

More than just a transaction: Conceptualising industry-based networks for virtual trading communities

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Abstract: This paper addresses the questions of why failure in industry-based networks has been so persistent and whether it is possible to avoid failure and achieve success in internet based markets [iMarketplaces]. A better explanation of implementation failures is important for both improved empirical outcomes and theory building. We construct a theoretical framework based on Bijker's technology frame (1995) and a contextualization typology developed by Nowotny, Scott and Gibbons (2001). The framework helps us understand how industry-based networks function, why they fail and how we can apply the framework to assist better empirical outcomes.

In this paper we apply our framework to Food Connect Australia, a vertically integrated marketplace, representative of the first wave of B2B markets. Sponsors of these iMarketplaces were quick to see and exploit the opportunities online access offered to bring together large numbers of buyers and sellers in new ways. However a lack of understanding of firstly, what represented true value in these networks and secondly, how to achieve buy-in at sustainable levels, meant that many of these first wave sites failed. Application of our framework reveals why there has been a radical shift from the trading role originally envisioned for these sites to the information hub model industry is now being urged to adopt (Berryman and Heck, 2001).

Keywords: electronic service delivery [ESD], G2B virtual trading communities, diffusion effects, export documentation

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1. MORE THAN JUST A TRANSACTION: CONCEPTUALISING INDUSTRY-BASED NETWORKS FOR VIRTUAL TRADING COMMUNITIES

1.1 INTRODUCTION

Failure remains a persistent problem in implementing multi-user systems. Questions persist whether it is possible to design industry-based networks to avoid failure and achieve success (Lyytinen and Hirschheim, 1987). Understanding of what these networks are, how they work and how they create value for participating individuals underpins more reliable predictions of outcomes. A workable theoretical framework will provide more open concepts that recognize the close connection between innovation and application contexts.

Internet based or B2B marketplaces (iMarketplaces) represent a type of industry-based network with a short but volatile history. These networks are particularly attractive to industries that are heavily reliant on competitive global supply chains and markets, such as the food and beverage industry (Devine, Dugan, Semaca and Speicher, 2001). Internet marketplaces are attractive to these industries in offering a new way to bring together large numbers of buyers and sellers not possible in the physical world. In theory, transactions can be automated with costs reduced for all participants. Choices available to buyers expand whilst suppliers gain access to new customers. In addition, as business grows, scaling can be implemented with minimal additional investment. In practice, it turned out that buy-in requires significant levels of trust and long-term commitment between all parties – something that was not given adequate recognition until after the first wave of sites had failed (Hansen, Mathews, Mosconi and Sankaran, 2001).

Perceptions about the role of iMarketplaces and what they have to offer participants are changing. It now appears that the value-creating potential of iMarketplaces is likely to be based on a very different model. The emphasis is moving from trading to sharing information and facilitating contacts amongst member companies. For example, Agrawal and Pak (2001) suggest that the future for iMarketplaces lies in taking on the role of information hub for distinct segments of the supply chain. This model offers members the advantages of instantaneous data exchange as well as the sharing of logistics support features. 'Third wave' models now emerging (Berryman and Heck, 2001) represent a considerable shift from the role originally envisioned for these technologically enhanced markets. These shifts also indicate that there may still be 'a lack of solid understanding of what they [iMarketplaces] are,

how they work, how they create value for participating individuals' (Kaplan and Sawhney, 2000).

This paper addresses the question of what the elements are that determine outcomes in implementing industry-based networks by

- examining promising theoretical approaches to understanding these outcomes
- developing a composite theory drawing on these approaches
- applying the composite theory to a case study of a vertically integrated iMarketplace in the Australian food and beverage industry.

This study will help us understand what elements are necessary for developing a successful system and how iMarketplace implementations should be approached.

