Abstract
Digital marketplaces are market institutions that employ digital information technology – computers, the Internet, and the World Wide Web – to provide trading services to buyers and sellers. We trace the development of agribusiness digital marketplaces on the World Wide Web and use observations taken from a sample of 233 agribusiness digital marketplaces to assess the impact of marketplace characteristics on market success. We measure success in terms of qualitative and quantitative indicators. Characteristics of marketplaces that could be expected to reduce transaction costs were identified. The impact of the selected characteristics on success was estimated using logistic and conventional linear regression analysis. Key success factors found are market liquidity, an international orientation, and concentration on providing exchange services as the core business of the DMP.

Keywords: digital markets, e-commerce, agriculture- and food industry, success factors

INTRODUCTION
Trade requires communication, in both senses of the word – communication as a means of transport, and as transmitting information. Revolutionary innovations in communications, therefore, always have the potential to revolutionize trade. During the industrial revolution transport communication was revolutionized by the invention of the railroad, the refrigerated steam ship, the combustion motor, and more recently by the cargo jet airplane. These inventions provided the technological foundations for the globalization of markets for agricultural and food products, thereby setting the stage for a global agricultural and food system.

Compared to the impact on agribusiness of transport communication technology, the impact of past innovations in information communication technology pales. To be sure, the great European trading houses at the beginning of the renaissance benefited from the arrival in Europe of paper making (Braudel 1979), and the meteoric rise of the Chicago commodity exchanges in the last quarter century of the nineteenth century would not have occurred without the telegraph (Cronon 1991). The advent of digital information technology, the personal computer and the Internet in particular, may, however, reverse the relative importance of transport and information communication in agribusiness. Within the past quarter century no drastic innovations in transport technology have occurred, perhaps with the exception of the GPS-monitored vehicle. Information technology, in contrast, has experienced a rapid succession of previously unheard of and unimaginable innovations: personal computers on the desk and in the shirt pocket, the Internet, email, the World Wide Web, the mobile phone, and many more. And, thanks to Moore’s law, the costs per unit of service provided by digital information technologies have fallen exponentially (Jorgenson 2001).

Technologies are economically inert and many inventions have never become useful innovations. Innovative entrepreneurship is also required, which first envisions an economic use for a new technology and which then designs a commercially viable business model based on the new technology. Innovation is never without risks and business models are founded on assumptions (Magretta 2002). The commercial viability of a business model can, therefore, never be demonstrated ex ante but always requires the test of market competition with rival business models.

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Success Factors of Agribusiness Digital Marketplaces
MICHAEL CLASEN AND ROLF A. E. MUELLER
In this paper we are concerned with digital marketplaces (DMP), which are innovative business models that employ digital information technology and which seek to generate revenue from providing transaction services to traders. The key assumptions of the DMP business model are four: (i) digital information technology can be used to reduce transaction costs and provide transaction services that are valuable to users of the system; (ii) rules and regulation can be designed and enforced on a DMP so that orderly trading is possible; (iii) the advantages of trading on a DMP are sufficiently large for traders to move some or all of their business from established trading arrangements to a DMP; and (iv) the entrepreneurs who organize and operate a DMP have some way to capture part or all of the benefits generated by the DMP.

DMP have mushroomed on the web, particularly during the period of ‘irrational exuberance’ when dot.com firms had easy access to venture capital. Perhaps lured into agribusiness by research reports that considered agriculture an inefficient industry which could benefit greatly from the application of e-commerce practices (e.g., Goldman Sachs 1999), many independent entrepreneurs rushed forward with DMP business models designed to cater for the needs of traders of many kinds of goods and services bought and sold in agriculture and the food industry (e.g., Graham 1998; van Heck and Ribbers 1997).

After the dot.com bubble had burst the grim reaper of competition weeded out many of the hopeful DMP ventures in agribusiness, but many remained and some flourish. What was a disaster for many entrepreneurs and their investors is an opportunity for research because periods when many organized markets have been created and abandoned within a short period are rare. Usually, only the causes of growth or of decline, but rarely both, can be studied empirically within the time limits of a research project. In this paper we report research that exploited the rare opportunity and that was aimed at identifying success factors – failure factors would be an equally apt term in this instance – for digital marketplaces in the agricultural and food industry worldwide.

