
Strategic innovation in the convergence era

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Abstract: Megatrends are shaping the rapidly changing global economy. These trends have also brought a convergence revolution, creating a new business environment ‘convergenomics’. An in-depth analysis of convergences from organisational factors to technologies, industries and biological-artificial systems is presented with numerous real-world examples. Then, strategic innovation approaches to create new values on the value chain are suggested in the new environment of convergenomics. The impact of convergenomics on organisational value creation leads to new strategic innovation approaches. The role of strategic innovation in convergenomics is discussed along with its impact on the value chain.

Keywords: enterprise development; convergence revolution; convergenomics; strategic innovation; value chain.

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1 Introduction

Welcome to the brave new world of convergenomics, a new business environment created by the convergence revolution. Convergence is commonly referred to the synergetic combination of different objects or ideas for other contexts. Convergence revolution has brought enormous opportunities to develop new products, services, values, business models and life styles. It has also brought new challenges to knowledge sharing, collaboration, competition and innovation. There are megatrends that are shaping the way people behave and organisations work. Convergenomics is the result of these fast developing megatrends in the connected global economy.

Globalisation and digitisation are the two most obvious trends that have helped flatten the world, as Thomas Friedman (2007) asserted. The end of cold war politics in 1989 opened up and accelerated *globalisation* through increased economic interdependence among nations. Technology and *digitisation* are accelerating globalisation with a speed never known before. Technologically advanced countries, such as the USA, UK, Germany, Japan, South Korea and Finland, and export-oriented nations such as China and India, use advanced information and communication technologies (ICTs) to efficiently conduct business globally. Even many underdeveloped nations are taking advantage of wireless mobile devices to connect to the global community. Anyone with internet access can use the web to be in contact and do business with anyone around the world.

Another megatrend is *commoditisation of processes*. Through standardisation and quality certification, operational processes become scalable. Thus, bundling, unbundling and rebundling of processes are feasible. Such approaches create new opportunities for global outsourcing and interorganisational collaboration.

There are other profound social, economic and political undercurrents in play. For example, *changing demographics* present a much different world map with new opportunities and looming social/political problems. The rapidly increasing older generation and the drastic decrease in the younger generation present new challenges for most developed and some developing countries. *Changing industry mix* in the developed and fast developing countries is another major force that has moved the economic centre of gravity from agriculture to manufacture and now to knowledge-intensive service industries.

Megatrends have varying degrees of impact on the business environment. Their most profound impact occurs when they interact and interplay (converge). The *convergence revolution* is at the centre of the whirlwind of global change and has resulted in *convergenomics*. By convergenomics, we mean the emergence of a new business environment as a result of rapid changes in megatrends involving new technologies, demographics and ever fierce global competition. To be competitive in convergenomics, organisations must behave differently through strategic innovation which requires exploration of new frontiers to create new values. In this paper, we discuss the convergence revolution and its impact on creating a new business environment through convergenomics. We also present new strategic innovation ideas in convergenomics.

2 Convergence evolution

Convergence is a consequence of the ingenuity and adaptability of the human being. Humans have the ability to learn and creatively transmit the knowledge gained for various practical uses. Convergence can be as simple as combining an eraser with a pencil to as complicated as combining biology with information technology: biotechnology. Today, we are living through a new wave of convergence i.e. changing the way societies, organisations and people work. Convergence revolution is opening new opportunities to create new values and in different ways than was the case with traditional business. Table 1 presents the general evolution of convergence.

Table 1 Evolution of convergence

	<i>Convergence level</i>	<i>Purpose</i>
Level 1	Component/product convergence	Product innovation
Level 2	Functional convergence	Process innovation
Level 3	Organisational convergence	Organisational value chain efficiency
Level 4	Technology convergence	New technology, product innovation
Level 5	Industry convergence	New industries, customer value innovation
Level 6	Bio-artificial systems	Ubiquitous innovation

2.1 Component/product convergence

Convergence of components and products has existed throughout time. Clock radios are a result of converging two mature products as components of a new product. Cell phones represent convergence of functions such as internet access, music, photograph and even telecommunications. The electro motion toothbrush is another good example of convergence obtained by combining electronic skills of the Braun Oral-B toothbrush and battery technology. Nike and Apple have recently combined the iPod with gym equipment, allowing health club members to make exercise more entertaining. These two organisations also provided wireless systems embedded in Nike running shoes to communicate with the iPod Nano for monitoring the heart beat, running speed and distance the runner is recording while listening to music. LCD technology has allowed development of more realistic video games, better quality movies on airplane flights and enhanced ability to learn and teach (Anonymous, 2007). E-book devices may replace books and newspapers through the use of ambient light from the surrounding area, yielding sharp images readable even in bright sunlight. Once a page is displayed, no further power is needed to keep it visible, as power is only consumed during updating. Newer devices have also been found to be easier on human eyes. This technology has been brought to market by Sony (marketing the Reader), Amazon (Kindle) and Motorola (Motofone).

