, ten farmers from each of three size strata: small (less than 1000 head), medium (between 1000 head and 3000 head) and large herds (more than 3000 head). From the initial list of 45 invited farmers, only 26 agreed to collaborate, being six from BrazilianGAP and 20 from APYS. The final distribution of farmers across the three strata was 10, 9 and 7 for the small, medium and large stratum, respectively.

2.2. Q-methodology background

Underlying this study is an assumption that insights on farmers' goals and values can be best gained through insiders' views. Assessment of a person's worldview is possible using Likert scales, unstructured qualitative interviews, and focus groups amongst other approaches. Q-methodology enables an assessment through allowing farmers to 'speak for themselves' and thereby incorporates their human subjectivity into the analysis (Addams, 2000; p. 17) but also deals with this information statistically (McKeown and Thomas, 1988; p. 12). In this respect, Addams (2000; p. 14) notes "Q-methodology combines the openness of qualitative methods with the statistical rigour of quantitative research analysis".

Q-methodology has its origins in factor analysis, with the difference being the inversion of rows and columns. With this inversion, the focus is on the inter-correlations of people rather than their traits (Brodt et al., 2006; p. 92), and on similarities of their worldviews (Fairweather, 1990). These worldviews are elicited by a rank-ordering of purposively selected statements (or other stimuli) about the issue at hand (McKeown and Thomas, 1988). The rank-ordered array of statements defines the Q-sort for a subject, thus revealing what is relevant for him/her based on his/her frame of reference (Fairweather, 1990; p. 3). The measuring unit in Q-methodology is the psychological significance of each statement for each individual (McKeown and Thomas, 1988; p. 48), which becomes clear through the relative position of statements in the Q-sort (Addams, 2000). Given the self-significance of measuring units, validity occurs internally rather than externally, since there is no external criterion for a person's own point of view (Brown, 1980; pp. 174–5).

In Q-methodology, breadth and diversity of views are more important than proportionality in the selection of subjects (Brown, 1980, p. 260). Typically, it requires from 20 to 50 subjects (Q-set), and involves from 30 to 50 statements (Q-sample). The small Q-set often raises concerns with the generalisation of the findings beyond the studied group, as noted by Hermans et al. (2012; p. 87).

Q-sorts from all respondents are correlated and factor analysed in order to yield groups of people who have ordered the statements similarly (i.e., have similar views). In this process, statements have little importance by themselves; more important is the relationship amongst statements, which is revealed by the way respondents sort them (Addams, 2000; Brown, 1980; McKeown and Thomas, 1988). The resulting factors represent major viewpoints: the higher the respondent's loading on a factor, the greater is that person's association with the viewpoint represented by that factor (McKeown and Thomas, 1988). Interpretation of factors occurs by consistently producing explanations for the factor arrays. Finally, labels are typically established for each factor to pinpoint its salient characteristics that summarise the viewpoints represented by the factor (Addams, 2000; p. 33).

Q-methodology has been successfully employed by social constructionists, feminist scholars and action researchers (Previte et al., 2007),

¹ The terms 'goals' and 'objectives' are used interchangeably in this article.

with strong foci in political sciences (Brown, 1980), psychology and health studies (Hall, 2008). The use of this method in agricultural and environmental research remains limited, but is rapidly increasing (for a comprehensive review, see Davies and Hodge, 2007; pp. 325–6). The studies usually fall into either “broad” or “specific” categories, according to their scope: the first addresses overall views, perceptions, assessments on broad rural issues or themes; the second focuses on specific subject matters within the rural context. Examples of the “broad” category include studies on farmers’ perceptions of ‘successful farming’ (Walter, 1997), stakeholders’ perceptions on marine fish farming (Bacher et al., 2014); farmers’ assessment of ecological and environmental issues (Davies and Hodge, 2007; Kvakkestad et al., 2015); and farmer goals and management styles (Brodt et al., 2006; Fairweather and Keating, 1990, 1994), including this study. Farmers’ perceptions on biosecurity at farm-level (Kristensen and Jakobsen, 2011) and attitudes towards genetically modified crops (Hall, 2008) are examples of the second category.

According to Previde et al. (2007; pp. 141–2), further use of Q-methodology in rural studies is appropriate given: (1) the focus on the participants’ experiences, context and making sense of the world; (2) the capacity of the method to limit the power of the researcher over the definition of terms and their meanings; (3) it does not seek a universal truth, but recognises the existence of alternative constructs for which understanding should be gained; and (4) it enables the development of more holistic knowledge that is open to “multiplicity, complexity, tension and inconsistency in subjectivities and between subjectivities”.