For several reasons, the conditions under which an agribusiness DMP has to perform are different from the environment of most B-to-B marketplaces in other industries. First, the agribusiness industry worldwide is composed of a large number of farmers and a much smaller number of agribusiness intermediaries and food processing firms. Second, because many farmers participate only infrequently in markets, they have less opportunity to develop sophisticated trading skills than their agribusiness partners who trade more frequently. Third, the digital information infrastructure of most farmers in the wired world is not much different from that of a private household (Strickler et al. 2003; NASS 2005). Agribusiness intermediaries and food processing firms, in contrast, are often much better equipped for digital trading than their farm partners. Finally, many agricultural markets are served by numerous institutions intended to facilitate trade, such as grades for highly heterogeneous farm produce, market reporting services, well established conventional auction markets for some products, such as livestock, and formal and informal arrangements that link input market transactions, such as credit for the purchase of seed, fertilizer, or pesticides, with the sale of produce. Because of this, the conventional distinction between B-to-B and B-to-C markets is blurred in agribusiness.

Arguably, market structure, technical sophistication, and trading skills found at agribusiness DMP resemble those of B-to-C markets, although, from a legal point of view, all DMP patrons are businesses. For this reason we chose not to maintain the conventional distinction between B-to-B and B-to-C market places.

Although agribusiness DMP are unique in some regards, they have much in common with DMP in other industries, in particular, they use the same information technologies, traders in agribusiness as elsewhere tend to pursue their individual interests, and, in agribusiness as elsewhere, supply curves tend to rise whereas demand curves tend to slope downwards. For these reasons we believe that many lessons learned from studying agribusiness DMP are also of interest for other industries.

**DIGITAL AGRIBUSINESS MARKETPLACES**

**What is a digital agribusiness marketplace?**

In agribusiness, DMP on the web was preceded by electronic marketing systems that used videotex technology (Henderson 1984). An early exposition of digital marketplaces outside agribusiness was by Malone et al. (1987). Since then, the literature on e-commerce marketplaces has become vast, with Lee and Clark (1996), Kaplan and Sawhney (2000), and Lucking-Reiley and Spulber (2001) counting among the more widely known contributions to that literature. Although DMP can vary in many details, which gave rise to many classification schemes, the basic principles of DMP are easily explained.

Jevons (1957: 84) has characterized a market as ‘a public place in a town where provisions and other objects were exposed for sale.’ By analogy, we define digital market places (DMP) as virtual locations in a digital data network, that are maintained by a market operator who offers services to buyers and sellers who meet at the virtual location with the intention to trade goods and services in which the market operator at no time acquires title.

The purpose of organizing marketplaces are the same, whether they are conducted on or off a digital communication network: allow the market to clear,
ensure the establishment of an economic price, and reduce traders’ transaction costs. A DMP-operator must, therefore, provide three things (Mueller 2001): First, the Internet-equivalent of a physical marketplace must be built that allows geographically dispersed buyers and sellers to communicate with each other; this is usually accomplished by using the World Wide Web. Second, because material goods are traded by description on the web, the DMP-organizer must provide sellers with some means that allow them to represent the goods they offer, and which enable buyers to assess the quality of the goods on offer. For standardized and graded products, this can be readily achieved by describing the product in standard terms. For other products the information richness of the web can be used to truthfully represent the visual characteristics of the product. Invisible product characteristics, such as texture or smell, are beyond the communication capabilities of the web. Finally, trading, like any social activity, is more gracefully and efficiently accomplished when it is governed by rules of good conduct. The organizer of a DMP may, therefore, specify protocols that provide order to the communication between buyers and sellers, and rules may be imposed that govern the rights and obligations for all traders. Most importantly, the rules must constrain buyers’ and sellers’ propensity for opportunistic behaviour so that all parties to a transaction have sufficient reason to expect that the transaction is concluded as promised. Finding rules that suit both the buyers and the sellers, that save trading effort, and that assure a liquid market is a challenge for organizers of any market. The task is particularly difficult for DMP-operators because delivery of material goods is separated in time and space from the sales negotiations, and trades on DMP are truly trades in promises. The separation provides opportunities for traders to renege on their promises when better trading opportunities are found in the interim between the conclusion of a negotiation and the consummation of the trade.

