TRIZ in the Knowledge Era: Achieving Profitable E-Commerce

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ABSTRACT

TRIZ is the data-based creativity method based on the work of G. Altshuller and his colleagues in the former USSR. It is becoming known in the West as a method for systematic innovation that creates useful, innovative concepts fast. Because the TRIZ research was originally based on the world patent database of the 1940's-1980's, there has been some doubt that TRIZ applies to the problems of the 21st century. Applications to e-business situations will demonstrate that TRIZ is a powerful tool for problem solving, technology forecasting, and business development for the emerging knowledge era.

Current e-business paradigms include inherent contradictions. The strength of TRIZ as a method for developing creative solutions to problems is the removal of contradictions, rather than the conventional approach of accepting compromises or making tradeoffs. Examples and case studies from e-business illustrate strategies emerging from the TRIZ methods of ideality, the use of resources, trends of evolution and TRIZ-derived Inventive Principles which may offer means of breaking out of the current loss-making paradigms.

INTRODUCTION

Like traditional businesses, dot-com companies need to attract increasing numbers of prospects and keep customers away from the competition. However, unlike their brick-and-mortar counterparts, they must do so in the digital domain where customers can click to the competition instantly. They must transact business at Internet speed, and many have started with inadequate operational infrastructure in place to support the service that their customers demand. Failure to provide that level of service has led to the somewhat surprising success of the "bricks-and-clicks" enterprises over the pure dot-coms.

While much of the business-to-business environment is comprised of virtual supply chains and innovative Web-based trading communities, dot-coms still need to tap into the traditional infrastructure to keep business flowing. To relate across the digital and the brick-and-mortar domains, they need to harness, unite, and share information with everyone involved in their business processes.

Making money on the Web is more complicated than "point-and-click." E-business has concentrated on Web order capture. Now it is in need of a ready-made connection between the Web order and the logistics muscle capable of fulfilling that order. The paper explores the conflicts present and suggest the contradiction-breaking types of IT infrastructures businesses are likely to need in order to succeed in the fast-moving, high-volume, high-expectation world of electronic commerce.

The Internet alone cannot currently transform business relationships and bring about the electronic marketplace. What is needed in this scenario is a strategic order-fulfillment process, including customer-focused steps such as order generation, order receipt, order selection and prioritization, order independence, and coordination of packing, shipping, and invoicing. Web-merchant sites integrated with software that can manage high-volume order fulfillment efficiently will be the first to establish flexible customer response centers on the Web that not only fulfill orders for customers anywhere in the world but do so profitably.

Logistics and supply chain management are critical success factors for every electronic commerce company that plans to turn its business into a profitable operation. Building a solid, yet flexible foundation will allow an e-business to conduct full-scale electronic commerce today and well into the future. Establishing the convenience and service levels customers demand, while carefully integrating the supply chain efficiency and scalability businesses need to drive revenue and remain competitive, will propel the next wave of e-business leaders and position them for future success only if the current contradictions can be eliminated.

TRIZ tools and rules have emerged from studying how people solve problems. (These tools were introduced in PICMET-1999 for innovations in conventional products, systems, and services.) As in Peter Ducker's famous definition of a customer, E-businesses have been created to solve their customers' problems. Therefore, it should be no surprise that successful e-businesses look like examples of TRIZ applications. We have, therefore, sequenced the sections of the paper in order of the different TRIZ tools, looking at case studies from different e-businesses along the way.

IDEAL FINAL RESULT

If we accept the concept of increasing ideality as the over-riding trend of technology evolution, then we must see moves from 'bricks and mortar' based business towards increasing use of virtual solutions as being a highly logical progression. The ultimate limit of 'ideality' is the Ideal Final Result (IFR) concept. The IFR is a simple and yet profound concept that systems will evolve to deliver all the benefits, without any cost or harm. Without actually using the term IFR, the concept lies at the very heart of the book *Free, Perfect and Now* by R. Rodin [7].