2.3. The application of Q-methodology in this study

Q-methodology was used in the present study to identify and group major values and goals amongst the Brazilian commercial-scale progressive beef farmers. Using a structured sampling framework, an initial list of 133 statements was drawn from the literature (Cezar, 1999; Costa, 1998; Fairweather and Keating, 1990; Gasson, 1973; Ohlmer et al., 1998; Wallace and Moss, 2002). Following a similar framework of the study by Fairweather and Keating (1990), the final list of 49 statements covered three themes (business, family and lifestyle) and was distributed across 19 dimensions: risk control (3), core business (11), development (3), technology (2), independence (2), financial security (2), easy care (2), marketing (2), debt (2), succession (1), intergenerational relationships (1), goals for children (2), role men/women (1), status (3), balance/lifestyle (4), aesthetic/conservation (4), country life (1), challenge (2) and later life (1). Not all dimensions were equally present in the Q-sample because covering all dimensions was more important than a balanced distribution of statements across the dimensions. The statements were tested with one farmer and further refined, being written in a colloquial language and printed on cards (usually 500 mm × 400 mm).

During face-to-face interviews over 2008/9, individual farmers performed statement sorting based on their level of agreement/disagreement. They were encouraged to move statements around until they were satisfied with the sorting. After the sorting, a tape-recorded interview was conducted to explore each farmer’s accounts for displaying statements in a particular order. In addition, farm data and socio-demographic information were collected. On average, the sorting and the interview took 1.5 h to complete.

The Q-sorts were analysed using ‘PQMethod’ software version 2.11 (available on <http://schmolck.userweb.mwn.de/qmethod/downpqwin.htm>). The raw scores of statements ranged from –4 to +4, with –4 meaning strong disagreement and +4 strong agreement; scores around zero meant that the farmer was indifferent to the statement. The software correlated all Q-sorts, performing a principal components analysis and a varimax rotation to identify a small number of heavily loaded factors, i.e. farmer types. The analysis initially produced eight unrotated factors that accounted for 78% of the total variance. To decide the

number of factors to rotate, we used a combination of methods suggested by Brown (1980). Applying the *eigenvalue* criterion (*eigenvalue* exceeding 1), the solution indicated six factors to rotate. In addition, considering the significance criterion, by which factors should have at least two significant loadings in the unrotated factor matrix to qualify for rotation (Brown, 1980; McKeown and Thomas, 1988), the six and five-factor solutions were discarded. Factor six had only one significant loading (over the significance level 0.369 for our dataset, at $P < 0.01$) while factor five had two significant loadings, but with one very close to the limit of significance (0.371). This raised concerns over the suitability of this factor for rotation. Consequently, four factors were selected for further analysis, representing 20 of the 26 participants (77% of the sample) and accounting for 62% of the total variance. The distribution of variance was 23%, 9%, 12% and 18% for factors one to four, respectively.

The remaining six participants loaded significantly on more than one factor (multiple loaders), which, according to Hermans et al. (2012; p.78) “is consistent with the theoretical notion that people have a nuanced view that combines different elements of two or more discourses”. Of the six multiple loaders, three loaded significantly on factor one and four, one was confounded between factor two, three and four, and the remaining two respondents were confounded between factor one and either factor two or three. This is consistent with the high correlations between factor one and four ($r = 0.69$), between factor one and three ($r = 0.55$) and between factor three and four ($r = 0.47$), indicating some overlapping views amongst these factors. Given multiple loaders’ views were essentially captured by the four selected factors, the analyses proceeded only with the respondents who significantly loaded on a specific factor. However, we recognise that the six multiple loaders remain relevant to future analyses that link goals to behaviours.

For each factor, PQmethod presented a top-ranked list of statements that highlighted the main values and goals of the farmers making up the factors. It also reported the most distinguishing viewpoints amongst factors. The full set of statements and scores can be seen in Table 1.

Based on this set of information, the four factors, i.e. farmer types, were interpreted and labelled as Professional Farmer (PF), Committed Environmentalist (CE), Profit Maximiser (PM) and Aspirant Top Farmer (ATF). Despite the Q-sorts being sufficient to capture the participants’ discourse and views, some descriptive statistics are presented in the following section to characterise the sample and to enhance overall descriptions of the farmer types. Specific statements are referred to in brackets (for example, S33 refers to statement 33).

3. Results

3.1. Farms and farmers’ description

All interviewees were males, although not predetermined by the purposive sample selection. In all cases they were the main decision makers, even when women were the legal farm owners. Accordingly, where the male pronoun is used in this article to describe the farmers, this is reflective of the sample characteristics, and we recognise that different insights may have been obtained from females.