Data on DMP

We searched the academic literature, newsletters, trade magazines and the web for agribusiness DMP. The search yielded 524 candidate markets. The candidates were visited and checked to decide whether they truly were digital marketplaces. To pass muster a website had to provide at least one trading pit (web page) designed for an agricultural or food product, and the market operator acquires at no time a title to the product traded at the site. This selection resulted in a list of 233 agribusiness marketplaces on the web, of which 177 still existed in July 2003.

In many countries agricultural and food markets are closely monitored and reliably reported by government agencies, private market reporting services and industry bodies. DMP, in contrast, often operate behind impenetrable access controls. Data on market volumes, numbers of transaction concluded, and prices paid are, therefore, difficult or impossible to obtain from digital market places (Clasen et al. 2003). Moreover, 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. 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 alone, data on enterprises that have failed are also included in this study. Furthermore, information services are available on the web that provide measurements on certain characteristics of websites, such as the number of visitors, the number of links pointing at a website, or the number of pages viewed per visitor, that may also be useful to describe digital market places.

Population dynamics

DMP are an invention from the late 1990s. Searching the archives, we found six agribusiness DMP that were active as early as 1996 (agriculture.com; farming.com; floraplex.com; eBay.com; ostrichsonline.com; resale.de). Following the soaring NASDAQ 100 stock market index for technology firms, the number of DMP grew rapidly (see Figure 1). In the year following the crash of the NASDAQ another 46 DMP were created and their number peaked in March 2001 when 208 marketplaces were actively trading agricultural and food products; thereafter few DMP were created, the number of closures increased, and the total number of agribusiness DMP began a steady descent. At the end of the 2002 only 159 DMP were still present on the web; at the beginning of 2003 the websites of only 113 DMP had been maintained during the past twelve months and the rest of the marketplaces, even if they were still present on the web, can safely be regarded as abandoned and inactive.

Most agribusiness DMP are located in the USA and in Germany: of the 191 DMP for which the location of its operating firm could be determined, 32% were located in the USA and 31% in Germany; the UK, where about 6% of the agribusiness DMP were located in early 2003, takes a distant third place.

DETERMINANTS OF SUCCESS

Marketplaces must attract the patronage of traders. Because all agribusiness DMP compete with established, conventional marketplaces for patronage and trading volume, trading on DMP must be superior to trading
conventionally in one or several of four dimensions: (i) price; (ii) transaction costs; (iii) market liquidity; or (iv) complementary services. In this section we first introduce measures of DMP-success and we then turn to factors that can be expected to impact DMP-success.

Measures of success

Reports on profits earned and losses incurred by DMP are not publicly available and surrogate measures of success have to be defined. In a rapidly evolving market, survival is certainly a natural measure of success. A DMP was deemed to be successful when it still existed and it was considered to exist when calling up its URI on the web generated a response. Closer inspection of this measure of success showed that some of the markets that were present on the web showed no signs of activity. Therefore, we defined a narrower measure of existence which required that the HTML-coding of a DMP-site with a responding URI must have undergone some change in the 12 month prior to the site’s inspection by us. The first measure of existence we call ‘observed existence’, the other is ‘corrected existence’.

In the absence of any statistics on trade volumes at DMP, changes in open offers for sale and unfilled requests for purchase may be recorded in order to measure trading activities at a DMP (Clasen et al. 2003). This measure of trading activity is, however, too time-consuming to be applied to more than a few marketplaces. Instead, we defined three quantitative measures of DMP success: (i) the number of hits received, which is a rough indicator of a site’s traffic generated by visitors of all kinds; (ii) the number of incoming links which measures how well a site is connected on the web; and (iii) the number of page views per visitor session which provides some indication of the intensity of visits. Data on these measures were obtained from search engines www.Alexa.com and www.Google.com.

Obviously, the measures of success that we use are imperfect. They have, however, two important practical advantages. One is their objectivity: the measures are taken automatically and without the intervention of people who may have some interest in biased measurements.

