Systems Innovation as a Source of New Business Opportunities

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Business leaders have long recognized systemic thinking as a useful source of ways to improve products, services, and processes. Examples of approaches based on systemic thinking include value analysis and process reengineering, which have proven effective in making the various elements of a product or service fit together and in integrating partial business functions (such as order processing, inventory management, purchasing, and production planning) into comprehensive business processes. Supply chain management and organizational learning, among other disciplines, have derived from this effort.

These efforts at system optimization have taken place primarily within individual companies or between individual companies and their suppliers, under the authority of a more or less systems-conscious overall management. Today, leading companies and other organizations are increasingly recognizing the need for–and the benefits of–applying systemic thinking and co-management at a higher level: where several product categories, types of service, and disparate processes–often provided by several companies or governmental organizations–are subsystems of an overall system whose effective functioning is a prerequisite for the various participants' success.

In this article, we discuss a number of examples in which the business development initiative is shifting to the overall systems level and in which the previously uncoordinated subsystems suppliers recognize the need for (or are coerced into) participating in joint optimization. We then suggest a systematic way to open up new business opportunities through exploiting overall systems innovation.

Why Think Systemically?

In many areas of business operations, as in daily life in general, technological progress and its accelerated flow of product innovations have reached a point of diminishing returns. Take office communications, for example. Under the current barrage of e-mail, voice mail, and telefax, the much-heralded „paperless office of the future" is anything but. Often awash in printouts, today's office also suffers from message overload. Reading and listening to your messages in all their various forms can take most of the day–and that's without even answering those messages, let alone creating new ones.

Or take transportation. The car is one of the greatest technical achievements of this century–but traffic jams and parking constraints often make it hard to get anywhere near your destination on time. Like many other areas that have only recently been recognized as overall systems, traffic infrastructures have developed so gradually and haphazardly that we have become accustomed to their often appalling flaws. Around the world, these infrastructures have expanded episodically and piecemeal, with each addition installed as a tardy response to the rapidly growing number of cars on the road. Consequently, traffic control systems, initially designed as simulations of traffic policemen, today contribute to congestion as much as they regulate traffic. Cars themselves, however functional they may be, are virtually useless in most modem cities much of the time. And because of urban traffic jams many people spend as much as 10 percent of their time in cars immobilized and waiting.

Air travel, meanwhile, makes nearly every comer of the globe accessible–if the traveler can first get to the airport and then make it through check-in, luggage control, security, and gate queuing, and if there aren't delays or cancellations of the flight itself.

Throughout these scenarios and countless others runs a common theme: the subsystems at work in each example have developed faster than overall systems to which they belong. That's because, for a long time, few people were concerned with–or even aware of–the overall systems. Almost all innovative efforts went into advancing and expanding the subsystems. Hence the development of the e-mail subsystem but not the overall communication system, the car subsystem but not the entire transportation system.

We now understand that disproportionate advances in subsystems can lead to congestion and dysfunction at the system level–more, in effect, becomes less. Only relatively recently have innovators begun to seek innovation at the level of the overall system.

Taking a Systems Approach

Before innovation at the system level can happen, the vendors/providers of the various subsystems involved need to recognize their interdependence. Such recognition may occur when the overall system begins to compete with another system, or when the dysfunctionality of the current system becomes intolerable, as illustrated in the following examples.**The Frankfurt Airport.** In recent years the Frankfurt Airport Corporation has begun to compete more aggressively with other airport terminals. Whether Frankfurt will remain a leading hub in Europe, in competition with Amsterdam, London, and Paris, will depend on its overall performance in terms of passenger throughput

capacity, attractiveness to passengers, and overall airport economics, including the success of its shopping areas, its cost of handling and logistics, and the effectiveness of its layout.

Optimizing the overall system is in the best interest not only of the Frankfurt Airport, but also of Lufthansa, which is based there, and of all the airport service providers, shop owners, and surrounding communities that depend on the airport as the largest local employer and source of tax income. For these diverse parties to recognize their common interest in treating the airport as a system needing optimization and innovation, rather than focusing only on their individual subsystems, is a major step forward. Recognition of their interdependencies in a highly competitive situation led the top management of Frankfurt Airport Corporation and Lufthansa to form a joint team and launch an effort to ensure that the Frankfurt airport will develop the handling capacity and attractive cost structure to remain a leading hub in Europe, while improving the overall quality of service for a rapidly growing number of passengers. They named this project „Best in Europe" and invited Arthur D. Little to assist them.

As the project progressed, it became clear that for the airport to remain competitive as a major international hub, the entire passenger flow and terminal system had to be rethought from A to Z. In particular, they needed an integrated approach to innovative automation systems (check-in, gate, luggage handling), active passenger routing and segmentation (business, tourist, frequent flyer, occasional flyer, European, trans-Atlantic), and the intelligent grouping of functional, shopping, and waiting areas.

The project, which is well under way, promises to increase the airport's capacity and save tens of millions of dollars in costs, through highly innovative solutions which neither the Frankfurt Airport Corporation nor Lufthansa could have achieved independently. All the other airlines that use the airport will also benefit from these solutions. For their customers, benefits will include less queuing, shorter transit times, less waiting time, better connections, and more convenient amenities.

Office Communication Systems. Similarly, systems integrators in the area of office systems and communications have assumed a leading role in large user organizations as a way of sorting through the overlapping and often incompatible subsystems provided by the various IT and telecommunications vendors. But apart from routine-based transaction-processing systems, office operations at the management level are still far from integrated. Innovation is still piecemeal and uneven, happening fastest in such subsystem areas as laptops/notebooks, mobile telephones, the Internet, and value-added services.