Free, Perfect and Now describes Marshall Industries – essentially an intermediary in the supply chain between manufacturer and end customer. If IFR says there ought to be no place for intermediaries, *Free, Perfect & Now* provides an object lesson in how such organizations survive and thrive in the market by essentially delivering to end users the new function of 'navigation' – i.e. they manage the complexity which results from a rapidly globalizing market-place and the ensuing availability of massive numbers of manufacturers offering massive amounts of information about the products they produce. We will return to the issue of the navigator when we look at how the Contradictions part of TRIZ might effect the role and/or existence of intermediary companies.

In the meantime, we examine a number of other examples of ideality and the IFR concept in action in the e-business community:

A modest example of the generation of a strategy directly from the IFR is Barnes and Noble's holiday delivery policy. The IFR (from the customer's point of view) is:

I buy books with no effort.

Implicit in this is that the cost is equal to or less than the "effort." By offering a policy of no delivery charges during the holiday season, B&N gives the customer to opportunity to buy books without the effort of visiting a bookstore, and without the delivery cost that usually makes the on-line purchase equal the price in the stores. Of course, as with all on-line shopping, the site must be easy to use and the delivery process flawless to meet the customers' full IFR.

Another example of the direct generation of a product concept from the IFR is the emerging technology of fuel cells for portable telephones. The IFR is:

I want to communicate anytime, anyplace, with no effort.

The wireless phone satisfies the "anyplace" requirement, if enough antennas and switching stations have been built. But, the "anytime" requirement is not met, since the phone requires recharging, and the charging station is either stationary or attached to a vehicle. Battery technologies have been improving rapidly, with shorter recharging times and longer time between charges announced almost weekly.

An alternative to batteries was recently developed, attempting to move closer to the IFR. SRI announced a fuel cell technology that uses PEM, Proton Exchange Membrane technology, using methanol as the fuel, in exchangeable cells [8]. The first version lasts five times as long as a typical battery. Although the need to change and recycle fuel cells does not fulfill the IFR (the phone is unavailable during the change, and the

user must carry the spare cell, or be restricted in his/her location for use of the phone) this technology is an alternative way of achieving the IFR.

In another example, Sergey Brin and Larry Page, the founders of search engine e-business Google.com define their mission as "We want to access everything available, all over the world, in all languages." [8]. To achieve this ideal final result, they have just added Chinese and Korean language capability to their system, which uses 6000 computers in the world's largest Linux installation to search over 1 billion (10^9) Web pages in one second. For reference, they point out that if these Web pages were printed out, they would make a stack 100 Km high!

For the future, their research team is defining the ideal search engine. "It will be a smart tool that understands exactly what you want, understands all the information on the Web, and then it gives you exactly the right thing." Their research has generated a list of improvements needed to move from their present method to this ideal system, and their development strategy is to work their way through the list.

In a humorous aside, they acknowledge the technical contradiction of their management (two 27-year old technical guys running the top search company on the web, with lots of algorithm and networking experience but no management experience.) They express it as a trade-off between "technological savvy and organizational savvy" and, for now, they and their investors are not resolving the contradiction; they are sticking with technological savvy.

Other e-business paradigms so far appear to have paid less heed to the concept of IFR, at least from the perspective of the customer. On-line grocery shopping is perhaps a good example of a sector where although ideality has been increased (assuming web-sites have achieved an acceptable level of use-ability) over physically having to visit a supermarket, it is still some considerable distance away from what might be classified as an IFR.

Fig. 1 illustrates the concept of first defining the IFR and then stepping back from this only when it is deemed that it cannot be achieved. In the case of grocery shopping, we might see the important word 'self' as a key driver, i.e. ideally, I would like the shopping to do itself – the store works out what I need and delivers it to me, when I want it, at the price I'm prepared to pay. While some supermarkets may be seen to be making tentative steps in this general direction (e.g. on-line accounts which recognize that most customer grocery orders are made up of over 80% staple, regular order items and thus contain 'you are low on sugar, I have added some to your basket' algorithms), none have as yet made a very good link to the ultimate function being delivered. What we mean here is that a carrier bag full of items from the store is not the ultimate (customer) functional requirement; a better customer IFR requirement is to have a specified meal on the table for a specified number of people on a specified date, at a specified time.