Lessons learned and not learned from electronic marketing

DMP are not the first attempt to leverage modern information technology for providing market intermediation services in agriculture. In the 1980s a few attempts were undertaken, mostly in the USA, to establish electronic marketing for the sale of livestock, slaughter hogs, meat, eggs, vegetables and cotton (Fong et al. 1998; Henderson 1984; Schrader 1984). The basic characteristics of an electronic marketing system were: (i) rule-based, organized trading; (ii) centralized competitive price negotiation procedures; (iii) remote access through electronic communications; (iv) description selling; and (v) post-sale product delivery directly from the seller to the buyer (Henderson 1984). Obviously, the information technology used for electronic marketing was much inferior to the technologies that became available in the wake of the Internet and the web.
Despite all its shortcomings, the information technology of the time was good enough to allow buying and selling by description among geographically dispersed traders who determined market prices on computerized auctions. The systems were meant to achieve mainly two things: electronic marketing was expected to enhance marketing efficiency by lowering trading cost, in particular by reducing search cost and by avoiding transport to and from central market places. What interested the designers most, many of them were university researchers, was the potential impact of electronic marketing on pricing accuracy and pricing efficiency. Reducing the costs of traders was a design concern, but not as prominent as the concern over pricing efficiency, and there was virtually no concern at all with how the operators of electronic marketing systems might capture some of the systems’ benefits to recover the cost of systems development and operation.

The actual impact of electronic marketing on the industries the systems were meant to improve was negligible. Few of the government-supported experimental pilot systems attracted sufficient business to become commercially viable and when government funding ran out the systems folded.

In hindsight, the promoters of electronic marketing appear to have put far too much emphasis on improving pricing accuracy, pricing efficiency and price information available in the market, all externalities that are potentially harmful to the operator of the marketplace as well as to the more powerful market traders. Schrader (1984: 854), for example, expected electronic trading ‘to result in prices which more accurately reflect a true temporal and spatial equilibrium price than is the case for traditional trading/pricing mechanisms’ and he asked the obvious question: ‘If these markets are so efficient, why is there so little support?’ His answerers were several: persistence of incumbent systems; high cost and uncertainty for the innovator; lack of interest from firms that wield market power; and that most farmers believe that they receive above average prices. And Purcell (1984: 866) warned that: “improved pricing” is a nebulous concept to system participants. Meat packers, livestock market operators, and grain traders do not worry a great deal about pricing efficiency.

We take from the experiences with electronic marketing that pricing accuracy and pricing efficiency are likely to be an irrelevance for market operators and traders alike and we disregard transaction prices as a success factor of DMP. We retain, however, the insight that transaction costs, search costs in particular, may matter.

**E-readiness and insights from IT-adoption surveys**

Several conditions must hold for trading on a DMP to be feasible. The trading platform must be programmed and linked to the web, traders must have reliable and continuous access to the web, they must be aware of the DMP’s existence and be able to use it effectively, the law must accommodate the new way of trading, in short, e-commerce readiness must have been achieved in the market that the DMP is intended to serve.

Empirical studies of e-commerce readiness of agriculture and the food industry suggest that agribusiness is not in the vanguard of e-commerce adoption nor do they indicate that agribusiness is among the laggards of e-commerce adoption (Henderson et al. 2004; Jessen 2003; Stricker et al. 2003). It is, therefore, reasonable to assume that a country’s e-readiness is also a reliable indicator of the e-readiness of that country’s agribusiness and we measured e-readiness using the e-readiness indicators provided by the Economist Intelligence Units for the years 2001 to 2003 (Economist Intelligence Unit 2001, 2003), the e-readiness index component of the Networked Readiness Index provided by Harvard University (Kirkman et al. 2000), and the index provided by the ICT Development Agenda of the Commonwealth Telecommunications Organization (CTO 2002). The three indices are closely correlated ($r: 0.81–0.99$) and they were aggregated into a single factor (see Table 1).

**Reduced transaction costs**

The purpose of organized markets is to facilitate exchange and to reduce transaction costs (Coase 1988). What counts as transaction costs and how changes in transaction costs can be measured requires some elaboration.