2.2 Functional convergence

In the 1990s, BPR was an innovative approach to cut across functions, developing new work processes, with the intent of identifying the best way of doing things. Many functional organisations, such as R&D, manufacturing, marketing, finance and human resources, had become isolated silos with limited interfaces. Process innovation through BPR represents functional convergence to develop efficient and lean value chains. Today, enterprise systems are an extreme form of functional convergence through unifying of organisational databases and reporting systems.

Dell computer streamlined its value chain by disintermediating wholesalers and retailers to provide speedy delivery of PCs to customers. Physicians Mutual shifted from a centralised, mainframe-computing environment to a distributed server-based framework to allow broader access to their information system. As part of the change, business processes were redesigned and a new service-oriented architecture was installed. The system enabled the information technology group at Physician's Mutual to improve service in a rapidly growing environment that was increasingly distributed (Anonymous, 2006a).

McDonalds was instrumental in making the fast food industry a major component of the USA (and even the world's) economy. Prior to 1950s, you could get food in one of many independent restaurants, each with its own décor and cooking style. McDonalds came up with a business functional style, bringing mass production to the food industry. Processes were created to make a limited set of products available in short periods of time, by low-cost labour that followed carefully laid out instructions. This idea led to a massive revolution in food distribution in the USA. It had side effects in that it made food obtained during travel less risky from botulism. Advances in ICT, e-business and global supply chains require streamlined and agile management.

2.3 Organisational convergence

In the era of e-global and digital economy, organisations have the opportunity to collaborate with other firms to enrich their value chain. Strategic alliances and joint ventures with suppliers, component assemblers, distributors and even competitors are good examples of organisational convergence. Vendor participants in supply chains such as Wal-Mart, Nike and Dell are required to have strong collaborative functions. Interorganisational relationships (IORs) or business-webs (b-webs), where each partner organisation brings its own core competence to the value chain, are new business models that agile organisations are using to become and remain competitive (Tapscott et al., 2000). Supply chains are being created that link previously independent organisations, at least temporarily, into cooperative assemblies and draw upon the specialties of participants from around the globe. For example, Nike is simply a brand management firm, while all of its products are produced by its partner organisations all over the world.

2.4 Technology convergence

Since the 1980s, there have been numerous revolutionary convergences of seemingly heterogeneous technologies to create new products, services, new processes or even new technologies (Bacon and Leung, 2007). The most prevalent convergences have involved information and communication technology (ICT), biotechnology, engineering, nanotechnology and artificial intelligence. We have seen liquid-crystal displays (LCDs) replace clock dials and all kinds of meters in automobiles. Science has miniaturised LCDs, enabling convergence with computer devices, leading to brilliant small displays for texts and graphics. The electroluminescence of organic compounds can be utilised to build organic light-emitting diodes (OLEDs), thinner and brighter than LCDs, with wider viewing angles. These devices have thus far appeared as secondary displays on the exterior of mobile phones or in music displays.

In the pharmaceutical industry, many new drugs have been introduced through convergence of biotechnology, agriculture and chemical engineering. There is the potential to treat patients at the genetic structure level. Neural technology is the convergence of biology with computer science (Talbot, 2005). Neuroscientists are interested in the neocortex as it promises better understanding of how to treat psychiatric disorders and brain diseases, and explain how learning and memory work.

Technology convergence also includes application of modelling approaches taken from engineering and applied to biology. These efforts can lead to biological computers. Convergence of engineering and biotechnology has also yielded remarkable new products and services such as magnetic resonance imaging (MRI) and positron emission tomography (PET) scanning. Further development may lead to atomic force microscopy, enabling scanning at the cellular and sub-cellular level.

2.5 Industry convergence

Industry convergence occurs when two or more previously distinct industries become direct competitors or cooperators or create a new one. Apple's iTunes, which competes with music distributors, is the convergence of IT and music industries. When Walt Disney went into the travel convention business, which was a convergence of entertainment, hotel and golf industries.