1.2 Approaches to Failure in Multi-User Systems

Failure in information systems [IS] implementations remains an important unsolved problem. The dominant paradigm in IS implementation research focuses on identifying key factors that can explain systems failure wherever and whenever it occurs (Moore and Benbasat, 1991). However very few factors emerge as consistently important or influential ones across multiple studies (Kwon and Zmud, 1987). Process theory or procedural analysis, an alternative approach to studying failure, has not had any widespread acceptance (Orlikowski and Baroudi, 1991) and the approach has been described as 'achieving only limited success' (Myers, 1994).

Social definition theories, a group that includes process theory, investigate how members of social units develop shared beliefs about what a technology is good for in the process of using it (Markus, 1994). Another social definition theory distinct from process theory is critical social theory. Critical social theory - as applied by researchers such as Bijker and Law (1992) and Bijker (1995) - is primarily concerned with the idea of social shaping and brings users into the foreground, taking into account their role in shaping technology. Critical social theory is particularly applicable to IS case studies where user perception and response to technology can impact significantly on implementation outcomes over time.

Bijker (1995) uses the concept of relevant social groups to demonstrate how technologies become sites where constituencies or groups negotiate the meaning attributed to a particular artifact. The relative success of a new technology results from the negotiations of these relevant social groups rather than from the design features of the technological artifact itself. These negotiations play a particularly important role in the developmental phase when the artifact is still changing rapidly.

New technological artifacts have interpretive flexibility. Relevant social groups interpret and redefine the artifact as they adapt it to their purposes and apply their understandings of what it is. Each group understands the artifact based on what they already know about related technologies. Groups will modify or refine the artifact's form to solve the problems that they have with it. The interactions within these groups are structured by what Bijker calls a *technological frame* (1995:123-124). Bijker (1995) presents richly detailed case studies showing that artifacts assume stabilized form only when groups of users reach a consensus about that form or when one group's needs or preferences dominate all others. Bijker and Law's technology frame (1992) enables us to relate features of the innovation process to the development and eventual fixed meaning of an artifact.

The key elements which comprise a technology frame include artifacts whose meaning is initially flexible and open to interpretation but stabilizes after elaboration. Physical artifacts can also be part of the technology frame. Groups will modify or refine the artifact's form to solve the problems that they have with it (see Figure 2). The technology frame builds up and mirrors the social construction of the exemplary artifact just as it mirrors the formation of relevant social groups. It provides a vocabulary for social interaction and for forming artifacts. The frame relates features of the innovation process to the development and eventual fixed meaning of an artifact.

Orlikowski and Gash (1994) have used technology frames to understand organizational information systems, demonstrating how they complement organizational change theory. The strength of this approach and Bijker's use of technological frames, in particular, lies in its ability to clarify the inner workings of a developing process, sorting out considerations that bear directly on creation of the artifact during its developmental and diffusion phases.

Diffusion network analysis is situated within this group of social definition theories and supplements the work of social constructivists. Network analysts study how an innovations network evolves, aiming to fill the gap between empirical findings and conceptual understanding. Their approach offers instruments for analysing new modes of knowledge production closely connected to applications contexts.

Nowotny, Scott and Gibbons (2001) have developed a conceptualization of what they term 'socially robust knowledge'. Socially robust knowledge is produced when research has been 'infiltrated and improved by social knowledge'. Nowotny et al recognize the role of users as key actors in innovation processes who fully participate in the process of knowledge production. They characterize knowledge production as a more distributed way of generating insights, knowledge and innovation. The technological solution "emerges" in the course of the interactions between users and suppliers.

Case study research has a strong affinity with this conceptualization of social robustness. Case study research has been described as aiming for holistic understanding of sets of interrelated activities engaged in by actors in a social situation (Yin, 1989). The researcher can only convey holistic understanding by observing these activities in context. Nowotny et al (2001) establish a typology of social knowledge or contextualisation of knowledge production in the evolution of innovation networks – a typology highly applicable to case study research.

Three types of contextualization are identified in the text – weak, middle range and strong. According to Nowotny, Scott and Gibbons (2001), a network with weak contextualisation is the least socially robust. Strong contextualisation is most participatory of the three typologies with the outcome strongly validated by experts and society. Contextualization occurs most frequently in the middle range between weak and strong due partly to the natural diversity of fields and types of knowledge production which cannot be forced into an ‘ideal’ type. Middle range contextualization is also favoured by two preconditions: the emergence of transaction spaces between groups or major configurations which may be transitory and ‘the potential emergence of objects that crystallize the transaction process and help to sustain dialogue and negotiation’ (Nowotny et al: 144).