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: 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’. Dahlman (1979) tidily disaggregates transaction costs into: (i) search and information costs; (ii) bargaining and decision costs; and (iii) policing and enforcement costs. Similarly, McMillan (2002: 8–9) lists seven activity groups associated with an exchange transaction: ‘locating potential trading partners, comparing alternative sellers and choosing among them, evaluating the quality...
of the good, putting an agreement together, monitoring, enforcement of contracts, and prevention and settling disputes.’ 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: (i) information; (ii) transaction execution; and (iii) transaction risks. The costs of a lack of market liquidity are discussed separately.

The web allows large volumes of multimedia data to be transmitted over long distances at very high speed. The web may therefore help to reduce the costs of search for suitable trading partners as well as for suitable products (Bakos 1991, 1998). This advantage over conventional markets is the more pronounced the more heterogeneous are the products. The costs of searching for partners and products is further reduced when trade for certain product categories are arranged into virtual ‘trading pits’ and when product catalogues are provided. Product catalogues may also be used to reduce the effort and time spent on price negotiations (Bichler 2001). Rather than posting prices that have been fixed by the seller some DMP exploit the interaction capabilities of the web and provide auction mechanisms of various kinds (Keenan 1998). Both, catalogues and auctions, are likely to lower transaction costs, thereby enhancing the likelihood of a DMP’s success.

In agribusiness supply-chains the exchange of goods and money is mostly accompanied by an exchange of documents that are required for accounting, inventory management, tracking and tracing, and many other purposes. The cost of document exchange is usually reduced if the exchange is automated using standardized

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<th>E-Readiness</th>
<th>Complementary services</th>
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Shaded loadings: variable is part of the factor.
procedures, such as EDI, direct communication among the traders’ ERP-systems, or any other technique for automating communication understood by suitably programmed computers (Schmitz 2001). Providing support for such systems may be a suitable strategy for attracting traders’ demand which is the basis for a viable DMP.

On the web people have no authentic identity. What may be an advantage from the point of view of privacy is a disadvantage for trading on the web. Trade in physical products among traders separated by distance is always an exchange of promises, but, as Hicks (1969, p. 34) observed, ‘it is futile to trade in promises unless there is some reasonable assurance that the promises will be kept.’ But how much faith should be put into the promises of somebody whose identity is in doubt? Is it up to a DMP-trader to decide how much trust he or she can put into the promises received from strangers. The motivation costs of a transaction 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. One way to overcome this deficiency of trading on the web is to provide information about the performance of traders that market participants can use to build up a reputation (McDonald and Slawson 2002; Resnick and Zeckhauser 2002).

Market liquidity

Trading on markets often resembles an autocatalytic process that speeds up because it has speeded up in the past. The process works in both directions and volume traded at a marketplace may be tippy: when trading volume is high more traders are attracted and when customers are few even the few are bound to move their business to more liquid markets. The cause for marketplaces to be tippy are liquidity costs: On a market that lacks liquidity patrons run a higher risk of not concluding a transaction, lack of competition may result in excessive bargaining, and large traders must be aware that their actions move market price in a direction that is unfavourable for them (Clasen 2005: 70).

Achieving market liquidity is a serious chicken-and-egg problem for start-up marketplaces: when active traders at a marketplace are few, few or none are attracted to take their business to the new market, the few that have been attracted are likely to take their business elsewhere, and the market collapses (Lee and Clark 1996). Marketplaces that can draw on a stock of patrons have a clear advantage over those who first have to acquire customers to get the market started (Kaplan and Sawhney 2000). Also, brokers may be encouraged to provide liquidity to a new marketplace and help to avoid an early collapse of trading volume. Fees charged to market patrons, in contrast, reduce demand for a DMP’s services, may tip a market into a downward liquidity spiral and seriously erode a DMP’s chances for success.

Complementary services

Trade in agribusiness is mostly with material goods that cannot be shipped over the Internet and for which transport and insurance must be arranged. DMP-providers may try to add value to their services by acting as intermediaries for transport and insurance companies (Richter and Nohr 2002). By providing both trading and complementary services the DMP operator may be able to attract additional customers and increase the revenue generated from the DMP.