Based on our sample, a typical progressive farmer was a well-educated male in his 50s, married, with two children (Table 2). Some 70% of these farmers had completed tertiary education, most of which were agricultural-related degrees and some in business administration. Most farmers lived in town and usually visited the farm once a week. This is a common practise amongst beef farmers in Mato Grosso do Sul State, as reported by Costa (1998) and Cezar (1999). Better access to school and having off-farm activities (e.g. self-employment or non-agricultural business) were some reasons for living in town. Each farm had a ‘live in’ sub manager working from detailed instructions.

The average farm from our dataset was 3344 ha with 1880 ha of pasture and 2688 cattle. ‘Nelore’ (*Bos indicus*) was the prevailing

Table 1
Raw scores of statements for the farmer types¹.

No.	Statements ²	PF	CE	PM	ATF
1.	My goal is to work at the farm capacity to avoid land invasion by landless people	-2	2	0	-3
2.	Borrowings should be restricted to a low percentage of the value of assets	1	-1	0	-1
3.	There are times when I take the risk in order to succeed	1	0	0	1
4.	A good farm manager has control over his/her farm and is not at the mercy of outer forces	0	0	1	1
5.	My objective is to adopt new technology as much as possible	2	-2**	1*	2
6.	I always wait for other farmers to adopt new technologies before I do it myself	-1	-1	-1	-2
7.	I want to achieve the maximum profit feasible	0**	-2**	4**	1**
8.	The benefit from the security and liquidity of cattle ownership is important to me	2	1	2	1
9.	My objective is to increase the crop production	0	-3*	-1	0
10.	My goal is to run the farm as a business, with clear goals, and close attention to my cash flow position	4	2	3	3
11.	The technical performance is more important to the business success than the financial control and planning	-2	-3	1**	-2
12.	I want to diversify my assets and invest in off-farm activities	-1	-2	-2	0*
13.	My goal is to have the best quality of livestock and pasture possible – good husbandry is the key to business success	2	2	3	1
14.	I value my staff – they are fundamental for the quality of my production	3	1	2	2
15.	My priority is to improve animal welfare	1*	3*	0	0
16.	I want to maximise the beef production in my farm	1	-2**	2	4
17.	My goal is to improve pasture productivity and animal performance	2	1	2	1
18.	I do not intend to expand the business	-1*	1*	-1*	-3**
19.	My objective is to hand over the farm to the next generation in better conditions than when I got it	3	2	-1	0
20.	The diversification of activities is not important to my farm	-2	-3	0*	-3
21.	I am a beef farmer because of the freedom of being my own boss	-2*	1**	-1	-1
22.	I try to make decisions on my own – I like things my way	-3**	3**	-2	-1
23.	An important goal to me is to have enough money for a comfortable retirement	0	-1	3**	-1
24.	I intend to have a higher withdrawal to live comfortably in the present	-1	-1	1	0
25.	My objective is to reduce my workload and improve my quality of life	-1	-1	2**	-1
26.	My goal is to have well defined roles and activities so that the farm runs smoothly	2	-1	1	1
27.	I try to control the sales of my production because I want to ensure I receive the best return possible for my products	1	2	2	2
28.	I do not have control over input and output prices; so I have to accept what the market imposes and there is nothing I can do	-2	-2	-2	-1
29.	I want to have my farm recognised for producing high quality meat	1	1	1	3*
30.	I avoid having debts – to have debts means poor administration, in my opinion	-1	0	-1	-2*
31.	I intend to encourage the next generation to do something else rather than farming	-3	-1	-2	-1
32.	I farm to follow the family tradition	-4	1**	-3	-2
33.	My aim is to encourage our children to study and then let them decide if they want to go farming	3**	-2*	1	0
34.	My goal is to share farm work and farm decisions with my spouse	0	0	1*	0
35.	To belong to the rural community is a satisfaction for me	0	0	-1	1
36.	It is important to me to be recognised as a modern farmer	-1	-1	-3*	2**
37.	Some people put too much emphasis on the business end of farming; for me, it is a lifestyle as much as a business	0	1	-2	-1
38.	Business goals must take priority over household needs	-1	-3*	-1	-1
39.	For me it is important not to allow the farm rule my life	0	-1	-2*	0
40.	One virtue of farming is that you can have your family working alongside you	0	-1	-3	-2
41.	Nature conservation is important and I value it as much as my income goals	2	4*	0*	2
42.	The good farmer does not exaggerate: moderate yields, modest improvements and old equipment suit me fine	-1	0	0	0
43.	There is no compatibility between beef cattle production and nature conservation: to improve one you need to disturb the other	-3	-4	-4	-4
44.	I want to enhance the landscape and have a beautiful farm	0	-1	0	1*
45.	I really appreciate the outdoor life, close to nature and with animals around	1	3**	0	0
46.	My goal is to be the best farmer I can be	0	0	0	3**
47.	I like innovating because new challenges inspire me	1	2	1	2
48.	I want to maintain some involvement in the farm, even after retirement	1*	0	0	0
49.	I want to rest and enjoy retirement – it's time for kids to take over the family farm	-2	-1	-1	-2

*P < 0.05 and **P < 0.01 indicate the farmer type is statistically distinguished from the other farmer types at 5% and 1% significance levels, respectively.