These typologies are proposed as a means of assessing the social robustness of an innovation. As such they enable the testing of this new analytical instrument in application contexts. Before moving on to our case study as one such application context, we have set out in Table 1 (below) the complementary features of Bijker’s technology frame and Nowotny, Scott and Gibbons (2001) innovation network theory

Bijker and Law (1992)	Nowotny, Scott and Gibbons (2001)
Integrates narrative/case history within a structured theoretical framework.	Integrates disciplinary perspectives.
Shows how innovation networks evolve.	Evolution, typology and outcomes of socially robust knowledge shown to characterize types of contextualisation.
Introduces concept of relevant social groups/stakeholders.	Develops idea of participation in a virtual dynamic space.
Each group/stakeholder modifies or refines the artifact's form to solve the problems that they have with it.	Reviews dynamic processes at increasing levels of granularity.
Identifies new technological artifacts as having interpretive flexibility.	Defines the artifact produced and distinguishes types of contexts.

Table 1: Complementary Features of Bijker and Law’s Social Constructivist Framework (1992) and Nowotny et al’s Innovation Network Theory (2001)

Our case study of FoodConnect Australia [FCA], an industry-based network, had a number of features that made it attractive for research purposes. Due to its close links with government agencies, documentation from launch to closure of the site was readily available in the public domain. The failure of the site exposed processes that are otherwise obscured in 'successful' projects (Bijker and Law, 1992). The unusually rich and varied data sources also enabled the researchers to disentangle how technical and social issues are constructed and delineated.

1.3 Methodology

FoodConnect Australia [FCA], a B2B marketplace that 'failed' within one year of its launch aimed to assist Australian exporters particularly in the Asian region. Australia's food industry is currently worth over 60 billion dollars, employing more than 225,000 people, over half of whom work in regional areas. Australian food exports doubled over the 1990s to \$20 billion with nearly 60 per cent of food exports going to expanding markets in Asia (Truss, 2001).

As we have indicated earlier in this paper, the iMarketplace phenomenon is not well understood, suggesting that there is an insufficient body of existing knowledge. Studying an industry-based B2B system *in situ* enables researchers to test key theoretical propositions and their sensitivity to a specific industry. FoodConnect Australia, provides an example of an iMarketplace that can be considered a critical case in that it corresponds closely to *all* the requirements Yin (1989) outlines for selecting case study methodology, namely:

- the existing body of knowledge is insufficient to permit the posing of causal questions
- the phenomenon cannot be studied outside the context in which it occurs
- the phenomenon is broad and complex

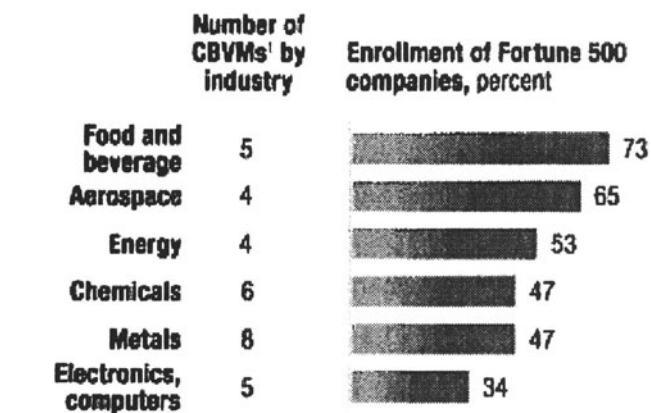
Data about FCA was obtained largely from interviews and some documentary sources. Semi-structured interviews with key personnel representing the sponsors were conducted before and after the closure of the site. Between October 2001 and July 2002, nine interviews were recorded with selected participants in the pilot study (4), a representative of each of the sponsors (2) and experienced electronic business commentators (2). Documents obtained included project deliverables, proposals, departmental newsletters and memoranda and articles from business magazines and press releases.

