Trust building in agri-food markets with computer-mediated business relationships

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Abstract

Trust is recognised as an important component for Business-to-Business (B2B) e-commerce success and consolidation among the agribusiness operators, but few studies link trust and e-commerce in agri-food markets. The implementation of trust into technical and organisational solutions is a prerequisite for using the Information and Communication Technology (ICT) potential in the agribusiness network.

This paper is aimed at identifying trust-building factors, or trust drivers, in agri-food business relationships, in order to transfer them into computer-mediated business relationships (CMBR).

First, the literature on trust both in the general agri-food environment and in e-commerce situation is considered.

Then, linkages between these two items were explored through focus group (FG) interviewing. The FG, was held in Italy in April 2004, and involved a group of experts of several industries and levels within the agri-food chains and ICT experts. A content analysis of the meeting verbatim and further elaboration with multidimensional scaling techniques allows for drawing a perceptual map of the dimensions of the logical construct of trust in agri-food e-commerce.

Finally, these results are the basis for the elaboration of a first hierarchy of factors, used within an Analytic Hierarchy Process (AHP) framework. The aim of this procedure was to assess the importance of the factors and to evaluate several alternative tools for CMBR, entailing different trust-building characteristics.

Preliminary outcomes are consistent with the literature on trust, even if the trust logical framework is affected by the specific context. The main trust dimensions for CMBR in agribusiness are reputation, non-opportunistic behaviour, and integrity according to shared values. The context may influence both the type of factors associated to the relevant dimensions, as well as their relative importance in relationship with the primary goal of building trust, so that in different scenarios both factors importance and hierarchies may be different.

Key words: Trust factors, Perceptual mapping, Analytic Hierarchy Process

1. Introduction

Trust is recognised as an intangible asset, crucial to let the business organisation to compete on the markets (Barney and Hansen, 1994). Several conceptual frameworks have been defined, but a generally accepted definition is not available, since the interpretation is often changing according to the context in which it is analysed, the disciplinary approach adopted, and the focus on a specific type of trust (Lewicki and Bunker, 1995; Smith and Barclay, 1997; Barber, 1983; Shapiro, 1987).

This paper is aimed at identifying the logical construct of trust, as well as trust-building factors, or trust

drivers, in a context of computer-mediated business relationships (CMBR) within the agri-food business environment. More specifically, the aim is to identify trust drivers in business-to-business (B2B) e-commerce relationships.

2. Theoretical background

Trust is a matter of study in several disciplines. Sociologists, psychologists or philosopher focus for example on interpersonal relationships and friendship (Johns, 1996; Burke and Stets, 1999; Gambetta, 1989; Luhmann, 2002; Shapiro, 1987; Deutsch, 1962). Economics and management of business organisations are interested in trust among the operators within organisations or markets (Kramer, 1999; Mayer *et al.*, 1995; McAllister, 1995). Marketing focuses on building trust among consumers and clients/customers (Castaldo, 2002; Moormann *et al.*, 1992; Raimondo, 2000). Information technology is interested in exploring the determinants of trust between a trustee (the subject to which trust is granted) and a trustor (the subject that grants trust). An extensive analysis of the literature was performed and is available by the authors.

The diffusion of the Internet brought potential advantages to the business activities, but most of these advantages have not actually been exploited in the agri-food industry. Even if the IT tools are broadly widespread and accessible, e-commerce applications in the agri-food sector did not have the expected development yet, both in the business to business and in the business to consumer environment.

Specific reasons have been identified in the "impersonal" nature of the IT environment (De Carli, 1997), the difficulty of judging the quality of the product and the related problems of asymmetric information (Akerlof, 1970), the geographic dispersion of the subjects involved (Castell, 2001) and, finally, the presence of a “digital divide” issue. All these aspects may be traced back to a lack of trust, and of the absence of trust building elements and mechanisms that may override difficulties that are not actually specific of the IT environment, but that in the IT environment did not find the appropriate treatment, yet.