¹ PF – Professional Farmer; CE – Committed Environmentalist; PM – Profit Maximiser; ATF – Aspirant Top Farmer.

² Consensus statements are in bold.

breed, but crossbred Angus was frequently present. Cow/calf raising plus fattening was the most common production system; combined rearing and fattening, but without breeding, was also common. On-farm diversification, when present, comprised mainly commercial crops and sheep. On average, 81% of the farmers' total income, considering both on and off farm sources, was from farming. Farmer ages ranged from 28 to 75 years and years of experience varied from three to 45. Farm size ranged from 162 to 19,200 ha, and herd size ranged from 300 to 13,980 head.

Although there were apparent differences in the socio-demographic characteristics of the four farmer types identified by the Q-sort (Table 2), this data set was not tested for statistical differences. Accordingly, although these differences provide descriptive insights, some caution is appropriate as to any generality that can be drawn associating apparent socio-demographic differences with particular value sets.

3.2. Values and goals shared by farmers

These progressive beef farmers held some common values and goals, with nine out of 49 statements scoring similarly (Table 1). There were two statements for which the consensus views were held strongly as indicated by particularly high ratings (positive or negative). Specifically, the consensus was supportive of the goal of running the farm as a business with close attention to the cash flow position. Similarly, there was a strong consensus against the notion that “there is no compatibility between beef cattle production and nature conservation”.

In general, these farmers wanted to improve pasture and animal productivity (S17), often being in the forefront of technology adoption (S6). They believed they could be proactive in relation to input and output prices (S28), although acknowledging their limited power to overcome outer forces (S4). Beef farming was perceived as a low risk activity to safeguard the family income, as suggested by the farmers'

Table 2
Descriptive statistics per farmer type and for the group.

	PF	CE	PM	ATF	GROUP ¹
<i>Farmers' characteristics</i>					
Number of farmers in each group	9	2	4	5	20
Average age (years)	60	61	52	44	55
Farming experience (years)	25	30	17	11	20
Live on the farm (%)	33	–	–	–	15
Tertiary education or higher (%)	68	50	75	80	70
Have off-farm activities (%)	22	50	50	80	45
Income from farming (%)	93	100 ²	58	72	81
<i>Farm description</i>					
Average farm size (hectares)	2983	1465	5428	2507	3344
Average pasture area (hectares)	1758	910	3137	1521	1880
Average crop area (hectares)	315	350	20	480	564
Average herd (head)	2697	900	4240	2146	2688
Average number of employees	7.3	3.0	6.7	5.2	6
<i>Beef production system (%)</i>					
Cow/Calf	11	–	–	20	10
Fattening	11	–	–	–	5
Rearing + fattening	11	50	25	40	25
Cow/Calf + rearing + fattening	67	50	75	40	60
On-farm diversification (%)	56	–	25	40	35

¹ Excludes the six multiple loaders.

² One farmer of the CE type had a non-paid off-farm work.

agreement with S8. Generally, these farmers were not retirement-focused and were not ready to hand the farm to their children (S49).

3.3. The farmers' distinguishing sets of values and goals

There were 28 values and goals statements that contributed to distinguishing the four farmer groups (Table 1). The four groups, each of which can be considered as a synthetic representative farmer according to their key characteristics, were named as the Professional Farmer (PF), Committed Environmentalist (CE), Profit Maximiser (PM) and Aspirant Top Farmer (ATF). The defining features of each synthetic farmer are evidenced mainly by particular statements that the group felt strongly about (either positive or negative). Socio-demographic data are sparsely used, but as a secondary source of information, to support and enhance the descriptions of the farmer types.