1.4 FCA: The Case Study

The food and beverage industry, in which FCA operates is a natural early adopter of digital marketplaces, because of this industry's traditional reliance on markets and the move to global supply chain management (see figure 1).

EXHIBIT 1

High enrollment levels



¹Consortium-based vertical marketplaces.

Figure 1. Enrolment levels in consortium based vertical market places (Devine, Dugan, Semaca and Speicher 2001)

Yet B2B transactions have remained largely domestic (UNCITRAL, Bled, 2001). The issues and challenges of international e-commerce are so varied and so complex that many solutions at many different levels are required. 'Efficiencies in the management of export information have not kept pace with improvements in what we call the distributed processing of goods' (Montoya, 2000). There is a pressing need in the food and beverage industry for an electronic trading system to facilitate flow of documentation.

The complexities of international trade limit it to parties with developed in-house expertise -- mainly large companies. The ability of IT to encapsulate these complexities in software products would allow smaller, less-expert companies to directly engage in global commerce. This is a particularly attractive incentive to governments promoting electronic service delivery. An important factor, implicit in all of these issues, is the role of government agencies, whose regulations are the source of many of the complexities.

Government and industry leaders are keenly aware that each of these issues impacts heavily on food exports, an industry that has traditionally relied on markets and is now increasingly reliant on global supply chain

management. In addition, a number of government publications had made it clear that both horizontal and vertical alliances were not well developed amongst Australian exporters with most competing rather than cooperating with other supply chain members.

The FCA site was offered to Australian fresh food suppliers and their Asian buyers by a combination of government and industry sponsors. The site and the pilot phase of the trading aspects of the website were launched in Sydney on 27 November 1998. In 1999, the sponsors established a trading platform, followed by a pilot program to review usability and support requirements. The FCA site went live from April 17th 2000.

The stated aim of the site was to make the service an efficient trading and communication hub for the whole agri-food industry, using electronic links to as many services related to international trade as possible. These were eventually intended to include road and rail transport, shipping companies, financial institutions, insurance and secure payments. The site was also intended to streamline export documentation. The sponsors saw FCA as a 'role model' for other sectors (Business Asia, 2000). The site featured three major components:

- a trading hub located at www.foodconnect.com.au with a searchable catalogue of products, an initial listing of around 400 Australian food companies and export documentation online.
- communities of interest such as State Governments, marketing authorities or groups of growers and producers. (included the pilot supply chain participants).
- an information hub with the latest in food news and links to organisations involved in the export process, such as financial institutions and transport providers.

(Supermarket to Asia Magazine, 2000)

On April 3rd 2001, a statement on the FCA website announced that the food export initiative was not working and that the service was not commercially viable. The sponsors explained the decision to withdraw funds as being due to the immediate additional costs that would be incurred in migrating the website to a new platform technology.

The conceptualizations of Bijker (1995) and Nowotny et al (2001) enable us to understand the reasons why FCA failed. These concepts readily accommodate research based on case study methodology (Bijker, 1995:6) and offer broad insights into the design components of sustainable multi-user sites.

1.5 FCA: in the Technology Frame

Bijker's technology frame (1995) helps us understand how power, as the capacity to shape the technology, is distributed amongst actors and objects. The 'actors' developing the FCA implementation are the two sponsors, the pilot study participants and other importers and exporters who consented to join FCA to access information and services. Export documentation, the FCA platform and the virtual community represent the objects or artifacts within the technology frame (see Figure 2).