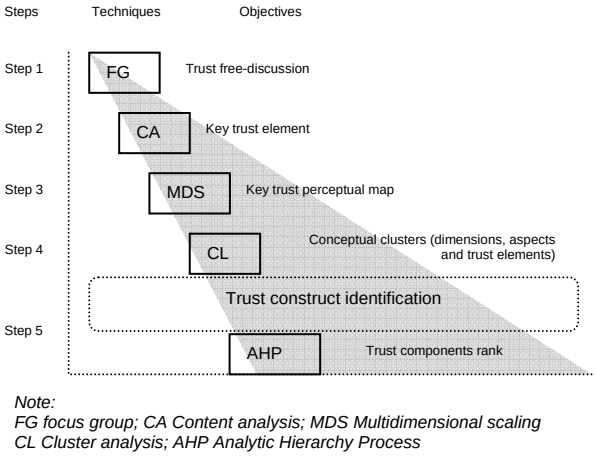
Several models have been proposed to interpret the meaning and the components of trust. Andaleeb (1992) defines trust as a mix of motivations and skills; Lewis and Weigert (1985) as a mix of “rationality” and “emotion”; McAllister (1995) talks about cognition-based trust and affect-based trust; several authors consider both the emotional and behavioural elements (Morgan and Hunt,1994; Mayer *et al.*, 1995; McKnight and Chervany, 1996; Smith and Barclay, 1997). A common element, then, is the consideration of both an emotional and a rational component, both for the trustee and trustor.

In order to allow the analysis and measurement of trust, it is often necessary to decompose its conceptual structure in different levels according to the cognitive proximity with the concept of trust. In our analysis we consider three different dimensions, aspects and elements, respectively. Each dimension tends to represent the intimate nature of trust; each dimension involves the consideration of several aspects, which are able to be evaluated using specific elements.

One of the main issues in the debate about trust regards which components are determinants or consequences. In some papers certain aspects are used as drivers and in others they derive from a trust evaluation and *vice versa*, and there are reasonable reasons to back both the approaches. This stalemate may be solved only if a dynamic perspective is adopted, in which the antecedents (dimensions, aspects, elements) are drivers but they are also influenced by trust because of a feedback effect (Raimondo, 2000). At the present stage, this paper also suffers of drawbacks for not considering this issue, which will be taken into consideration in a further step of the research.

3. Materials and methods

Few works in the literature adopt a “bottom-up” approach, in which the components of trust descend from the opinions of the subjects involved into a certain relational context. Some authors propose to verify the validity and coherence of a trust construct through qualitative techniques, taking into account the characteristics of the environment and those of the subjects engaged in the relationships (Riegelsberger and Sasse, 2001; Riegelsberger *et al.*, 2003).



Note:
FG focus group; CA Content analysis; MDS Multidimensional scaling
CL Cluster analysis; AHP Analytic Hierarchy Process

Fig. 2 Methodological path adopted in the analysis

In this paper, the analysis of the role of trust in CMBR is made using the approach represented in Fig. 2. The definition of the trust construct and of it components is based on the results of a focus group (FG) composed by experts operating at various stages and industries the agri-food sector, and by experts of Information and Communication Technology (ICT), held in Bologna on April 2004. Since the FG is a qualitative technique, it is useful as an exploratory tool (Folch-Lyon and Trost, 1981; Easton *et al.*, 2003; Zammuner, 2003), even if it does not allow conclusions that may be generalised.

The verbatim minutes of the meeting has been analysed in order to isolate words and phrases without a specific meaning in relationship with the topic (Krippendorff, 1983). The resulting textual body is then cleaned up and it represent the database of key words and key phrases (both representing a semantic category - SC) to be elaborated using a component analysis. The importance of each SC is evaluated using the Term Frequency-Inverse Document Frequency (TFIDF) index often utilised in the Text Mining procedures (Bolasco *el al.*, 2004), that is calculated as follows:

$$TFIDF = F_{td} \times \log(N / F_t) \tag{1}$$

where:
F_{td} = times that a SC term is cited during the discussion
N = total number of speeches within the discussion
F_t = number of speeches in which at least a SC term is cited

The basic assumptions are:
- the representativeness of the SC increases as frequency of citation increases;
- the specificity of the SC decreases as the number of speeches in which the SC is cited increases.