There are three types of industry convergence. *Functional* convergence is when products from different industries perform the same function(s). Personal computers and television industries both provide some of the same functions, and are becoming more and more substitutes of each other. *Complementary* convergence occurs when multiple objects of value from different industries are obtained in one location, such as getting travel and lodging services in the same location (as when travel agents sell both airline tickets and hotel rooms). *Institutional* convergence is when firms behave as though products of two industries are linked. While complementary convergence focuses on the product being developed, institutional convergence focuses on the organisational structure. The banking industry has converged with the mortgage industry, so that they can provide both checking deposit services as well as mortgage loans. The edutainment industry is the result of convergence between education and entertainment. Some oil industry firms claim that they are in the energy business, allowing them the latitude to develop petroleum as well as hybrid fuels. Digital convergence of IT and broadcasting is another example of institutional convergence. ENPS shifted its focus from output at given intervals (such as the evening news) to pools of content distributed in multiple ways. Editorial work is unified to serve all media, providing output for television, radio, print and the web.

2.6 *Biological and artificial systems convergence*

The convergence of biological and artificial systems represents the highest level of convergence. As such, it represents the cutting edge of development, where ideas from the prior levels of convergence can be utilised to lead radically new methods and products. Ubiquitous life (u-life) involves a state where our lives are managed and controlled by a combination of technologies and systems. These advances are changing the life style of people through miniaturisation, visualisation, manipulation and evaluation.

Miniaturisation leads to application in a number of areas. We are all familiar with the advances in computer chip technology, and Moore's Law, characterising the geometric rate of improvement in computational power in an ever-decreasing size of the chip. Miniaturisation also has impacts in healthcare, through gene splicing and molecular biology.

Visualisation advances come from molecular technology as well. X-ray crystallography enables resolution to about the size of a water molecule. Atomic force microscopes allow scanning surfaces to detect variances in atoms, which is translated to an image. Commercial applications include tools to understand differences in chemical forces on surfaces, which can be useful in development of drugs or materials.

Manipulation extends the knowledge gained through visualisation. The NanoManipulator combines virtual reality and tactile feedback, allowing operators to manipulate material on a nano scale. On a larger scale, it is used in medical training to allow students to experience the feel of inserting needles into spinal columns.

Evaluation is gaining value from technology. The genome project is one development coming from technology, as are microarrays, hybrids of biotechnology and IT. A test medium is divided into thousands of partitions, with a different molecule attached to each section, binding to one of the targets. A chip gathers feedback from the probing

molecules and generates a digital output. This ability for remote sensing is usable in detecting when impurities are present, or when mechanical parts are wearing out, or when other specification limits are exceeded. In the medical field, translation of measures into simulations of human organs allows experimentation in virtual space rather than real bodies.

Gains from the convergence of engineering and biological studies are found at the University of California – Santa Barbara (2007), which initiated a laboratory in 2000 with the aid of Microsoft Corporation. The lab focuses on developing new technologies to enable people to interact with computers in more powerful ways. One output of the effort is HandVu, a vision-based system for hand-gesture interface. Users carry a computer and wear goggles with an attached camera. The computer is activated by sticking a hand into the camera's field of view. The camera locks onto the hand and tracks its movements, displaying the changing scene in the goggles. Various gestures are used as computer commands. For instance, a fist followed by a scissors motion with thumb and forefinger grabs a virtual object in the computer display. The virtual object is released by opening the fist and pointing thumb and fingers forward. Table 2 recapitulates some of these convergence examples.

Table 2 Examples of convergence products and services

<i>Level</i>	<i>Manufacturing</i>	<i>Service</i>
Product convergence	Cell phones (telephone, information access, camera, games) Coffee (soy milk, decaffeinated, diet, frappacinos)	Jazzercise
Functional convergence	Lean manufacturing Enterprise resource planning systems	McDonalds' hamburgers (fast service, consistent quality, entertainment for kids)
Organisational convergence	Steel (movement from mass production to minimills)	Banks (from checking accounts to include savings, mortgages, bill paying, many other services)
Technological convergence	Hybrid cars	Cell phones (communication, music, e-mail, photos, etc.)
Industrial convergence	Starbucks Political ads (from stump speeches and posters to a transformation of the television industry)	e-Bay (transformed want-ads and flea markets to get rid of white elephants to an e-commerce revolution)
Bio/artificial systems convergence	Medical testing (X-rays to MRIs and beyond)	Chinese medicine

3 Strategic innovation in convergenomics

The convergence revolution is opening new opportunities to create value in different ways than the traditional business thinking. The traditional management approaches emphasise reinforcing or optimising the existing core competence of the firm as a stand-alone organisation. Examples of these approaches include benchmarking, continuous

improvement, differentiation, focus, cost leadership, global strategy and customer-centric management. The traditional management strategy involves improving efficiency in the value chain by emphasising economies of scale, economies of scope and market expansion. While these practices are good when executed properly to increase the firm's share in a zero-sum game, they would not allow the firm to reinvent itself to explore blue oceans (Kim and Mauborgne, 2004).