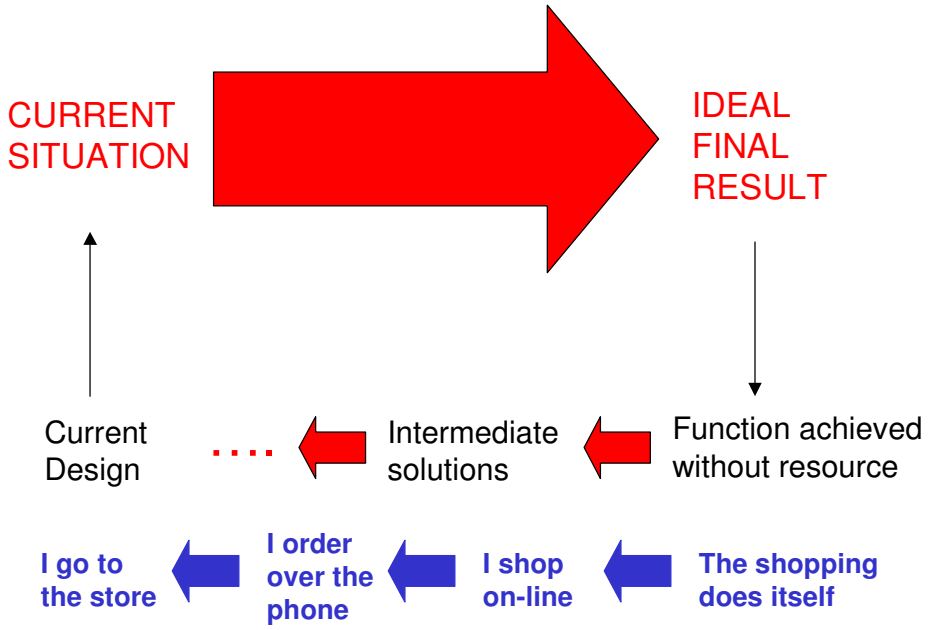

Fig. 1: IFR and 'Grocery Shopping' from a Customer Perspective

If most if not all e-business companies are failing to make profit at the moment, it may be seen to be in large part due to the fact that they are trying to evolve things from left to right – the way we usually do things – on the Fig. 1 picture, rather than starting from the right and working left. In other words, e-business cannot hope to prosper by replicating the traditional bricks and mortar business model, but at a lower cost. Instead it must seek to add value – increase ideality – by offering customers tangible benefits that do not or cannot exist in the non-virtual world.

Priceline.com and similar companies perhaps offers some insight into how this concept might begin to work in practice. With Priceline.com, the customer defines his or her own 'IFR' by defining how much they are prepared to pay for a given product or service and then soliciting bids from prospective suppliers. While this is an obvious step in the right direction as far as customers are concerned, the business model is currently too limiting and clearly still doesn't work in certain sectors (e.g. groceries, fuel) where fixed costs are a small proportion of total cost. For airline seats, hotel rooms, cinema seats, concert tickets, etc – where fixed costs are a high proportion of total cost – and suppliers have a much greater incentive to fill all empty seats. Perhaps this scenario suggests that evolution towards ideality will happen most quickly when the conflict between the IFR of the supplier and the IFR of the customer is at its smallest.

CONTRADICTIONS

Use of the IFR thought process often helps to identify the contradictions that prevent the IFR from being achieved. A classic example emerges from the work of Evans and Wurster in their book *Blown To Bits* [3]. The book considers how the information-age affects the ability of companies to target information, like google.com above, specifically to the needs of every individual customer. Blown To Bits identifies the contradiction between 'richness' (the quality and relevance of information received by each individual) and 'reach' (the number of individuals the information reaches. Fig. 2 illustrates how the richness versus reach contradiction is traditionally viewed as a one-or-the-other relationship, such that the more I have of one parameter, the less I must accept of the other.