Many agribusiness websites, including some DMP, offer a range of complementary information services, such as weather reports and forecasts, price statistics from key markets, policy and industry news, and many more. Adding many complementary services has, however, a drawback: the website becomes cluttered, usability is reduced, and the site may lose its attraction to new customers as well as old (Nielsen 2004). Focusing the DMP-website on the key functions required for trading is, therefore, likely to be more conducive for success than a large variety of complementary information services.

EMPIRICAL ANALYSIS AND RESULTS

Attributes of agribusiness DMP

The qualitative variable measuring success, a DMP’s survival, has already been discussed. Only the quantitative measures of success need to be presented here, together with a broad characterization of the observations on the potential success factors.

The most striking characteristic of the quantitative measures of success—the number of hits received during a certain period, the number of links leading to a DMP’s website, and the number of page views per session—is their extremely skewed distribution. Number one in terms of hits received from Alexa users is eBay with some 29,000 hits per day; second placed alibaba.com, in contrast, attracts about 1,000 daily hits and achieves only one-thirtieth of eBay’s success (see Figure 2).

The most successful purely agricultural marketplace is agriculture.com which attracts about 30 hits per day from Alexa users and is ranked fifth in terms of hits received per day. Similarly skewed is the distributions of links (Figure 3). Again, eBay is the most successful DMP in terms of links received and in terms of page views per session. But in terms of links received eBay is closely followed by dealtime.co.uk. The purely agricultural DMP, agriculture.com, receives less than one tenth of the links that point at eBay and it is ranked third in terms
of links received. The distribution of page views, the third quantitative measure of success is much less skewed than the distribution of hits and links (Figure 4). With respect to this measure, the most successful marketplace is again eBay followed by plantfind.com, a marketplace for plants in the USA, and the Dutch market for used machinery, workingwheels.com.

Turning to the attributes of DMP that may affect their success, it is useful to distinguish between marketplaces that are specialized with respect to the goods that can be
traded and those that are not. The most prominent non-specialized DMP in our sample is eBay, the World’s most popular DMP, where agricultural goods are traded in sizable volumes. Most DMP are, however, specialized and one-quarter of the DMP trade in only one type of goods; on one-sixth of the DMP ten and more types of goods may be traded. The goods that are most frequently tradable on the specialized DMP are used farm machinery (18% of all DMP), agricultural inputs, such as pesticides and fertilizer (each 10% of all DMP), feed and seed (each 9% of all DMP). Among agricultural products, cereals are the most popular with 10% of all DMP offering trading pits for cereals, followed by trading pits for fruit and vegetables (9% of all DMP) and cattle (5% of all DMP).

Nearly all DMP (91%) offer complementary services of various kinds; nearly two-thirds (63%) of the US DMP, but only one third (35%) of the German DMP, offer information services at their sites. Product catalogues are the most popular service and 91% of all DMP include a product catalogue. Auctions are used by one-third of the DMP but few assist traders in making and ensuring payment (17%), and less provide product guarantees (11%) or reputation managers (6%). EDI and other inter-organization information systems are rare, less than 10% of the DMP have EDI-capabilities. Trading specialists who may provide liquidity to the market, are seemingly nonexistent on agribusiness DMP. Most DMP (82%) are open for anybody but require registration. Most DMP were operated by start-up firms and only one in five DMP was attached to a conventional ‘brick-and-mortar’ firm. Among the languages offered, English dominates (168 DMP), followed by German (79 DMP), Spanish (40 DMP), and French (36 DMP). Most DMP make little efforts to overcome barriers of language: 169 DMP are monolingual and only nine DMP offer their services in more than five languages.

**Aggregating variables into factors**

Inspection of the data for the success factor variables showed that some variables were highly correlated. We therefore conducted a factor analysis to avoid problems from multicollinearity in our analysis of the determinants of DMP success. Using principal component analysis, varimax-rotation and the Kaiser-criterion, seven factors could be extracted from the data (see Table 1).