3.3.1. The Professional Farmer (PF)

Nine farmers loaded significantly on a factor having a set of objectives and values compatible with the description 'Professional Farmer' (PF), and reinforced by the emerging theme "the farm as a business" during the interviews. These farmers relied almost totally on the farm for their family income, with the farm providing 93% of this income (Table 2). This 'synthetic farmer' was business-oriented, was more likely than the other groups to live on the farm, and had a management style that was marked by a balance between office tasks and field activities (S11). He sought to have well defined roles and tasks so that the farm could run smoothly (S26). He valued the staff and the sharing of decision-making, as indicated by his strong disagreement with 'liking things his way' (S22). He also paid close attention to the cash flow because "in beef farming, one gets income few months of the year while expenditure happens every day" (Farmer 26). From a technical perspective, the PF's objective was to improve pasture and animal performance (S17) so that he could achieve the best quality of livestock and forage possible (S13). This was in line with another objective: he wanted to improve the farm before handing it over to the next generation (S19).

Despite the fact that all farmer types aimed to run the farm as a business, this was a stand-out characteristic of the PF due to the strength of ranking. The PF thrived on managing the farm professionally.

Furthermore, the PF was passionate about farming: "I really like farming" (Farmer 17). He was the only type that wanted to keep some involvement in farming even after retirement (S48) and he was not totally comfortable about stepping back and letting the children run

the farm (S49). Farmer 7, who was 73 years old, epitomised this perspective, stating: "Part of my farm I will hand over to my children in a few years' time. The other part I'll keep to myself and my wife until I die."

The PF held a neutral viewpoint on profit maximisation, in contrast with most other farmer types. As farmer 8 explained: "profit is not the main objective (...) it is important but not at any cost".

3.3.2. The Committed Environmentalist (CE)

This farmer type comprised two farmers and had 'environmental stewardship' as defining characteristic. This type found most joy in outdoor life, being close to nature and animals (S45), and held a major goal of improving animal welfare (S15). The CE strongly valued nature conservation as much as income (S41). Unlike other farm types, the CE farmer wanted to maximise neither beef production nor profits (S7 and S16). Farmer 02 clarified: "Maximising production doesn't mean it's going to benefit you because you might be destroying the environment".

The CE emphasised not only environmental but also family goals. The CE strongly disagreed with the idea of business goals having priority over household needs, did not want to expand the business, and was not interested in adopting as much technology as possible (S38, S18 and S5). In addition, increasing crop production was rejected because "tree cutting is required" (Farmer 2). This was perceived as incompatible with 'sustainable farming'. Given these minority views, the CE needed and enjoyed the freedom of being his own boss and making independent decisions (S21 and S22).

Family tradition was an important value for the CE farmer: "My granddad already had this concept of taking good care of animals" (Farmer 2). The CE's apparent disagreement with S33 about children first becoming educated and then deciding if they wanted to go farming was influenced by the family already being grown up.

3.3.3. The Profit Maximiser (PM)

Four farmers loaded significantly on a factor for which the standout goal was to achieve the maximum profit feasible (S7). This was in sharp contrast with other farmer types. Hence, this 'synthetic' farmer was labelled as the Profit Maximiser (PM). This farmer relied more on off-farm income than the other farmers (Table 2), and sought profit as a means to achieve other goals: "Profit allows you to do other things like improving staff conditions" (Farmer 15). The PM type was also concerned with future income since the farmers sought to make enough money to secure a comfortable retirement (S23). They also focused on reducing workload and increasing quality of life (S25). This person's approach to achieving economic goals differed considerably from other farmers, focusing somewhat more on technical performance rather than on planning and controlling the finances (S11). However, close attention was still given to the cash flow position (S10). Technology adoption was important (S5), but to a lesser extent, compared to other production-oriented farmers (i.e. excluding CE). The PM showed some evidence of risk aversion behaviour: "If I'm producing beef, it's because I don't like risk" (Farmer 14).

Overall, the PM was neutral to diversifying the farm because diversification "means more work" (Farmer 12). Increasing the workload was incompatible with the PM's lifestyle objectives. In contrast, all other farmer types considered diversification important.

Despite strong beliefs that cattle production and nature conservation are compatible (S43), the PM only gave a neutral score to nature conservation being as important as his income goals (S41). In contrast, all other farmer types gave a positive response to this statement.

3.3.4. The Aspirant Top Farmer (ATF)

Five farmers loaded significantly on a factor labelled as Aspirant Top Farmer (ATF). This farmer stood apart from all other farmer types over the strength of ranking given to eight related statements. The ATF wanted to maximise beef production (S16), produce high quality meat (S 29), be the best farmer possible (S46), be recognised as a modern farmer (S36) and have a beautiful farm (S44). The ATF was also positive

about farm expansion (S18) and was more willing than other farmers to take on debt (S30). Individual statements elicited in interviews that help capture the essence of the ATF included: “If I were to use only my own capital to expand the business, nowadays I would be at the same level I was seven years ago.” (Farmer 9); being “not scared of new challenges” (Farmer 4); “I try to be the best farmer I can be; and [I want] to show others how to run a beef business” (Farmer 3). Farmer 4 stressed “challenge as a motivation”, and Farmers 1 and 4 both saw profit not as an end-goal per se, but as a reward for and an indicator of good work. Farmers making up the ATF type were the youngest of all farmer types (Table 2), and the stage of life was consistent with further developing the business and increasing net worth.