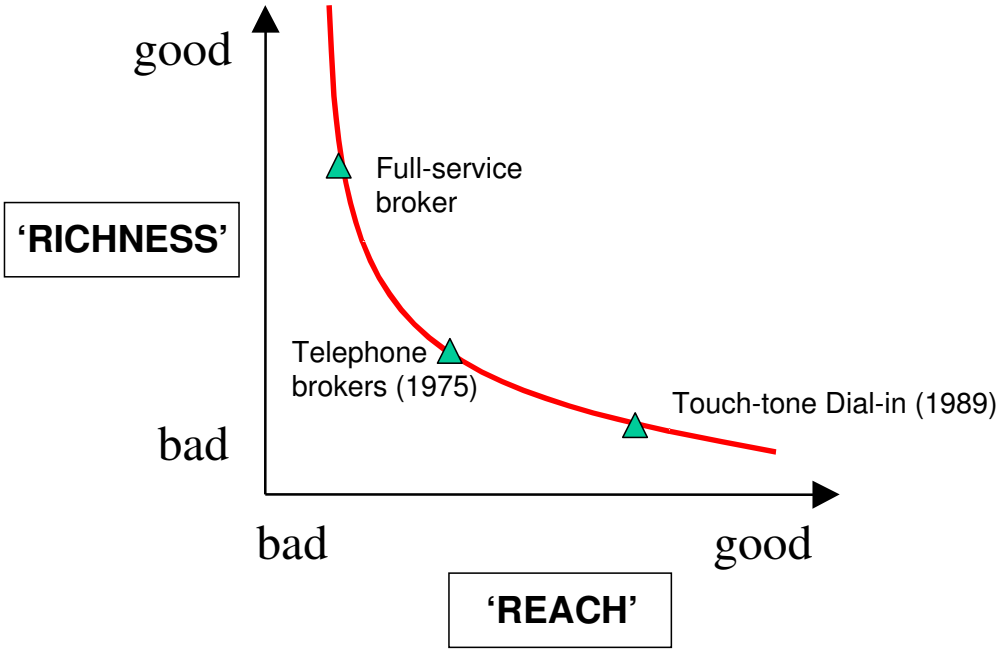

Fig. 2: Richness versus Reach Contradiction for Share Dealing

The figure is drawn for the example given in *Blown To Bits* of share dealing. Traditional richness versus reach trades mean that when Schwab introduced telephone broker services in the 1970s, it was an inherent compromise – more people had access to share dealing services, but the quality of information ('richness') they received from a phone broker as opposed to a full-service broker was inherently compromised. Further evolution to 24 hour, touch-tone dial-in from the late 1980s was a further step towards greater reach by further compromising richness.

TRIZ, of course, tells us not to accept the compromises, and a large part of the message of *Blown To Bits* is that the Internet is the thing that has broken the contradiction not just for share dealing – Fig. 3 – but for a variety of other industry sectors as well. In the case of Schwab's share dealing activities, Blown To Bits argues that Internet dealing now offers enormous reach with a richness (thanks to data mining and on-line data acquisition strategies) that is better than that available from just about any individual full-service dealer. In other words, the Internet has made available to the general public just about all of the data available to the full-service dealer when he or she is making decisions on the behalf of a client.

Fig. 3 shows how the Internet has shifted the traditional contradiction inherent in the hyperbolic curve. The idea of shifting the curve rather than accepting its position was first discussed by Mann and Domb [5] [1], in describing 'Contradiction Chains'. The main thesis of the Contradiction Chains article was that the shifting curves idea extended well beyond just two curves, and that the elimination of one contradiction merely serves to bring to the fore other contradictions. Thus although the Internet has to a large extent 'solved' the richness versus reach contradiction, Contradiction Chains say that the new paradigm also eventually hits a new contradiction which has to be solved if ideality is to increase further.