**Regression analysis of success factors**

Because we are using binary as well as quantitative measures of success two types of regression analyses – conventional and logistic – were necessary. The impact of site attributes and environmental variables on DMP success, measured in terms of a DMP’s existence, was estimated using logistic regression. In one model the dependent variable did not take into account whether there were signs of activity at a DMP, in the other model DMP were considered to exist only if the HTML-code of their website had undergone some changes within the past 12 months. Success, in terms of uncorrected existence (Model 1 in Table 2) is affected by only one variable, the variable ‘Start-up’, which has the expected negative sign; the impact of all other variables is insignificant. If corrected existence is taken as the measure for success, we find four variables that determine success. Trade in agricultural products, the provision of information services, and being a start-up venture all have a negative impact on the probability of success whereas inclusion of a job market increases the chances of success for a DMP (Model 2 in Table 2). Montealegre et al. (2004), in contrast, found that information services had a positive impact on the survival of the agricultural and food e-commerce sites in their sample.

The impact of the independent variables on the quantitative measures of success was estimated in Models 3 to 7 in Table 2. Because the frequency distributions of quantitative measures are highly skewed we used the logarithms of the dependent variables. When success is measured in terms of the number of hits received per day, English language content, eastern languages content, trading agricultural machinery, and age of the DMP, all have a significant positive impact on success, whereas fees reduce the number of hits that a DMP receives (Models 3 to 5).

EBay is an exceptionally successful DMP and most goods traded on eBay are unrelated to agribusiness. To see whether eBay significantly affected the empirical test of our hypotheses we estimated a model in which eBay was excluded (Model 4). The regression estimates differ only marginally from estimates for Model 3 in which eBay was included. The variable ‘Jobs’ is highly correlated with a DMP being part of an agricultural portal, probably because portals tend to attract more hits than pure trading sites. Eliminating the variable ‘Jobs’ from the model does not affect results by much – trade in general merchandise and the number of product categories tradable at a DMP then have a significant positive impact on success, whereas the provision of information services shows a significant negative impact when ‘Jobs’ is excluded from the model.

Model 6, where the number of links leading to a DMP is the measure of success, yielded results that are in some respects similar to the results for Models 3 to 5. Again, English language content, jobs, fees and age of the DMP are significant and have the same signs as in Models 3 and 4. In contrast to Models 3 and 4, eastern language content and trade in agricultural machinery have no significant impact on the number of links received. Furthermore, the number of links received is lower when a DMP provides for trade in agricultural...
Table 2. Results from logistic and linear regression analysis

<table>
<thead>
<tr>
<th></th>
<th>Logit regression</th>
<th></th>
<th>Linear regression (standardized beta-values)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Model 1</td>
<td>Model 2</td>
<td>Model 3</td>
<td>Model 4</td>
</tr>
<tr>
<td></td>
<td>observed existence</td>
<td>corrected existence</td>
<td>No. of hits (log)</td>
<td>No. of hits (log) (without eBay)</td>
</tr>
<tr>
<td>Independent variable</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MF a)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>1.531**</td>
<td>0.414</td>
<td>0.51</td>
<td>0.45</td>
</tr>
<tr>
<td>Language:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>English</td>
<td>0.954</td>
<td>0.387</td>
<td>0.295***</td>
<td>0.350***</td>
</tr>
<tr>
<td>Eastern Europe and Asia</td>
<td>0.584</td>
<td>0.846</td>
<td>0.264***</td>
<td>0.229***</td>
</tr>
<tr>
<td>F: b) Romanic languages</td>
<td>0.261</td>
<td>-0.111</td>
<td>-0.021</td>
<td>-0.049</td>
</tr>
<tr>
<td>F: Dutch/Norwegian</td>
<td>-0.031</td>
<td>-0.443</td>
<td>-0.100</td>
<td>-0.085</td>
</tr>
<tr>
<td>Trading pits for:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agricultural machinery</td>
<td>-1.005</td>
<td>-0.377</td>
<td>0.190*</td>
<td>0.247**</td>
</tr>
<tr>
<td>Agricultural inputs</td>
<td>-0.617</td>
<td>-0.263</td>
<td>-0.107</td>
<td>-0.083</td>
</tr>
<tr>
<td>Agricultural products</td>
<td>-0.494</td>
<td>-0.856*</td>
<td>-0.144</td>
<td>-0.169</td>
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<tr>
<td>Livestock</td>
<td>-0.073</td>
<td>0.303</td>
<td>-0.050</td>
<td>-0.065</td>
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<tr>
<td>General merchandise</td>
<td>-0.191</td>
<td>0.028</td>
<td>0.146</td>
<td>0.174</td>
</tr>
<tr>
<td>Other goods</td>
<td>-0.184</td>
<td>0.383</td>
<td>0.104</td>
<td>0.117</td>
</tr>
<tr>
<td>Jobs</td>
<td>19.975</td>
<td>1.228*</td>
<td>0.192**</td>
<td>0.160**</td>
</tr>
<tr>
<td>F b): Complementary services</td>
<td>-0.019</td>
<td>-0.291</td>
<td>-0.024</td>
<td>-0.119</td>
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<tr>
<td>F b): Fees</td>
<td>-0.451</td>
<td>-0.228</td>
<td>-0.141*</td>
<td>-0.155*</td>
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<tr>
<td>F b): EDI</td>
<td>0.354</td>
<td>-0.356</td>
<td>-0.093</td>
<td>-0.063</td>
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<tr>
<td>Information services</td>
<td>0.279</td>
<td>-0.801**</td>
<td>-0.125</td>
<td>-0.092</td>
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<td>Auctions</td>
<td>-0.561</td>
<td>-0.222</td>
<td>0.100</td>
<td>0.063</td>
</tr>
<tr>
<td>F b): E-readiness</td>
<td>-0.057</td>
<td>-0.278</td>
<td>0.069</td>
<td>0.082</td>
</tr>
<tr>
<td>F b): Start- up</td>
<td>-0.803**</td>
<td>-0.566**</td>
<td>-0.064</td>
<td>-0.089</td>
</tr>
<tr>
<td>Operating years</td>
<td>n.i. c)</td>
<td>n.i. c)</td>
<td>0.191**</td>
<td>0.163**</td>
</tr>
<tr>
<td>No. of product categories</td>
<td>0.111</td>
<td>-0.020</td>
<td>0.195</td>
<td>0.159</td>
</tr>
<tr>
<td>Size of the market</td>
<td>-0.144</td>
<td>0.393</td>
<td>0.137</td>
<td>0.042</td>
</tr>
</tbody>
</table>

