Success Factors of Digital Markets in the Agricultural and Food Industry*

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Abstract: In this paper hypotheses concerning the success of digital market places for agricultural inputs and products are tested. The hypotheses were derived from transaction cost considerations. Success of digital market places was measured in two ways: (i) the probability for a digital marketplaces to survive the competition from conventional and other digital market places and (ii) various metrics of market activity such as the number of hits received, number of incoming links, and page views per visitor session. Data were obtained from a survey of 233 digital market places that had been installed to serve the agricultural and food industries.

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1   Introduction

Buying and selling means communicating and the advent of any new and revolutionary communication technology gives rise to new forms of trading. The great European trading houses in the middle ages benefited from the arrival of paper and the great commodity exchanges got most of their business by wire. No wonder that the arrival of the internet and the web aroused the spirits of market-making entrepreneurs to an extent that has no precedent in living memory and which resulted in the installation on the World Wide Web of a large number of digital markets intended to facilitate and to profit from trade in agricultural inputs and outputs.

Entrepreneurship generates the mutants for an evolving economy and rare is the mutant that is well adapted to its environment and purpose. Digital markets are the new mutants of organized market places and the grim reaper of competition struck many of them down when the dot.com bubble burst in early 2002, However, what was a disaster for many digital markets is an opportunity for market research because opportunities where many organized markets are created and abandoned within a relatively short period are rare.

In this paper I report research aimed at identifying success factors – perhaps failure factors would be more appropriate in this instance - for digital markets places in the agricultural and food industry. My paper comprises five sections. After the introduction I discuss the expected impact of trading in an organized market on the web on the transaction cost of buyers and sellers and on the returns for the entrepreneurs who organized such markets. From this discussion I derive several hypotheses for empirical testing, In section 3 I briefly describe how I collected my data, I discuss a complication for data analysis that appears to be specific for the web, and I present some results that I consider both interesting and important. Section 4 closes my presentation.

2   Transaction costs and digital market places

Some organized market places may have come into existence as spontaneously emerged institutions. Most market places are, however, organized markets in the sense that they have been organized by some individual or group of entrepreneurs who hoped to profit from the investment in the installation of a digital market place on the web. Because most digital market place compete with established, conventional market places for patronage and trading volume, their creators must have hoped to become competitive either by providing trading services at lower cost than established markets or to allow buyers or sellers to reach trading partners who are beyond their reach on established markets. Both effects can be translated into trading cost and, more specifically, transaction cost arguments.

Define trading costs TC_{ij} of trader i when trading with trader j as the sum of transaction costs TAC_{ij} and transport costs TP_{ij}: $TC_{ij} = TAC_{ij} + TP_{ij}$. Most agricultural and food products are physical goods which cannot be transported by the internet and their transport costs are unaffected when they are traded on the internet instead of on conventional markets. Hence, it is safe to assume that per unit transport cost on the TP^{web} are equal to per unit transport cost in conventional trading TP^{c} and transport costs may not deter us any longer.

Transaction costs are the costs of exchanging ownership titles (Demsetz 1968), or, what amounts to the same thing, the costs of using the price mechanism (Coase 1937). In line with this understanding North (1990, p. 27) defined transaction costs as the resource inputs and capital involved in "defining, protecting, and enforcing property rights to goods". More operational definitions of transaction costs usually refer to the phases of an exchange transaction. Thus Coase (1988) observed "In order to carry out a market transaction it is necessary to discover who

it is that one wishes to deal with, to inform people that one wishes to deal and on what terms, to conduct negotiations leading up to a bargain, to draw up the contract, to undertake the inspection needed to make sure that the terms of the contract are being observed, and so on and, according to Coase, "Dahlman crystallized the concept of transaction costs by describing them as 'search and information costs, bargaining and decision costs, policing and enforcement costs.'" Barzel (1982), in contrast, emphasizes the costs of measuring product characteristics and Milgrom and Roberts (1992) distinguish two main components of transaction costs: coordination costs and motivation costs. The former comprise the costs entailed by searching for a trading partner, making contact and negotiating the terms of exchange and motivation costs are the sum of the costs arising from incomplete and asymmetric information and the cost arising from incomplete commitment. Demsetz (1968), finally, also regards as transaction costs losses from a lack of market liquidity. In summary, transaction costs are here considered to consist of the costs of (a) information, (b) lack of market liquidity, (c) transaction execution, and (d) transaction risks.