4. Discussion

A key strength of the Q-sort is that it captures the subjective perspectives of the participant farmers and this is achieved independently of any researcher judgement. Further, the Q-methodology allows quantitative and statistical analysis. However, there are no objective measures for determining the most appropriate number of farmer types (factors). This does require researcher judgement and an associated trade-off between extent of variance explained and a meaningful set of farmer types. Accordingly, and consistent with soft systems thinking (Checkland, 2000), the farmer types can be considered as a typology that brings meaning, insight and understanding to what would otherwise be a complex mess. However, given the key role of the analyst in determining the typologies, there is scope for alternative interpretations.

Several farmer typologies have been previously described in the literature (Burton and Wilson, 2006; Fairweather and Keating, 1994; Garforth and Rehman, 2006; Wilson et al., 2013), some of which resemble the findings of this research (Table 3). An early study across a range of farm types and including both men and women (Fairweather and Keating, 1990, 1994) identified three major farming orientations amongst pastoralists and crop producers in New Zealand. They were labelled as the Dedicated Producer, the Environmentalist and the Flexible Strategist. Brodt et al. (2006) studied California almond and winegrape producers, including participants and non-participants in biologically integrated farming systems programmes. They identified three management styles labelled as Environmental Stewards, Production Maximisers and Networking Entrepreneurs. Burton and Wilson (2006; pp. 101) identified in the literature four farmer ‘self-identities’ (similar to farmer types), which were later validated with UK farmers and named: the Agricultural Producer, the Diversifier, the Conservationist, the Agribusiness person.

The Environmentalist (E) of Fairweather and Keating (1994), and the Environmental Steward (ES) of Brodt et al. (2006), similarly to our Committed Environmentalist (CE), tried to manage their farms in cooperation with nature. They placed higher value on environmental stewardship than on productivity and production, and were willing to sacrifice some income for the sake of being more environmentally friendly. The Conservationist (C) of Burton and Wilson (2006) also aligns with many elements of these farmer types. They all have an intrinsic orientation to farming where farming is “valued as an activity in its own right” (Gasson, 1973; p. 527), creating opportunities for being in a natural and healthy environment.

The Dedicated Producer (DP) of Fairweather and Keating (1994) and the Production Maximiser (PMx) of Brodt et al. (2006), like our Professional Farmer (PF), emphasised financial control and high yields and quality, accepting the environmental consequences of farming. They found most joy in farming and, generally, were not interested in off-farm pursuits. They also resemble the Agricultural Producer (AP) in his strong productivist focus and stewardship (Burton and Wilson, 2006). These farmer types also seem to value farming intrinsically (Gasson, 1973).

The Flexible Strategist (FS), identified by Fairweather and Keating (1994), and the Networking Entrepreneur (NE) found in Brodt et al. (2006) resemble the Aspirant Top Farmer (ATF) in their emphasis on marketing and external orientation. In general, these farmers had a strong interest in networking and off-farm activities. The latter is also a defining aspect of the Diversifier (D) of Burton and Wilson (2006, p. 101), whose focus “is shifting away from standard agriculture towards non-agricultural sources of income”. Farming is, thereby, perceived as a means of self-expression (e.g., meeting a challenge and feeling pride of ownership) and social interaction, which are defining characteristics of the expressive and the social farming orientations, respectively, described by Gasson (1973).

The identification of a fourth farmer type in this study, i.e., the Profit Maximiser (PM), extended the set of orienting principles found in previous Q-studies (Fairweather and Keating, 1994; Brodt et al., 2006) and supported other typological research (Burton and Wilson, 2006). While the identification of the PM gives some support to neoclassical economists’ claims on farmers’ profit orientation, the description of other goals and values held by this and by other farmer types is evidence of farmers’ multiple objectives.

The PM’s prevailing goal of maximising profit aligns with the Agribusiness person’s (AgP) concerns with profitability to the potential detriment of stewardship (Burton and Wilson, 2006). Both farmer types have a strong productivist orientation, which supports the notion that profit and high production levels were closely associated. These descriptions are compatible with an instrumental orientation where farming is “viewed as a means of obtaining income and security” (Gasson, 1973; p. 527).