Elements of a technological frame	Application of the technological frame to FCA
Goals	To provide an efficient trading and communication hub for the agrifood sector via streamlined export documentation etc
Key Problems	To change customers' buying and selling behavior
Problem Solving Strategies	By providing a technology platform Extensive marketing
Requirements to be met by problem solutions	To set up a one-stop shop for export documentation, marketing, publicity resulting in a globally competitive supply chain
Tacit knowledge	Knowledge of culture of food and beverage sector
Testing procedures	Pilot study, surveys
Perceived substitution function	Paper-based documentation and signatures Fragmented supply chain Firm-based marketing, publicity expenses
Exemplary artefacts	Government forms and business documents, Virtual Community Portal, Technology platform

Figure 1: Application of Bijker's technology frame to the development of the FCA site

1.6 FCA: Social Robustness

Bijker's technology frame shows that development and diffusion are two distinct phases in adoption of an artifact. Firstly, during the development phase of a process, an artifact changes rapidly and is applied in a very specific or narrow form. The development phase is distinguished from the diffusion phase, which is one of rapid spread where the form changes slowly if at all as it comes into routine use and is embedded in a social matrix. Whilst the FCA site experienced the development phase, it did not experience the diffusion phase. It did not become embedded, did not stabilize and did not become meaningful to its stakeholders. Where diffusion does not occur successfully as in the case of FCA, the concept of *social robustness* provides an additional analytical tool to explain the outcome.

In the methodology section of this paper we described the typology of social contextualisation developed by Nowotny, Scott and Gibbons, (2001). We have extended their descriptions to review variations on each dimension and place them on a continuum. We categorize the dimensions of *participation*, *dialogue* and *level of representation* of those involved in the implementation on a continuum of weak, middle and strong contextualization typology. Accordingly on applying the typology descriptors, we found the FCA implementation clearly fitted in the weak range of contextualization. Participation in the weak contextualization range is characterized as a type of ground-clearing exercise where there is no intention to develop participation over time. Statements by respondents who indicated that there was loss of contact with the sponsors for long periods of time and that there was little consultation throughout the whole process correspond with this description of participation level.

Strongly contextualized implementations are characterized by stakeholder views being solicited, advice sought and reliance on this feedback for design modification. Instead, the FCA pilot study participants said they felt excluded from the process. Respondents recalled a lack of assistance being offered or follow up. Some said they felt they had been left in the lurch. Users experienced a lack of continuity, an absence of meaningful collaboration or dialogue. Trading partners did not get an explanation of the relevance of the solution. An electronic business commentator reflecting on the FCA experience, said: *'It's always got to do with trust – a web screen is not enough'*

The FCA implementation was only weakly contextualized and therefore lacking in the social robustness that 'allows the potential of projects to be realized under existing constraints.' (Nowotny: 142). However it did have some features of the middle contextual range where participation should occur between different groups in a transaction space. The FCA site was clearly understood to be such a transaction space. In this transaction space, a virtual community of suppliers and buyers was expected to populate the site beginning with participants in the pilot study. The expected growth of a virtual community drawn from the target market of the food export industry was the reason for the existence of the site. When it failed to achieve this outcome attracting no more than 50 members, it no longer served any role and was closed down.

This analysis suggest ways in which data from a case study such as FCA can be integrated in a conceptual framework based on the complementary approaches of Bijker and Law (1994) and Nowotny et al (2001). It is arguable that at this stage of their development, the explanatory adequacy of this composite theory cannot always be tested as there is still a good deal of work to be done to substantiate their claims. However these approaches have enabled us to formulate rich data from case studies of innovation in ways

that clarify the inner workings of a developing process and sort out those considerations that bear directly on the its development.

1.7 Discussion

In publicly announcing that the FCA site was no longer viable and would be discontinued, the sponsors focused on issues such as

- Low levels of e-commerce capability among exporters
- Low acceptance of e-documents for banking transactions and import clearance
- Suppliers exploiting the site as a source of content rather than for transactions
- Usability issues (a platform that was difficult to use)
- Low levels of internet reach in regional areas
- Unwillingness of customers to accept electronic documents

(Supermarket to Asia Magazine, 2001)

However, our interpretation of the case using technological frames and contextualization typologies suggests that there were more fundamental problems. The value of a vertical iMarketplace resides in the membership base and its unique insider knowledge of the industry. Sellers and buyers want better access and sharing of information to improve trading operations (Berryman and Heck, 2001). In practice the sponsors could not convince enough members of the target community that the FCA site could offer greater benefits than their traditional ways of operating. One respondent and pilot study participant summed up the problems for the FCA site model: 'many manufacturers including ourselves held the view that such a site should only be paid for if you get results.'

