THE WHOLE TREE: FOOD MARKETS AS SOCIO-TECHNICAL ENVIRONMENTS

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Abstract - Feeding an estimated 9 billion people by the year 2050 will require the creative use of technology. This paper calls for a broader socio-technical approach to the introduction of information systems within food value chains. The focus of this paper falls on a prominent spot market within the fresh produce value chain in South Africa. This paper is part of an extended study of the various technical, social, commercial and political dynamics that characterises the functioning of the South African fresh produce markets.

Keywords - Food markets, fresh produce, socio-technical systems.

I. INTRODUCTION

The fresh produce industry in South Africa is a vibrant and competitive industry. South Africa is fully self-sufficient in the major fresh produce lines and a net exporter of fruit and vegetables [1],[2]. The South African industry is well established and has as one of its marketing channels a network of fresh produce markets that operate under the same institutional, operational and governance framework. In this paper, we examine the structural dynamics of one such a commission spot market. Focus falls on how the technological, economic and social activities of buyers and salespeople combine to shape a trading environment. Within the South African market environment, the central computer system's role is of particular interest as the role it plays is more than just facilitating the commercial transactional activities. The specific institutional structure of these markets, contributes towards the enhancement of a trust environment. It is this unique structure that provides insight into how future electronic markets could be structured to provide low-cost low-risk marketing channel to growers and buyers based on trust. The study approaches the market environment from a transactional, social and institutional perspective. These varying perspectives assist us in understanding how the underlying technology platform stimulates trust amongst the trading parties.

We are facing a future in which a potential nine billion people need to have a stable food supply by 2050 [3]. That is 35% more people than in 2014 [4]. The challenge? How to feed a changing demographic of higher income, richer urbanised middle-class populations that in turn demand higher quality, safer, convenient and healthier food [3],[5].

This paper contributes to discussions surrounding food provision. Firstly, the use of information systems within South African fresh produce spot markets. Secondly, towards discussions surrounding food markets and the provision of food to an ever-growing urbanised population. Thirdly, the role information systems play within a socio-technical environment affecting trust forming behaviour.

The following sections provide background surrounding the method and theoretical approaches after which the case and findings will be discussed.

II. THEORETICAL LENSE

A. Socio-technical

Socio-technical theories seek to explain the links between the social and the technical aspects of information systems, highlighting how these links are inter-related [6]. Although structuration theory cannot be classified as a pure socio-technical theory, there have been studies to extend structuration theory into more technical domains, notably, the work of [7]-[9]. Information systems and trust creation require a socio-technical approach to incorporate both the ‘hard' and the ‘soft' aspects. Particularly in macro-micro environments where the individual community member influences a community and in turn is affected by the community as part of the use of information systems [10]. Facilitating trade through technology across wider geographical spaces, increase the importance of trust [11].

B. Institutional approach towards trust

Institutional trust formation is enjoying renewed focus. The study of trust in online settings is vital and could further enhance our understanding of trust in off-line contexts [13],[14]. In [15] the question is asked directly: "…how should a firm go about developing trust with customers when there is an absence of human contact?" Reference [16] also calls for a better understanding of trust-centric approaches to governance. Institutional trust still lacks the necessary understanding, which can only be provided by extended research [17].

C. Methodology

A qualitative approach using a case study was utilised. Although case studies have been criticised, single case studies have been employed in IS

research by [18],[19] and are now widely used in IS research [20]. A case study method is an appropriate approach within IS when one is researching development, implementation, and application of technology within organisational contexts [21]. Very little research has been conducted within the fresh produce industry focusing on technology and trust. The case environment has a unique character due to the high levels of trust and self-regulation of institutional trust relations. The social nature of trust itself requires a broader social approach to the phenomenon, something for which a case study is appropriate. A single case study allowed the for an in-depth insight into the phenomenon [12].

III. RESULTS AND DISCUSSION

A. Case environment

A network of fresh produce markets in South Africa ("markets") forms the primary platform for the trade of fresh produce [22]. Since the 1960's this network of markets was systematically established through state-sponsored investment and strict legislative regulated control governing the flow of produce in South Africa. The result has been a transparent trading environment underpinned by a specific institutional structure. These markets offer a low-cost, low-risk marketing option for growers with very low barriers to entry and high levels of trust amongst the parties. Buyers on the other hand also enjoy low barriers to entry, access to fresh food daily as well as a transparent, competitive and dynamic price discovery mechanism.