Despite the common patterns amongst the farmer types discussed relative to other typological studies, differences were also found. For instance, the Networking Entrepreneur (NE) of Brodt et al. (2006) aligns closely with our Aspirant Top Farmer (ATF), but the ATF does not emphasise the community involvement to the extent of the NE. In addition, the Custodians, Lifestyle Choice, Pragmatists, Modern Family Business and Challenged Enterprises, self-identified by farmers in Wilson et al. (2013) work, had mixed interfaces with our farmer types, often matching more than one type. Differences such as these are to be expected, because it is reasonable to assume that farmer typologies may vary across time, location and industry. Specifically, the social and economic environment influence the farmers’ objectives, as Howley (2013; p. 110) argued. Thus, we note that the contextual differences between the studies have broad physical, biological, economic and cultural spans. In this study, the findings relate specifically to relatively large scale Brazilian beef producers, all male, with a history of progressive behaviours. All of the farmer types show a strong focus on farming as a business, all place importance on environmental issues, and all believe that successful and profitable beef farming is compatible with environmental sustainability. Particularly notable is the diversity

Table 3
Major farming orientations found on typological literature.

Fairweather and Keating (1994)	Brodt et al. (2006)	Burton and Wilson (2006)	This study
Environmentalist	Environmental Steward	Conservationist	Committed Environmentalist
Dedicated Producer	Production Maximiser	Agricultural Producer	Professional farmer
Flexible Strategist	Networking Entrepreneur	Diversifier	Aspirant Top farmer
-	-	Agribusiness Person	Profit Maximiser

of farmer types identified from within what might, in other contexts, be considered a relatively homogeneous group.

Despite any restrictions from our small sample and the methodological limitations of Q-methodology for extrapolation, we note our findings reinforce other studies that identified somewhat similar divisions of farmers. In particular, we draw attention to four major overarching orientations that have been consistently reported in the literature and can be summarised as: (a) Nature; (b) Production; (c) Profit/Income; and, (d) Market/Networking (Fig. 1). In our study, the Committed Environmentalist, the Professional Farmer, the Profit Maximiser and the Aspirant Top Farmer are, respectively, representatives of these four farming orientations. The most distinguishing division amongst all typologies is the Nature-oriented farmers, since they share the least values and goals with other farmer types, as our own findings also pointed out (Fig. 1).

These overarching orientations have implications to AIS in general, and to technology adoption in particular. They provide the framework for farmers' decision making, including adoption decisions, and possibly influence the type and quality of their interactions with various social actors within AIS.

Different farmer types (or farming orientations) have different interests in, or attitudes to, particular types of technologies. Farmer types with a strong production orientation (i.e. except the Nature-oriented type) are likely to adopt technologies supportive of agricultural production where that is consistent with their environmental orientation, but may be reluctant about other innovations. Pereira and Woodford (2011), for instance, noted farmers' perceived a lack of compatibility of some environmental technologies with their production goals. This negatively influenced their adoption rates. As Beedell and Rehman (2000) observed, and the findings of Davies and Hodge (2007) further supported, the determinants of farmers' behaviour have less to do with the legitimacy of environmental concerns, which they are generally positive about, than with how they perceive the benefits and trade-offs of environmental practices on their own farms. External financial incentives and institutional support systems may be necessary to facilitate the uptake of such environmental technologies by strongly production-oriented farmers, including the subset of progressive farmers. In contrast, farmers with a Nature-orientation, like our Committed Environmentalist, are genuinely interested in nature conservation and sustainability and, consequently, may be more willing to adopt sustainable practices, environmental technologies, organic and agro-ecologic farming systems and other environmentally-based initiatives, including policies.

In turn, particular managerial technologies may be appealing, to various degrees, to all farming orientations, albeit with different motivations. While farmers with a Market/Networking orientation (e.g. our

Aspirant Top Farmer), whose focus is on market operations, may use management tools to reduce risk, farmer types under a Production orientation (e.g. our Professional Farmer) want to farm efficiently utilising farm planning and control systems; having a profit orientation, like our Profit Maximiser, indicates interest in cash flow and, therefore, may use associated plan and control technologies; lastly, for the Nature-oriented type, managerial technologies are likely to be applied to assess sustainability.

Although beyond the scope of this study, a relevant question in R&D involves tailoring innovations, and their promotion, to specific farmer types relative to their frequency within the farming population. While Q-methodology was effective in capturing the diverse goals set amongst these farmers, it does not allow for the estimation of relative frequencies of these farmer types across the Brazilian beef farming population or within the subset of progressive beef farmers.