Using the text analysis, a Boolean matrix of correspondences was created. In this matrix the SC (in columns) and the speeches (in rows) are compared to analyse the intersections and interrelations. Starting from this matrix, a perceptual map was built considering the proximity (similarity) between the SC emerged during the meeting. The similarity or proximity among the SC was evaluated using a correspondence analysis, considering the frequencies of citations of the same SC within the same speech. As the number of joint citations increase, the similarity index also increases (Hair *et al.*, 2003). The computation of the distances among objects was performed using a Multidimensional Scaling algorithm (MDS). With this technique, it is possible to find out an optimal configuration of the available information, representing them using a limited number dimensions, that represent the axes used for the graphical rendering of the map. The PROXSCAL algorithm, an application for non-metric MDS implemented in the SPSS software package, automatically performs the procedure.

In order to improve the interpretation of the resulting MDS perceptual map, the similarity matrix was also used to group several SC, through Cluster analysis. The objective of this step was to reduce and resume the information, merging together similar SC, and then obtaining more distinct concepts.

At the end of this methodological path, a hypothetical hierarchical structure was defined. This structure is taken into account for building a reference structure for trust within CMBR. The selected components have been classified into the above mentioned three levels (dimensions, aspects and elements). This framework is suitable for the analysis of relative importance using the Analytic Hierarchy Process (AHP) technique (Saaty, 1980).

A specific questionnaire was developed in order to assign to each component a weight in relationship with its importance toward the objective of the analysis, i.e. trust in an e-commerce environment for business to business relationships.

4. Results

4.1 Focus group

Twenty participants composed the FG, a number slightly higher than the suggested amount of participants. In this case 10 participants were experts in the agri-food B2B environment; 6 experts of ICT and 4 were experts of services for the agri-food chains. The meeting duration was 2,5 hours and it was recorded on magnetic tape. The verbatim minutes of the meeting included 103 speeches, not comprising those of the moderator. Overall, 9,000 different words were recorded. The transcription of the meeting minutes was made during the next 36 hours, in order assure important information and possible interpretation of unclear phrases within the speeches are not lost.

4.2 Content Analysis

The analysis of the textual database was performed using the application TextSmart included in the SPSS software package. Overall, 28 SC were identified, and the TFIDF index for each of them was calculated (Table 1).

#	SC	no. of citations	no. of speeches	TFIDF
1	Type of good (Product/Service, Industry, etc.) treated	106	32	53,8
2	Brand, off-line reputation of the company	96	31	50,1
3	Reliability, in the different communication forms	162	53	46,7
4	Relationships management	70	29	38,5
5	Motivational aspects	52	20	37,0
6	Expectations on additional advantages compared with other forms of relationship	44	18	33,3
7	Perceptions on safety and control	46	20	32,7
8	Monitoring of the transactions	63	32	32,0
9	Information	50	24	31,6
10	Logistics and timeliness	36	15	30,1
11	Reliability of the platform	46	27	26,7
12	Industry of reference	34	18	25,8
13	Transparency of the relationship	22	7	25,7
14	Users experience	36	20	25,6
15	Digital Divide	37	21	25,6
16	Cultural aspects	28	14	24,3
17	Website usability	37	23	24,1
18	Perceptions on skills and competence of the seller	30	17	23,5
19	Perceptions on credibility for investments made in specific technology	23	12	21,5
20	Accreditation of the seller	25	15	20,9
21	Non opportunistic behaviour	15	7	17,5
22	Market channels	15	7	17,5
23	Perception on monitoring ability of the market institutions	20	14	17,3
24	Guarantee	19	13	17,1
25	Legal contractual protection	16	9	16,9
26	Integration	15	9	15,9
27	Perception on privacy	11	7	12,8
28	Additional services included in the product	10	7	11,7
	no. of speeches (N)		103	

Table 1 Semantic categories (SC) ordered by TFIDF index (descendent), emerged during the focus group on the role trust in the B2B e-commerce in the agri-food chains.

The first three SCs are broadly shared among the participants. The most shared argument is the specificity of the trust relationship for the product considered. This is consistent with the opinion of several authors on the possibility that the trust components importance may vary according with the specific transaction context and the type of good in which they are involved. The second one, "Brand, off-line reputation of the company" is also very important. Reliability, in the different communication forms is very relevant too: verbal communication and face-to-face interaction are still an important way to let the trustor to form an opinion on the trustee characteristics and on its trustworthiness. Finally, another important aspect is the perception of the reliability of the communication tool by the trustor.