Located in the South of Johannesburg is the Johannesburg Fresh Produce Market (see www.joburgmarket.co.za). This market offers a complete basket of produce to thousands of buyers daily. The sales area consists out of 3 sales halls (See Fig. 1). The following are some key facts about Johannesburg market [23]:

The Market occupies 63 hectares, 60% of which is developed; There are three produce sales halls, totalling 65 000m2; There are 55 cold rooms that can accommodate 4561 pallets; There are 50 banana ripening rooms that can accommodate 1590 pallets per cycle; The specialist watermelon trading area is 3500m2; Over 20000 buyers of which about 9800 are regulars buy produce at the Joburg Market; The Market's open roads records on average through flow of over 10000 vehicles and pedestrians per day; The Market's on-site laboratory was established at a cost of R4 million; About 1,000 0000 tons of fruit and vegetable is sold at the Joburg Market per year; Turnover for the last financial year exceeded R4.1-billion per annum; Average value of sales per month exceeds R466 million; On average, the Joburg Market sees about 450 000 sales transactions conducted per month; Currently, the Joburg Market sees less than 1% wastage on fresh produce; The Joburg Market currently employs 280 people.

Buyers range from small to large with the majority being hawkers distributing fresh produce daily into the cities, suburbs and townships.

Relationships between agents and growers in these markets are characterised by undocumented contractual agreements. In South Africa, there are no formal contracts between the agent and growers sending to markets; this also seems to be the case in spot markets internationally [24].



Fig. 1: One of the sales halls on Johannesburg Market. The vegetable hall (Hall number 3/4).

This requires the existence of high levels of trust between the agents and their growers. All sales are performed on a consignment basis under an established trust relationship between the agent and principal (grower). The possibility for opportunistic behaviour is substantial because trade is conducted without the presence of the grower while still retaining the risks. Trade occurs within an environment driven by relational dynamics, historic legacies, commercial objectives and various levels of competition.

Trust and governance within the fresh produce industry are paramount:

"…if you fail, and his is where the real test comes, if you fail on those responses and those outcomes then you undermine the system, then it does not matter what technology you provide, what information you give them if in practice you cannot deliver on the governance issue then you might as well not have a system." (Interview reference L553)

Information technology is not merely servicing the transactional component of the service, but it also must facilitate the broader relational dynamics between the stakeholders to establish institutional trust structures. Reference [17] argues that future research should seek to understand, through empirical studies, situations where institutions directly influence actors to develop trust in inter-organizational collaborations, from those where institutions only vaguely encourage or discourage actors to consider institutional-based trust. The more diverse the trading environment, the more challenging it becomes to facilitate trust forming

behaviour through electronic means. Given the maturity of the relationships between agent, buyer and principal(grower), this environment should be the perfect candidate to implement and benefit from increased information technology implementations. Unfortunately, online type initiatives have been met with mixed reaction [25].

We observed four primary stakeholders involved in the market trading process: grower, agent, market authority, and buyer. We also observed secondary role players: various quality assurance, food safety audit and inspection services from state departments. Fig. 2 illustrates the relationship between role players creates that form the dynamics of the market environments. The market authorities provide the systems that control all transactions.

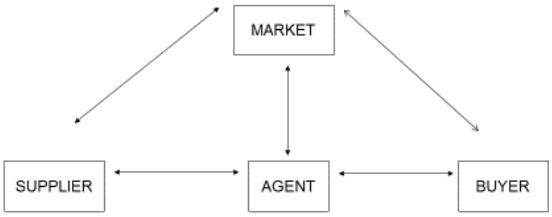


Fig. 2: Main stakeholders on South African markets.

B. Discussion and Findings

Reference [26] indicate that confidence in inter-firm relationships stems from two aspects: trust and control. When treated as a supplementary manner, trust and control in /various combinations exert an influence on the confidence and ultimately the success of strategic alliances. Also that potential high-risk and transaction costs lead to more integrated and governed arrangements.

Again, this is visible in the structure of the transactional environment on markets where the low levels of control and high levels of risk necessitate stringent measures in the form of highly structured governance structures. The positioning of information technology plays an enabling role in entrenching market system rules. Reference [26] differentiates between control levels and control mechanisms. Different levels of cooperation affect trust jointly and independently.

We observe these aspects within the case environment. Strong, almost draconian, control is exercised by a formalised regulatory structure. This is physically enforced through inspections on the floor. Roles of the trading parties are framed though profiles embedded in a central information system. This information system also captures all aspects of the trading workflow across the entire facility.

The market authority has the power to sanction activity across the whole business workflow. Every aspect of this transaction chain is captured on the computer system. This provides the market authority with significant detailed insight into the status of all produce received and sold. It is specifically in the areas of power and sanction that the combination of a central market authority armed with a central computer system exerts the biggest impact on perceptions surrounding control of the thousands of buyers. The information system strengthens the ability of the market authority to monitor and enforce compliance.

Technology provides a powerful tool to the market authority as illustrated by the following two quotes:

"The system is a tool, in the past there was the hand system, the computer system is 80% for trading and 20% for information delivery. My mandate is to create a trading environment, the system gives me a trading platform, it allows to receive product in an orderly manner, to sell it in an orderly manner and to distribute information to the various stakeholders." [Interview Ref.: 1:4312]

The case study illustrates how trust the grower and buyer places in the agent and product, is not only based on personalised trust relationships but also based on the broader institutional trust within the trade environment.