With the major components of transaction costs identified, we may now speculate how the internet affects specific transaction cost components in order to arrive at some empirically testable hypothesis. As is well known, the World Wide Web allows its users to communicate large amounts of multimedia data over large distances at very high speed. Using the web, traders may therefore attempt to reduce the costs of all transaction activities that require the processing and communication of information, such as searching for trading partners, describing products, negotiating the terms of exchange or communicating billing and shipping data.

The web has, however, some characteristics that may cause transaction costs to rise. A major disadvantage of trading on the web is the anonymity of traders. As a by now paradigmatic cartoon had it, nobody on the internet knows you are a dog. Trade in physical products among traders separated by distance is always an exchange of promises and nobody has much confidence in the promises of dogs. The costs of transaction execution and transaction risks may therefore be higher on digital market places than on conventional markets unless market organizers succeed in somehow infusing trust into web-mediated transactions among complete strangers.

Trading on the web may also have cost disadvantages when trading volume is low. Installing a market place on the web requires a substantial investment whereas the operating costs are low compared to the investment costs. Average costs for the operator of a web market place therefore fall over a wide range of trading volume. Traders also benefit from large volumes because of the higher liquidity of busy market places. Both pronounced economies of scale and benefits from market liquidity are barriers to entry which put new web markets at a disadvantage compared to established markets.

Finally, digital market places require that a complex information infrastructure is in place, that traders are adept in using it and that the law has been adapted to accommodate the new way of trading, in short, that e-commerce readiness has been achieved.

It would be futile to generate hypotheses without taking into account the availability of empirical data. In contrast to conventional markets, which, in many countries, are closely observed by government agencies and private market reporting services, digital market places often operate behind impenetrable access controls. Data on market volumes, numbers of transaction concluded, and prices paid are therefore hard or impossible to obtain from digital market places. However, digital market places, in contrast to their conventional counterparts, leave traces on large data banks which are accessible to outsiders. Particularly useful is the web archive at www.archive.org, where large sections of the internet are stored periodically. Furthermore, services are available that provide measurements on certain characteristics of websites, such as number of visitors, number of links pointing at a website, that may also be useful to describe digital market places.

Based on the transaction costs considerations and taking data availability into account, the following hypotheses were posited:

Table 1: Hypotheses

Hypothesis	Variables	expected direction of influence on success
internationality	English language exotic languages other languages	+ + +
size of product range	number of products offered market size job brokerage	+ + +
electronic data exchange	EDI enabling CPRF enabling	+ +
dynamic pricing	auction tool	+
e-readiness	several e-readiness indicators	+
concentration on market transaction; no additional general information	offerings of information or news on website	-
mechanisms to reduce opportunistic behaviour	warranties insurances mechanisms to assess traders reputation handling of payments logistic services	+ + + + +
liquidity enforcing activities	time online start-up company (not grown up out of existing business) fees	+ - -

2.1 Power-Law Distribution

Newer research on statistical web analysis has shown that on the internet power-law distributions are dominant. Adamic and Huberman (1999, p. 4) for example have indicated in a study with AOL-Users that only 0.1% (1%) of all internet sites will capture 32.36% (55.63) of all hits by users. A 2003 executed survey of German agricultural websites confirmed this phenomenon (Clasen and Müller, 2003); 1% (5%) of all agricultural sites monitored by the website www.land24.de received 24.08 (60.21) of all hits. Huberman (2001, p. 25) regards the power law distribution as "… a robust empirical regularity found in all studies of the Web."

A population of websites that follows a power law with respect to the number of links or hits, has several interesting properties: The average number of links or hits received is not typical for the population of sites, the distribution of links or hits is scale free, and the population contains a small number of sites that are of the "Winner-Takes-All" kind.

The average number of links is not typical because power law distributions are skewed, have long tails, and are not symmetric around a modus or mean. They are scale free in the sense that the distribution looks the same at different size intervals of its scale. In this context, Broder et al. (2000) perceive "an almost fractal like quality" in that the power law appears both as a "macroscopic phenomenon on the entire web, as a microscopic phenomenon at the level of a single university website, and at intermediate levels between these two."

To get proper results in the hypotheses testing, these results have to be taken into account.

3 Data

Collecting data on digital market places required first to search for digital market places on the web an then to observe certain characteristics of the markets found.