4.3 Mapping

According to the methodology explained above, the correspondence analysis allowed to evaluate similarity among concepts and to apply the MDS technique to reduce the dimensionality of the analysis. A bi-dimensional representation of SC (Fig.3) has been chosen considering the changes in the STRESS value (0,107) and in the squared residuals (RSQ) value (0,894). The distances matrix resulting from the MDS mapping allowed the positioning of the 28 SC on the bi-dimensional space and the individuation of the following 8 clusters of conceptual elements.

[1] **Relationships management**: perception of the agro-food services supplier's ability to communicate, adapt and satisfy the customers' expectations through the ICT tools;

[2] **Skills**: perception of the ability to carry out the allotted tasks and warrant the technical characteristics in a relation within telecom markets in terms of management, security and quality control;

[3] **Tool Reliability**: perception of the trustworthiness and ability of the ITC tool chosen to manage the relations and transactions in the chosen market. The factor is influenced by the availability of the technical tool and by the degree of the IT alphabetisation of the potential users;

[4] **Availability to integrate and non-opportunistic behaviour**: perception of the possibility to take risks due to the sharing of information and the co-ordination with partners;

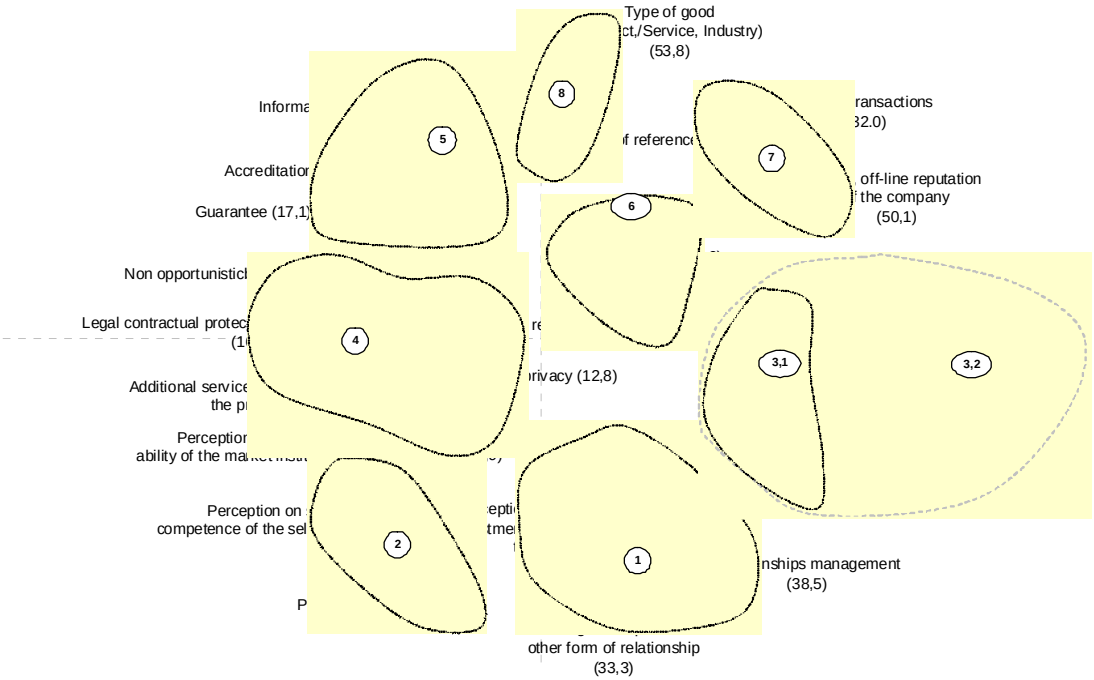


Fig. 3 – Perceptual map and conceptual clusters

[5] **Certification, accreditation, and guarantee**: perception of external bodies' ability (Certification Body, Association, etc.) to supply information about the suppliers' ability to keep the quality level explicitly (in the contract) and implicitly (according to conventions and customs) agreed;

[6] **Shared of values and motivations**: perception of the degree of 'integrity', that is the consistency to the values of the partner;

[7] **Surveillance**: perception of the ability of public and private control bodies of monitoring, verifying and assuring through a system of sanctions the operators behave correctly;

[8] **Specificity of the context** this element is not to be considered as a component of trust but as an influencing factor over all the components of trust.