In the new era of convergenomics, organisations are not an isolated and independent entity but a member of the wide open global community for collaboration or partnerships. In convergenomics, organisations pursue not only economies of scale and scope but also economies of expertise and collaboration (Gupta and Govindarajan, 2004).

Strategic innovation is fundamental reconceptualisation of how an organisation creates value in dramatically different ways. Innovation can be classified in a number of ways. In Table 3, innovation is classified in terms of its level and purpose in three levels where organisations pursue innovation for value creation.

The first level involves improving the efficiency of the value chain by dramatically redesigning the end-to-end value chain architecture. In this phase, innovation involves application of many proven or new approaches for procurement, transformation and distribution channel innovation as follows:

- *Procurement innovation*: just-in-time system, outsourcing, electronic markets.
- *Transformation innovation*: lean manufacturing, production vs. assembly, outsourcing, bundling, debundling and rebundling.
- *Distribution channel innovation*: disintermediation, outsourcing, direct marketing via the demand chain.

Table 3 Innovation levels

<i>Level</i>	<i>Purpose</i>	<i>Value creation objective</i>
1	Process innovation	Improve the value chain architecture <ul style="list-style-type: none"> • Procurement • Transformation • Distribution
2	Customer value innovation	Enrich and reinvent customer value <ul style="list-style-type: none"> • Cost • Quality • Speed • Customisation • Emotional needs
3	Customer base innovation	Redefine and create the customer base <ul style="list-style-type: none"> • End user • E-customer • Customer communities • Global customers • Non-customers

The second level of innovation involves customer value creation. The traditional values of cost and quality are simply market entry conditions. They are no longer sufficient or sustaining customer values. Today, organisations must pursue new convergence to provide speed (responding almost instantaneously to customer needs), customisation (providing exactly or beyond customers' expectations of what they want) and satisfy customers' emotional needs (beauty, elegance, memory, hope, sense of security, etc.).

The third level of innovation deals with redefining the customer base. The traditional definition of the customer is simply the end user of a product or service. However, in the e-global economy, customers can be those who do not actually consume the product or who are physically in contact with the product. E-customers, global customers, customer communities and current non-customers (who may become customers in the future) should all be included in the customer base. Through convergence of technologies and new methods, organisations must find ways to create demand or develop new markets in the blue ocean. Figure 1 demonstrates the relationships of these concepts.

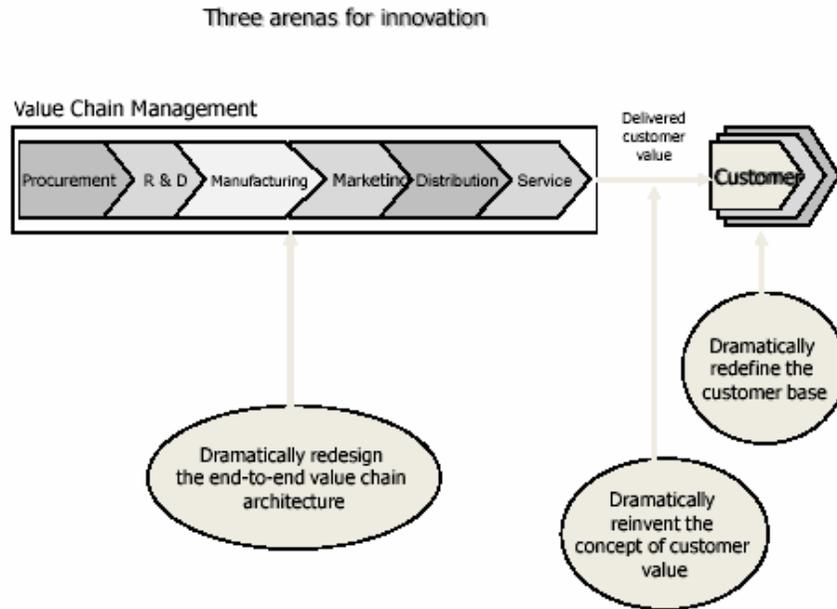
Innovation can be any combination of exploitation of what is known and exploration of what is unknown. Thus, we can classify strategic innovation also based on the type of approach used (Figure 2). The first type can be classified as *evolutionary* or optimising innovation where continuous improvement of the existing core competencies is obtained (Kaizen is the main thrust – an evolutionary development). On the other extreme (of classification) is *revolutionary* innovation, where new frontiers are explored to create new core competencies. Two other types of innovation come as a combination between the two approaches. The ultimate innovation type is where both exploitation and exploration are high. We call this ubiquitous innovation based on convergenomics. The optimum balance between exploitation and exploration for any given organisation depends on several factors such as the industry type; size, age, management vision, product lines and DNA of the organisation.