Whether or not typology shifts might occur over time is also worthy of consideration. Despite Howley's (2013) claims about the influence of the socioeconomic environment on the farmers' objectives, the time required for significant changes to occur and consolidate is not clear. Davies and Hodge (2012), who conducted a repeated Q analysis in 2001 and 2008 to explore farmers' shifts in environmental perspectives, found that no new typologies (or discourses) emerged over that period, although many farmers changed their original alignment with particular types, indicating a reorientation of attitudes. In Brazil, even though the farmer types found in this study will probably continue to hold relevance in the years to come, it is reasonable to assume that new types might have arisen, or the distribution of individual farmers across the four types might have changed, given changes in the political, economic and social environments over the last few years. The farmers' age, farming experience and stage of family lifecycle are factors that could also cause farmers' objectives to shift. In the longer term, changing perspectives concerning the multi-functionality of rural landscapes may see additional typologies emerge in Brazil that are more consistent with current perspectives in Northern Europe (Hermans et al., 2012).

Another question of interest is whether different progressive farmer types show measurable differences in the types of innovation that they actually adopt. By itself, a study of goals is insufficient to address this question since other factors also influence the adoption behaviour, such as the farmers' capacity to adopt (Hurley and Hult, 1998), the technology characteristics (Rogers, 2003; Pereira and Woodford, 2011), and social influences (Ramirez, 2013) amongst others. Our own work, beyond the scope of this paper, is addressing this question.

Finally, we give consideration to the implications of our work for systems thinking in relation to innovation adoption. We note the experience of Garb and Friedlander (2014) in relation to the importance of context, and their introduction of the metaphor 'technology translation' as a replacement for 'technology transfer'. Whereas Garb and Friedlander (2014) consider the translation of innovation practices from one country to another, the relevance of our own work relates more to the translation of innovations from a research to a commercial environment where the early adopters typically also have to face under-developed support systems. Considering the farmers' "web of influencers" (Oreszczyn et al., 2010, p. 410) and the process of social learning (Conley and Udry, 2001), studying progressive farmers allows not only for the identification of the types of innovations they will most likely adopt, adapt or re-invent (i.e. translate), but also to identify key actors sharing their views to promote, and further develop, particular types of technologies throughout the AIS.

In addition, we note the limitations of the Rogers model (Rogers, 2003) for its failure to consider goal diversity as an explanatory factor for non-adoption (Vanclay and Lawrence, 1994). Given the diversity of values within our own group of progressive farmers, we see each farmer type identified through Q methodology as representing its own continuum from early adopters to later followers. Accordingly, goal diversity and traditional adoption theory can be viewed as complements which jointly describe a multi-dimensional construct of farmer behaviour. As

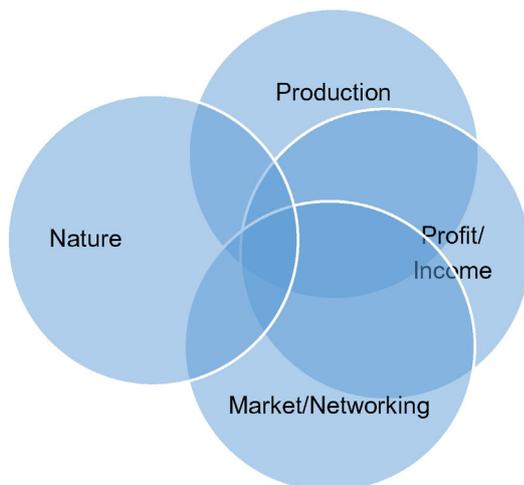


Fig. 1. Venn diagram representing major farming orientations.

such, our work provides insights for the integration of traditional adoption theory and goal diversity, with followers within each farmer type having potential to be influenced by the experiences of early adopters in that same type.

5. Conclusions

There is considerable diversity amongst Brazilian commercial-scale progressive beef farmers as shown by the four synthesised farmer types identified in this study using Q-methodology. This is the first Q-methodology study to have specifically focused on the diversity of farmer types within the progressive early-adopter subset of a farmer population. The diversity of farmer types within this subset holds relevance for AIS, in general, and technology adoption in particular, and reinforces the necessity of a paradigm shift from an emphasis on the technology itself to an emphasis on potential users and their preferred behaviours. In particular, there is need to recognise that lead farmers exist across diverse value systems. This thinking is relevant for all groups within an innovation system, including scientists, extension workers, farmers and policy makers.

Acknowledgements

We would like to thank the farmers and staff from APYS and BrazilianGAP who participated in this study. We also thank the Brazilian Agricultural Research Corporation – Embrapa – (21000.013785/2006-54) and Lincoln University for the financial support. This study benefitted from the critique of two anonymous referees.

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