4.4 The trust construct and a tentative hierarchical structure

Components of trust (dimensions, aspects and elements) have been elaborated starting from the perceptual map drawn in Figure 3. For our purpose, three out of 8 elements have been linked to a single aspect called "Perception of professionalism", while the elements 5 and 7 are linked in the aspect "Institutional protection".

As showed in Figure 4, also in CMBR in the agri-food chains, trust is characterised both by an emotional and a rational (cognitive) dimension. The former is influenced by the perception of the trustor on the absence of opportunistic behaviours by the trustee (A1). On these regards, perception of transparency in the relationship appears to be an important driver, able to stimulate this specific aspect. The cognitive dimension is characterised by credibility and reputation of the trustee (A2), and the presence of shared motivations and values (A3). A2 is influenced by those elements letting the trustee to perceive the professionalism (P) of the trustor and by the institutional protection (IP).

4.5 The final hierarchical structure and the AHP procedure

The construct resulting from the FG outcomes has been adopted as a starting point for the next step. The tentative hierarchical structure has been integrated with other information and elements taken from the literature. The final structure emerges from a follow-up critical analysis of the results of the FG with its participants, who gave their impressions and opinions on the multidimensional map and on the proposed trust elements.

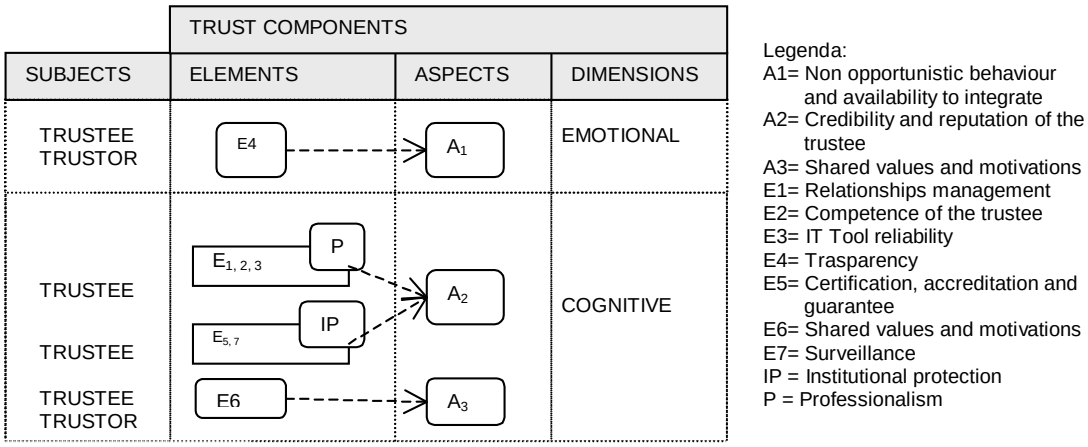
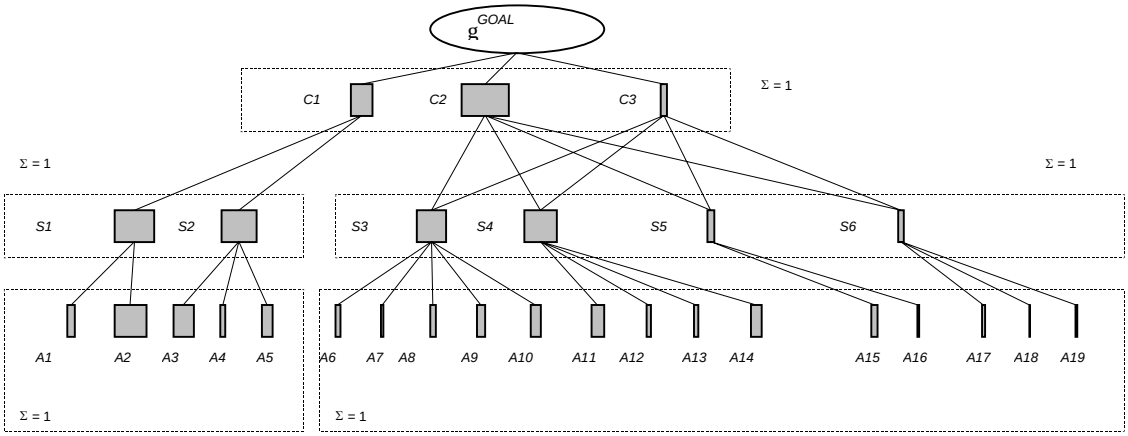