a) MF = McFadden; b) F = Factor; c) n.i. = variable not included in this model; */**/*** = significant at the 0.1/0.05/0.01 level.
produce and when it has Dutch or Norwegian language content.

When the number of page views is taken as the measure of success little additional insight is gained. Again, success is increased by English language content and when agricultural machinery is traded. Unsurprisingly, what also adds to the number of web pages viewed per visitor is the provision of complementary services.

What is perhaps most striking are the many variables that are usually considered to be important for a DMP’s success but that actually do not have a significant impact, irrespective of how success is measured. None of the following contribute significantly to DMP success: auctions; trade in agricultural inputs and livestock; EDI; e-readiness; and the size of the market.

CONCLUSIONS

Trade requires communication but new, improved communication technologies do not necessarily translate into improved marketplaces. This was the lesson from electronic marketing in the 1970s and 1980s and it is also a lesson learned from the short but lively history of agribusiness digital marketplaces. As Williams (2001) has pointed out, more is needed to create a lively marketplace than information technology which may have only a small impact on transaction cost.

There are four more detailed lessons learned from our empirical study of 233 agribusiness DMPs:

1. Liquidity is key – not being a start-up, not collecting fees from traders, and having an established market presence are all conducive for market liquidity and do contribute to success.
2. No frills – some things that are often regarded as indispensable features of a DMP, such as auctions, information services, and advanced inter-organization communication systems do not foster success and may be detrimental to it.
3. Agricultural machinery sells on DMP.
4. Trade in agricultural inputs, agricultural products, and livestock do not make a DMP successful.

Does all this imply that agribusiness trading cannot benefit by much from further advances in digital information technology? That conclusion would be premature. To date, DMP-entrepreneurs have employed digital information technology to do what could be done quickly and easily – reduce search and communication cost, and facilitate price negotiation. It is not at all clear that total costs per transaction have thereby been reduced for both sellers and buyers. Perhaps the task of designing a successful digital marketplace is beyond the capabilities of any individual entrepreneur and success stories like eBay are nothing but evidence of entrepreneurial good luck. But then, as long as there is luck there is hope for successful institutional advances induced by digital information technology.

References