Digital market places were defined as *virtual locations in an electronic data network in which several suppliers and several buyers meet to trade specific agricultural or food commodities or services, whereby the provider of the markets acquires the ownership of the products at no time.* Searching the literature, newsletters, trade magazines, and the web for digital markets yielded 524 candidate markets. The candidates were visited and checked to decide whether they truly are digital markets. 233 markets passed muster of which 177 still existed in July 2003. In contrast to conventional markets which are unobservable when dissolved, digital markets are conserved on the website www.archive.org even after they have gone out of business and this archive provided us with most of the data needed for both the existing and the 56 markets that have been abandoned. In contrast to many other studies of success factors, which usually have to rely on data of surviving enterprises, data on enterprises that have failed are also included in this study.

As a first measure of success the binary variable 'existence' acts, surveyed by calling up the URL of each market site. Because a first look at the data has indicated, that many of the still existing markets (observed existence) are showing no sign of life, all markets with no change in the HTML coding within the last 12 months are also regarded as dead (corrected existence).

Because of the absence of reliable financial figures for every market, publicly available traffic data are used to measure the success of the digital markets on an metric scale, knowing that a high traffic on a market is only a necessary but not a sufficient condition for economic success. The traffic measures are the number of incoming links, number of hits and number of page views per session. These data are achieved by the internet toolbar alexa.com and the search engine google.com.

4 Results

To test the hypotheses two regression analyses were calculated. First the success measure 'existence' is tested by a logistic regression and second the metric measures number of incoming links, number of hits and number of page views per session are tested in a linear regression. In a first step a factor analysis was calculated to eliminate some critical multicollinearity.

Table 2 shows the results of the logistic regression for both the observed and corrected existence of digital marketplaces. It is visible that a start-up strategy and the offering of information and news on a marketplace site affects the probability of surviving significantly negative. Also the offering of agricultural output has a lightly significant negative influence and announcing vacant jobs a positive effect. All other variables are not significant.

Having determined what influences the probability for a digital marketplace to survive in competition, table 3 shows what factors are influencing the traffic on a market site. As the first two double columns show, the differences between the double log reach and the log reach are only small. In both cases fees affects the number of hits negatively, whereas the language English, exotic languages, the offering of agricultural machines, jobs and a high number of still existing months have a significant positive affect. The calculation with not logarithmic reach leads to the design of 'ebay', as the prototype of a successful marketplace, with risk reducing features, no information or news, price setting by auction, jobs and longtime online. Without the case 'ebay' the results are completely different. This phenomenon shows the importance of consideration of the power-law distribution in the web, making logarithms of the dependent variable necessary.

The success measure 'number of incoming links' shows very similar results to the measure 'reach'. The model with 'pages, visited per session' as dependent variable is not significant (R^2 = 0,214).

Table 2: Factors of influence in respect of the probability of surviving

F = Factor	observed existence		corrected existence	
	-2 Log likelihood 108,222 Cox & Snell R Square ,140 Nagelkerke R Square ,252		-2 Log likelihood 195,162 Cox & Snell R Square ,165 Nagelkerke R Square ,221	
	B	Sig.	B	Sig.
(Constant)	1,531	,043	,414	,421
F: e-readiness	-,057	,869	-,278	,220
F: risk reducing tasks	-,019	,954	-,291	,178
F: Romanic languages	,261	,480	-,111	,559
F: fees	-,451	,163	-,228	,282
F: electronic data exchange	,354	,367	-,356	,137
F: Nordic languages	-,031	,927	-,443	,116
F: start-up company	-,803	,035	-,566	,011
English	,954	,152	,387	,394
exotic languages	,584	,646	,846	,276
information & news	,279	,618	-,801	,040
auction	-,561	,324	-,222	,587
agric. machinery	-1,005	,197	-,377	,475
agric. inputs	-,617	,476	-,263	,687
agric. outputs	-,494	,445	-,856	,091
cattle	-,073	,932	,303	,596
trade goods	-,191	,806	,028	,956
misc. goods	-,184	,757	,383	,348
jobs	19,975	,998	1,228	,077
number of products	,111	,113	-,020	,597
market size	-,144	,851	,393	,393