Fig. 4 – Dimensions, aspects and elements of the "trust" construct



CRITERIA
C1 Shared values and motivations (0,282); C2 Credibility and reputation (0,633); C3 Availability to integrate/Non opportunistic behaviour (0.085).

SUB-CRITERIA
S1 Culture (0,533); S2 Motivation (0,470); S3 Professionalism(0.398); S4 Transparency (0.434); S5 Legal assistance (0.090); S6 Institutional protection (0.078);

ASPECTS
A1 Linguistic aspects (0.106); A2 Correct behaviour corporate policy (0.422); A3 Economic advantages(0.271); A4 Organisational advantages (0.060);
A5 Commercial advantages (0.060); A6 Competence (0.063); A7 Relationships management (0.029); A8 IT tool reliability (0.070);
A9 IT Tool usability (0.103); A10 Off-line reputation of the IT platform managing organisation (0.139); A11 Information authentication (0.165);
A12 Information integrity (0.067); A13 Privacy (0.060); A14 Aknowledgement of the transaction (0.147);
A15 Knowledge and usage of documents (0.070); A16 Settlement of litigations (0.021); A17 Certification and accreditation (0.036);
A18 Guarantee (0.009); A19 Surveillance (0.023.;

Fig. 5 – Hierarchic structure and results of the AHP evaluation procedure

The final construct scheme (Figure 5) was used as the basic structure necessary to evaluate the relative importance of the different elements using the Analytic Hierarchy Process (AHP) technique (Saaty, 1980). A specific questionnaire was developed and submitted to 5 experts, in order to let them assign to each component a weight in relationship with its importance toward the "goal" of the analysis, i.e. trust in an e-commerce environment for business to business relationships. For the sake of brevity we assume the method as known and we just consider some of the results.

The experts considered the questionnaire complete and they shared the hierarchy. Broadly speaking, it can be pointed out that the trust stimulating factors for CMBR are, according to these 5 experts, mainly related to the rational dimensions of trust. Among them, the perception of credibility of the organisation that manage the market through ICT networks (weight 0.633) as well as the sharing of values with the organisation (weight 0.282) seem to be the most relevant. Less importance (0.085) is assigned to the emotional component of trust, such as the "willingness to integrate/non opportunistic behaviours". The latter two components seem to be connected to the trustee's perceptions of transparency (priority 0.434) as well as of competence (priority 0.398). Contrary to expectations, the institutional aspects have been seen as particularly important as well as the trustee willingness to offer legal support for the management of controversial issues and specific advice about the documentation.

Particularly, among the alternatives, the ones that received the most importance by the interviewers seem to be the authentication of information about transaction and the acknowledgement of a transaction both related to the trustee perception of transparency. Other two alternatives have been particularly appreciated, the off-line reputation of the platform manager and his supply of a relationships management tool, characterised by a high perception of usability. With respect to the criteria of 'sharing of values and motivations', the two components of the inferior hierarchical level seem to have the same importance. The analysis of alternatives related to them, points out the motivation encouraging the trustee to trust. These are a) the acknowledgement that behavioural norms are followed by the organisation managing the ICT network market and b) the scope for economic advantages.

5. Conclusions

The analysis has highlighted the opportunity for a systemic approach to the theme. The logical concept

for trust definition is still a debated subject. The trust dimensions and their components needs to be further analysed. On the other hand, it is confirmed the widely accepted the hypothesis according to which trust includes rational as well as emotional dimensions. On our opinion, it is necessary to consider jointly both these dimensions of trust in CMBR, in order to avoid getting biased and partial results, even if the impact of the emotional dimensions may be small. The AHP procedure seems to be helpful in this purpose, even if other methods, such as structural equation models, may be also explored.

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