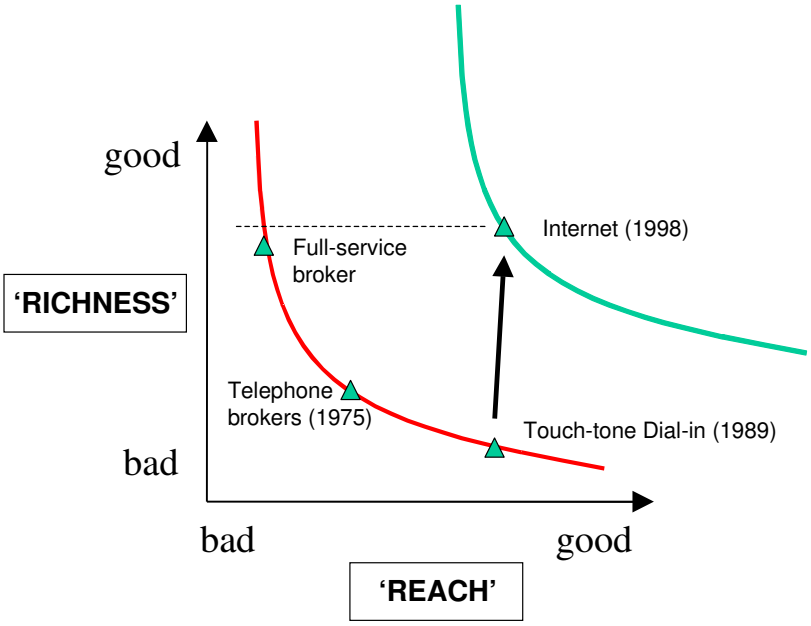

Fig. 3: Richness versus Reach Contradiction Broken by the Internet

Fig. 4 illustrates the concept and suggests that the new contradiction emerging from the Internet solution of the richness versus reach contradiction is the 'too much information; too little time to process it' contradiction.

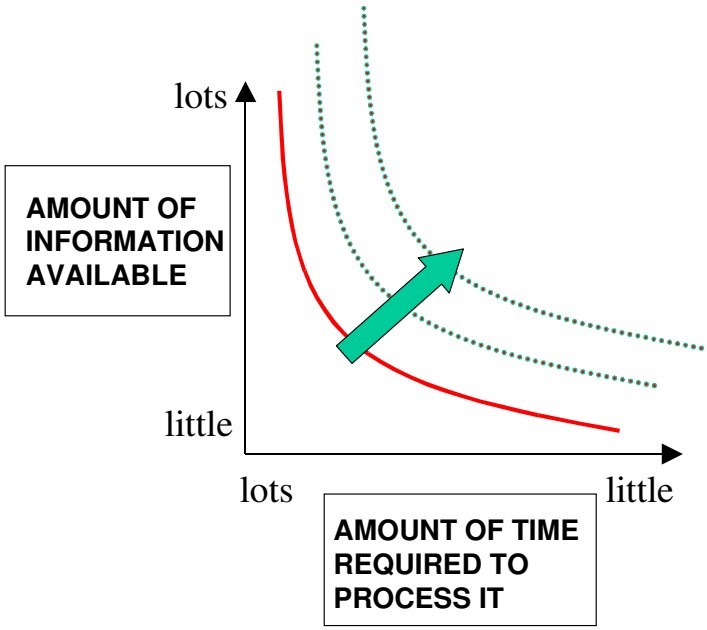

Fig. 4: Solve One Contradiction and Another Emerges

It would appear likely that the emergence of 'semantic processing' capabilities offer the potential for if not solving the contradiction, at least shifting the hyperbolic curve closer to overall ideality. We await the next contradiction emerging from semantic processing with interest.

The world of e-business abounds with physical as well as the technical contradictions seen above. A basic one is:

I want lots of inventory but I want no inventory.

I want lots of inventory to have many choices for my customers ready to ship as soon as the customer orders something, but I want no inventory to have no carrying costs, no warehousing costs, and no surplus inventory if a particular product is not popular.