Table 3: Factors of influence in respect of reach, page-views and links

	success measure: log_log_reach (reach * 1000) all cases R^2 = 0,463 adj. R^2 = 0,350		success measure: log_reach all cases R^2 = 0,507 adj. R^2 = 0,403		without eBay R^2 = 0,453 adj. R^2 = 0,337		success measure: reach no logarithm all cases R^2 = 0,302 adj. R^2 = 0,188		without eBay R^2 = 0,236 adj. R^2 = 0,111		success measure: log_page-views all cases R^2 = 0,214 adj. R^2 = 0,049		success measure: log_links all cases R^2 = 0,437 adj. R^2 = 0,312	
	Beta	Sig.	Beta	Sig.	Beta	Sig.	Beta	Sig.	Beta	Sig.	Beta	Sig.	Beta	Sig.
(Constant)		,000		,000		,000		,342		,073		,000		,002
F: e-readiness	,063	,494	,069	,431	,082	,374	-,012	,894	,081	,383	,061	,579	,065	,505
F: risk reducing tasks	-,064	,421	-,024	,753	-,119	,147	,261	,001	-,066	,440	,172	,078	,004	,963
F: Romanic languages	-,010	,903	-,021	,786	-,049	,544	,045	,564	-,079	,336	,112	,242	-,035	,670
F: fees	-,170	,056	-,141	,098	-,155	,085	-,036	,680	-,042	,649	,094	,378	-,156	,089
F: electronic data exchange	-,077	,351	-,093	,240	-,063	,450	-,101	,210	-,017	,837	-,023	,816	-,021	,816
F: Nordic languages	-,070	,373	-,100	,186	-,085	,288	-,073	,345	-,040	,617	-,069	,469	-,209	,013
F: start-up company	-,077	,352	-,064	,422	-,089	,289	,049	,540	-,047	,583	-,039	,697	,098	,262
English	,317	,000	,295	,001	,350	,000	-,052	,557	,233	,013	,239	,026	,281	,003
exotic languages	,229	,012	,264	,003	,299	,001	-,032	,718	,131	,167	,053	,624	,061	,529
information & news	-,071	,374	-,125	,106	-,092	,260	-,170	,036	-,162	,059	,016	,870	,090	,283
auction	,096	,251	,100	,211	,063	,457	,148	,070	-,012	,890	-,087	,385	,032	,718
agric. machinery	,227	,039	,190	,072	,247	,027	-,126	,243	,119	,294	,237	,075	-,089	,466
agric. inputs	-,095	,479	-,107	,404	-,083	,538	-,104	,398	,095	,461	,052	,747	,110	,444
agric. outputs	-,161	,130	-,144	,157	-,169	,115	,049	,634	,027	,800	-,140	,277	-,222	,043
cattle	-,103	,336	-,050	,622	-,065	,543	-,006	,953	,038	,732	-,078	,546	,005	,966
trade goods	,116	,283	,146	,157	,174	,110	-,031	,774	,221	,052	-,085	,514	-,072	,538
misc. goods	,102	,252	,104	,221	,117	,194	-,003	,974	,040	,661	-,033	,756	,060	,514
jobs	,179	,035	,192	,019	,160	,060	,164	,048	,196	,023	,103	,315	,258	,005
months of existence	,181	,032	,191	,018	,163	,052	,142	,093	,006	,943	-,026	,797	,171	,051
number of products	,180	,155	,195	,109	,159	,200	,161	,213	,226	,088	,029	,850	,190	,169
market size	,106	,374	,137	,232	,042	,721	,314	,008	-,280	,020	,075	,603	,108	,396

significant on level 0,1 or level 0,01

5   Conclusions

The regression analyses have shown that digital marketplaces should use the possibilities of international communication provided by the internet. It is vital for digital markets to offer the site in English and in some other 'exotic' languages. Many of these exotic languages are Eastern Europe languages and further investigations have shown, that a lot of trade, above all with used agricultural machinery, are traded between Western and Eastern Europe countries.

The providing of information and news has, as expected, a negative impact on the probability of survival. Digital markets should focus on their main business to keep the website simple (Nielsen, 2004). There is enough information on the internet that is only one click aside.

Also on the internet liquidity is essential for markets. As expected fees have a negative influence as well as the start-up strategy. An early start with a small turnover can create via recursive effects (everybody wants to trade where everybody trades) very quick big turnovers. The power-law distribution shows that it is almost impossible to displace the winner in a winner-takes-all market from the top later on.

The presumptions from some expert interviews and pre-tests that on digital agricultural markets only used machinery is traded in mentionable numbers also could be confirmed.

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