Our use of the technology frame revealed that the strategies employed to change customers' buying and selling behaviour were not adequate responses (see Figure 2). The contextualisation typology reveals that FCA did not move beyond limited dialogue between formulators and proposers of the FCA marketplace. The sponsors did not succeed in producing a site that was acceptable to its industry base. Low levels of contextualisation characterize the FCA site. It lacked the socially robust knowledge that leads to high levels of participation and sharing in a transaction space. Nowotny, Scott and Gibbons' typology is helpful in elucidating why FCA did not attract adequate membership to sustain the site.

As understanding of their possibilities increases, broader options for iMarketplaces are beginning to receive attention (Devine, Dugan, Semaca and Speicher, 2001). A more flexible, user-oriented approach opens opportunities for iMarketplaces to foster information sharing and cooperation, to improve sector business planning and projections. An

information hub can be developed for distinct sections of the supply chain. Sponsors who encourage member-generated content can engender strong member loyalty. A more flexible approach would allow for a mix of browsers, users and buyers, a choice of channels and some personalization. Content on these sites could replace time and cost spent on other activities by the members both at work and at leisure.

Many of the problems experienced by the FCA site were related to different user perspectives in the industry that had been overlooked. For example, relative size of the food-exporting firm turned out to be a significant variable. Size led to differing priorities and therefore different expectations of benefits arising from the new interface. Small to medium-sized companies looked for better market opportunities and improved communication avenues for buyers on-line. Cost reduction was a priority for this group. Large companies looked for increased efficiency in documentation. However, this did not necessarily mean that these firms wanted an open market. As FoodConnect was clearly intended to operate as part of an open system, not to be exclusive, these issues remained unresolved.

Apart from size-based considerations, there was the issue of software selection. The FCA site experienced problems from its earliest days with a platform that was difficult to use and commercially inefficient, using outdated software (interview 18th June 2001 P.S.). Poor software selection meant that the potential for fostering information sharing and cooperation between users never developed. The success or failure of digital products is typically interdependent with standards and technological compatibilities (Wilkins, Castleman and Swatman, 2001). Such network externalities can play an important part in the adoption of digital products in the marketplace and so in their ultimate success.

1.8 Conclusion

The conceptual framework of this paper is based on the complementary approaches of Bijker and Law (1992) and Nowotny, Scott and Gibbons (2001). The framework enables us to formulate rich data from case studies of innovation in ways that clarify the inner workings of a developing process and sorts out those considerations that bear directly on the creation and demise of the site as artifact.

This paper provides several contributions to our understanding of iMarketplaces. We furnish a simple, integrated framework for understanding not only why iMarketplaces fail but also the conditions under which they can form durable communities. We extend social definition theories by integrating two approaches for the case study analysis and by moving consideration of iMarketplaces from a trading model to an information hub

perspective. We extend the work on electronic markets by identifying conditions, which promote their development and also elaborate the role of mechanisms such as 'social robustness'.

Since there is a lack of solid understanding of iMarketplaces (Kaplan and Sawhney, 2000), we enhance understanding of analytical theories available in the extant literature. Although we identify and apply a composite theory, there is considerable work to substantiate claims for their explanatory adequacy. Whilst few comparative studies exist to date, we expect future research to apply the technology frame and the typology to review other iMarketplaces and their comparative sustainability. There are learning issues in building an iMarketplace. Governance of a network or virtual community is increasingly important if poorly understood. Our research adds to the understanding of the conditions that are needed for emergence and viability of an iMarketplace and the dangers for sponsors who seek to implement a site without adequately acknowledging user perspectives. As the research agenda we outline above suggests, we still have much to learn about implementing iMarketplaces. Our conceptual framework provides an enhanced understanding of and guides needed empirical research on implementing an iMarketplace.

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