Strategic innovation is a requirement for firms to survive and prosper in convergenomics. There are many successful examples of such strategic innovation. In the air travel industry, low-cost airlines have reshaped value chains by reinterpreting criteria to measure customer value. Fleet standardisation is a means to reduce maintenance costs. Use of cabin crews to clean planes between flights also lowers operating costs. Use of small, low-tax airports enables price advantages. Southwest Airlines and Jet Blue offer a limited menu of services, focusing on providing value in point-to-point business models (Thamara, 2007). Airline innovations can also take advantage of technology development. In Singapore, joint efforts of Singapore Airlines and the Civil Aviation Authority of Singapore have led to the use of biometrics to improve customer flight experience through fully automated seamless travel (Heracleous and Wirtz, 2006). Biometrics is used for airline check-in, pre-immigration security checks and immigration clearance. The clear objective is not simply security, but integrating processes to drive service excellence. This strategic innovation leads to simplified procedures, reduced error, efficient use of self-service technology, greater security, and greater customer service and convenience.

Strategic innovations are also found in banking. Banks serve a mature market in a highly competitive industry with commodity products and services and intense competition from many sources, including automobile companies (for automobile loans) and advisory firms and insurance companies (for financial advice). Product/service innovation options include evolutionary improvement of established business (such as use of web technology for internet banking), process innovations to increase productivity

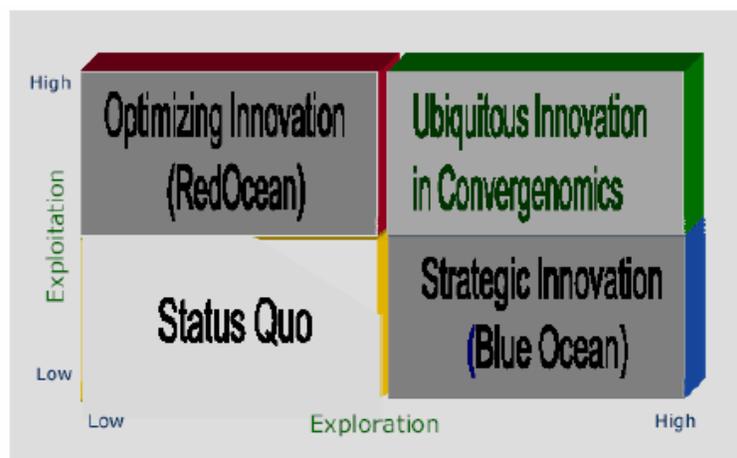
and reduced staffing (such as use of ATMs), value engineering through operational excellence through enterprise system technology, and value innovation. Value innovation creates differentiation from competition through providing superior customer value, leading to new demand (Thamara, 2007). Customer relationship management is a means to seek improved customer value.

Figure 1 The value chain and innovation levels (see online version for colours)



Source: Adapted from Gupta and Govindarajan (2004).

Figure 2 Strategic innovation classification (see online version for colours)



Healthcare is a growing sector of the global economy, with many opportunities for strategic innovation. Some hospitals are strategically innovating themselves through the help of IT. Examples include web-enabling patient televisions, which can be accessed for medical care by allowing doctors to access patient records over the web rather than needing to bring in a computer. Patients can also utilise web television to complete surveys, order meals and make purchases (Sternberg, 2005). Medical tourism has been successfully launched by Bangkok Dusit Medical Services and Bumrungrad Hospitals in Thailand.

4 Conclusion

The world is becoming flatter because of the combined effects of megatrends. This road is by no means smooth but is rather bumpy. There are widening economic and digital divides. While the broadband internet is becoming more widely available throughout the world, there are millions of people who are trying to survive on less than \$1 a day. Nevertheless, the explosive technological advances, globalisation, changing demographics and fast evolution of new business models have brought the convergence revolution. Application of convergence to opportunities to create value has led us to the brave new world of convergenomics.

The era of convergenomics has opened new opportunities to develop new products/services, design lean value chains, create new customer values and expand the customer base. It is important to predict the trajectory of new convergences and explore new opportunities ahead of competitors. The first mover advantage in the deep blue sphere of convergenomics will yield enormous wealth creating opportunities to strategic innovators. Wal-Mart has been proactive in the use of radio frequency identification (RFID) technology, not only to track inventory but also to provide fresh products to customers while minimising cost (Fishman, 2006). In the world of convergenomics, opportunities for strategic innovation are constrained only by human imagination and creativity.

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