The market's central computer system serves as a constant reference point, viewed as independent, for verification and enforcement of transactional agreements and contracts. The case environment indicates that the central computer system facilitates these higher levels of perceived control the buyer experiences.

Within this relational structure the alignment of core regulatory structures affects the ability of the market to ensure trusting relationships.

Misalignment of these governance structures dilutes regulatory power. As [27] illustrates, the more centralised legislative, judicial and executive aspects are the greater the influence. Although the allocation of power to support governance is assumed, in practice this is not the case. Both on the judicial and executive levels the failure affects trust between he stakeholders.

Fig. 3 illustrates the interaction between the buyer and the market environment. The physical trading environment is where the actual exchange of products occurs. Produce is delivered by the grower, received by the agent, presented for sale and ultimately bought and collected by the buyer. The market authority provides the infrastructure and complimentary services.

From a buyer's perspective, interaction is mainly on three levels. The agent interaction where the negotiations occur, the physical product level where inspection occurs and the central system where the information and rules are entrenched. The buyer has control of various aspects such as quality, price, inspections were done, and handling. All these interactions occur through some form of physical interaction. But also, the centralised computer system is aligned with these physical processes and is part of the enforcement of formal norms.

Mutually agreeable assurance functions govern the actions of the relationships between individual parties on a transactional level. Information flows need to include not only formal measures (codified rules, goals, procedures, and regulations) but also informal communication ("soft" measures). Control is attained through formal and informal structures.

Fig. 4 illustrates the various aspects of the interaction with the market eco-system. This conceptual framework makes specific provision for formal and informal signals as part of the interaction and trust forming behaviour.

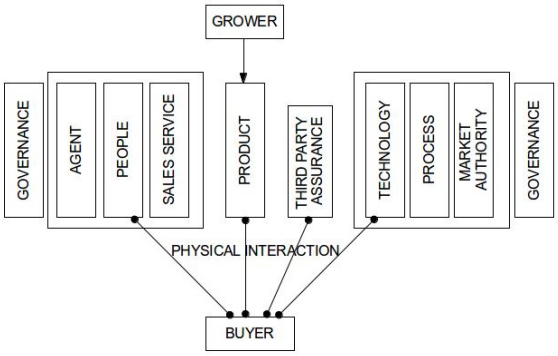


Fig. 3: Buyer contact points with sale environment.

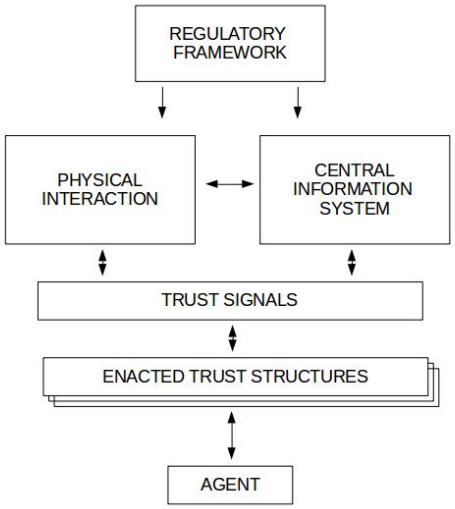


Fig. 4: Conceptual framework: trust structures across time and space

Fig. 4 also illustrates how physical aspects of a market environment need to be reflected in the electronic.

Buyers interact with the market environment and enact structural perceptions in a routinized manner. The dynamics of this is shaped by the key elements of power, communication and sanction. Each one of the parties involved is engaging with the market in through similar interactions.

The physical environment is interlinked through the incorporation of control points enforced by the information system. Formalised norms, legislative requirements are built into the various workflows of different users. Workflows of the physical environment are directly reflected in the electronic system which allows for transparent enforcement. Again, the electronic system affects the level of perceived trust and in turn affects the structural perceptions. This dynamic between the physical and electronic shapes the trusting perceptions and behaviour over time. Over emphasising the use of information systems on markets without paying attention to the interaction between the physical and electronic structures is central to the creation of trust as one move to more self-service solutions. The electronic side of the market is under the independent control of the market authority which plays an impartial and objective oversight function.

The case study illustrates the importance of ownership and control of both the system and the rules frameworks to effectively monitor and enforce these rules.

CONCLUSION

In this paper, it is argued that both the electronic system, social and physical interaction with people, products and services influence trust perceptions. The way both these aspects are integrated strengthens the overall trust perceptions of users in the central information system.The conceptual framework highlights the need for the intentional incorporation of the broader trading environment's governance frameworks in supporting trust formation behaviour.

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