A large family of solutions called "b-webs" for "Business webs" has been created to resolve this contradiction, using the solution method of going to the supersystem. A b-web consists of customers, suppliers and the organizing company, linked so that a customer order triggers suppliers to provide the parts needed to build that specific order. The organizing company holds no inventory, and the suppliers hold much less inventory than in conventional relationships. Dell Computers is considered the archetype of the b-web business. They hold less than 3 days inventory at any time, and ship orders less than 24 hours after they are received. Office Depot claims that switching to the b-web model saved it US$600 million the first year [2].

40 INVENTIVE PRINCIPLES

Previous work [6] has shown that the business world appears to require the same 40 Inventive Principles used to solve technical problems. This paper continues the theme by suggesting that the same 40 Principles are relevant in an e-business context. We also submit that we have not identified a contradiction breaking principle being used by any e-business that does not fit the framework provided by the current list of 40.

Below are some of the examples found of Inventive Principles being applied in an e-business context:

- The richness versus reach contradiction has been solved by the Internet adopting Principle 6, Universality (i.e. the Internet offers a truly universal communication medium), and a Parameter Change (Principle 35) from a physical to a virtual infrastructure.
- The semantic processors, which are beginning to solve the 'amount of information versus time to process it' contradiction, are using Inventive Principle 2, Taking Out – in that they are separating the useful information from the noise.
- Ford [4] uses Principles 5 – merging, 20 – continuity of useful action, 24 – intermediary, 3 – local quality – adopt/adapt/reject based on local conditions in their RAPID program for enabling all parts of their global organization to have access to (and the ability to filter for local relevance) the good practices developed in other parts of the organization.
- eyetracking.com uses a sensor to examine where, how and when our eyes travel around a computer screen filled with information in order to help web-site designers to identify the best places to position different aspects of the data required to be presented – in other words, to provide eye-tracking data; demonstrating inventive Principle 3, Local Quality information. (eyetracking.com itself is using Principles 23 Feedback, and 28 Replacement with a field) One eyetracking.com finding, for example, is that when a new screen full of information appears, our eyes tend to start at the center of the screen, and so we should position the information required first in a sequence to be positioned in this area.
- The concept of viral marketing as pioneered by Hotmail.com [4] – i.e. the offering of free e-mails to users where the free e-mail comes with an (subtle) advertisement for hotmail is a good example of Principle 25, Self-Service, being a clever way of targeting a highly focused audience of relevant users.

76 STANDARD SOLUTIONS

The idea of viral marketing described above also serves to illustrate the relevance of the traditional TRIZ method of substance-field (or "Su-Field") analysis techniques when considering e-business issues. Viral

marketing [4], starting from a Chained Su-Field to create demand, then goes too far such that a harmful effect (privacy invasion) emerges – this in turn creates a new Su-Field problem.

Viral marketing is an e-business technique that is spreading like the common cold. It is successful, and it is being used to market everything from telecommunications plans to personal products like soap and shampoo. The originator may have been the free e-mail Hotmail system, which went from concept to 11 million users in 18 months by adding a message at the bottom of each e-mail that advertises the service.

But, some viral marketers have gone too far. They have used the data from the referrals to study the purchasing patterns of their customers in ways that customers consider invasion of privacy. In TRIZ terms, they have linked Su-field models

Beneficial function	Providing the service
Beneficial function	Increasing number of customers
Beneficial function	Provides data about customers
Harmful function	Customers object to the collection of data

Companies that have been successful with viral marketing have avoided this last step. Some have tried to provide such high value that the customers contribute the data themselves, with mixed success. Viral marketing is in its infancy, and its practitioners are still searching for the "X factor" that can make these chains of functions all succeed.

PATTERNS OF EVOLUTION

Many e-businesses are following the trends of evolution of the pattern called "decreasing human interaction" or "increasing automation" [10]. The pattern can be summarized as follows:

1. Human does the work
2. Human with tool does the work
3. Human with tool set, selects the right tool and does the work
4. Human directs tool; the tool does the work
5. Tool works, modified by human when needed
6. Tool adapts itself to situation; tool does the work, learns from the experience, and modifies itself and the work it does as needed

The PointCast system was an example of levels 4, 5 and 6 of this pattern. The basic premise underlying PointCast is that the customer designates what news she wants to receive during the day. A typical request might be prices of certain stocks, news of particular sports teams, news that affects her business issues, and local politics for her city. The PointCast system updated a personal "newspaper" with these topics throughout the day (hence the name "PointCast" as opposed to "Broadcast" news.). But, PointCast took the system further. It would include articles on subjects related to the requested subjects, but not specifically requested. If the customer spent time reading these, the PointCast system would send more on those subjects. Likewise, if the customer did not spend time on these extra subjects, the system would try different subjects. Also, if the customer did not read the articles that she had requested, the system would gradually stop sending them, and substitute additional articles on other subjects.

It remains to be seen whether the PointCast model is economically viable. Although highly consistent with the trends of evolution and an increase in overall user perceived ideality, it is not clear how the company can earn enough revenue to meet the cost of providing what is undoubtedly a powerful capability.

CONCLUSIONS

Many if not all e-businesses are evolving in directions consistent with the strategies suggested by TRIZ trends of evolution. They are all to varying degrees changing the business paradigm through the use of

Inventive Principles 6 and 35 to 'eliminate' contradictions associated with bricks and mortar-centered businesses. This paradigm shift alone however, is patently not enough because few if any e-businesses have yet returned a profit.

Financial success of e-business may not be well correlated with technical success because of the immaturity of the business models. Utterback's book *Mastering the Dynamics of Innovation* [9] illustrates a common historical trend regarding major innovations and new markets which shows that the number of offerers in the market increases markedly during the infancy period of a market and that very few expect to turn a profit until the market begins to mature. It is at this point also that the number of offerers begins to decline sharply. The correlation between market maturity S-curve and number of players is suggested in Fig.5.

If history repeats itself, then few if any e-businesses will make money before many have gone out of business.

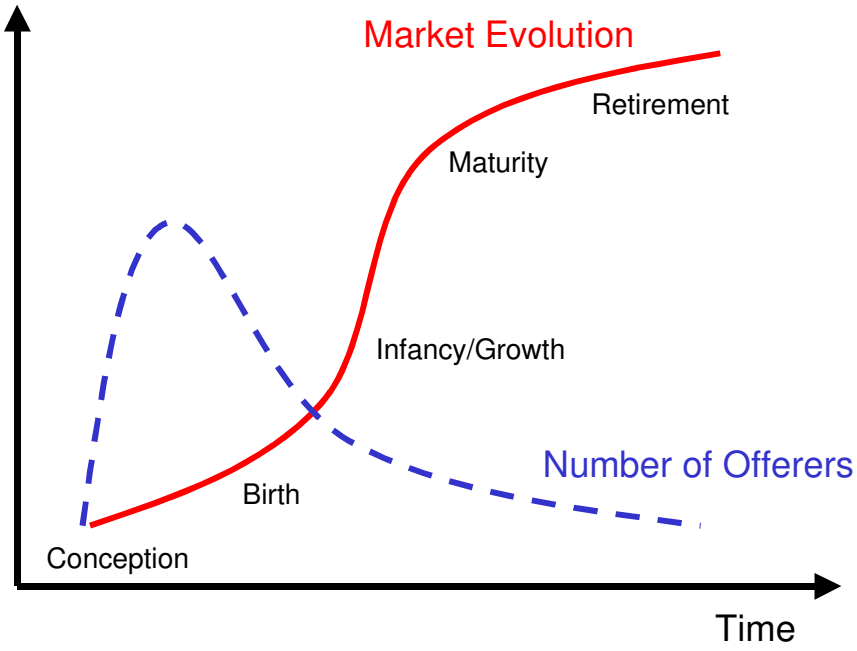

Fig. 5: Correlation Between Typical S-Curve and Number of Players

The big difference this time around, however, - and it is a big difference – is that we have Utterback's data and, more importantly, TRIZ gives us specific tools to help companies to ensure that they are the ones who survive. Survival means awareness of the trends of evolution and it means recognizing the importance of solving contradictions, and then solving the new contradictions that emerge as a result.

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