In this area, a truly systemic approach might yield, for example, a „communicator" the size of a flat notebook, which would provide both PC and voice communications functions, based on voice recognition. It would show the identity of and the key words used by any caller and would allow the user to retrieve any message orally or via display, on-line or via mail box. Such a system would require the interaction of laptop/notebook vendors, mobile telephone vendors, system software vendors, telecom service providers, and Internet service providers. The attractiveness to business users is obvious. The only question at this point is who will take the lead in launching this systems initiative. Nokia seems to be moving actively in this direction, but would need to join forces with a major provider such as Compaq.

Home Electronics. Not long ago, Bill Joy, co-founder of Sun Microsystems, declared the private home to be a badly coordinated system. Many of us have several telephones, a videocamera, a videorecorder, at least one television set, a PC, a printer, and a modem connected to the network. But few of these sophisticated pieces are properly interconnected; in fact, it can be challenging to get some of them to function together at all.

Sun Microsystems has set up a research group, headed by Mr. Joy, that is developing a systems software called „Jim," which will make it easy to interconnect and interoperate all the electronic devices in the house–creating a truly integrated home system. Already, Bosch, a supplier of white goods, plans to equip its dishwashers with a module to connect them to such a home system. The refrigerator, stove, air-conditioning unit, and security system may soon follow. Other companies are launching similar initiatives. Matsushita, Sony, and other consumer electronic firms are working on a home audio-video interconnect system, „Havi," that will let televisions, VCRs, digital videodisk players, and other devices recognize one another and link up in a home network. And Microsoft is on a similar track with „Hapi"–its Windows consumer-electronics-based home application-programming interface.

Transportation. A number of European car manufacturers, telecommunications companies, satellite service providers, IT companies, and automotive suppliers are working together on a project known as Prometheus, sponsored by the European Union, to develop an integrated traffic guidance and driver assistance system. This system will take into account the current traffic situation and help each driver reach his or her destination along the fastest route. It is estimated that total sales generated by products and services of this system will be in the order of several billion dollars annually by 2005.

Innovating at the Systems Level

Systems innovation has been problematic because barriers to innovation tend to rise exponentially when subsystem vendors recognize their subsystems as belonging to an overall system that includes many subsystems of other vendors, and which nobody really controls.

A case in point is the home system. As long as the focus is on videocameras and VCRs, individual manufacturers compete happily in an innovation race, suboptimizing video technology but making it more and more complex to let the user benefit from all its fantastic new capabilities. However, when it comes to letting the videocamera, the stereo-system, and the PC work together to create a well-edited home movie, one has to be a highly skilled hacker just to interconnect them. Soon, however, Jini, Havi, and Hapi are going to make this interconnection possible for the normal mortal.

Systems innovation can come about in different ways:

• Economic and competitive pressure can push various neighboring subsystem vendors to accept their positions within a larger context and join forces to make the overall system perform better, as in Frankfurt's „Best in Europe" airport terminal project.

• A master innovator can develop the integrating technology to interconnect and control previously incompatible or difficult-to-connect subsystems, thus creating dramatic new system features, such as Sun Microsystems' home-networking software.

• Operational and compatibility problems of poorly coordinated subsystems can become so severe that their ability to function is put at risk, and the parties involved call for a joint effort to reengineer the overall system. This point will likely be reached one day regarding urban traffic congestion.

Systems innovation requires a different approach from the one most companies apply to product/service innovation. Most traditional product innovations happen incrementally, using new technology to make product enhancements or tapping into a stream of creative ideas to come up with brand-new products.

Product innovation on even a highly sophisticated item, such as a PC or an airplane, is a relatively contained and straightforward process. Systems innovation, in contrast, involves a complex interplay of subsystem requirements, capabilities, and provider interests. Innovating at the system level is not so much a matter of inventing new capabilities but of optimizing the array of existing capabilities under a common cost-benefit and ergonomic umbrella.

The first step in achieving systems innovation is to visualize the overall system and identify its various subsystems, which have likely been developed and used separately. The next step is to find where the obstacles lie in achieving common purpose, e.g., which interconnections have not been thought through? Where can synergies be achieved? What kind of common control or optimizing approach will help achieve a new level of effectiveness and user benefit?

This information can then be used to create alternative systems configurations that will allow the parties involved to test alternative system layouts and to experiment– conceptually or in fact–with various approaches, to determine whether they can achieve the overall purpose.

Take the home system idea–often the home contains the following subsystems:

• The electrical system, with the lighting subsystem and the various electrical appliances and electrically driven installations, such as air conditioning, heating, and hot-water generation

• The radio-based security system

• Assorted items of voice and data communication equipment–either haphazardly assembled by connecting one IT product after another, or conceived and laid out as a local area network–and connected to external telecommunication networks

• The stereo and video installation, mostly stand-alone, but often connected to a broadband cable coming into the house

• A number of electronic devices generally used in isolation (e.g., the digital camera, the copier)

All these subsystems and networks could be made to operate as part of an integrated home system, easily controlled under the same standards, communicating with each other and complementing each other. But how much of this integration would be worthwhile from a cost-benefit point of view? What does the user really want and find practical? What can he or she cope with? What value does a systems approach offer as a simplification?

Exploiting Opportunities in Systems Innovation

The organizational learning approach to systemic thinking and acting can be applied to systems innovations involving a group of subsystem providers that have hitherto acted independently. This approach involves three basic steps:

Develop a shared vision. The challenge is to get the subsystem providers to visualize the overall system as the environment in which their own subsystems can survive and thrive over time. They need to agree on a desired evolutionary path for the overall system that will permit continued growth and customer satisfaction. In most cases, this desired evolution will not be an extrapolation of subsystem trends, but will require fundamental innovation affecting all subsystems. To ensure customer satisfaction, participants must base their vision on a complete profile of the system's customers or end-users. What do these people really need? What has to happen to meet these needs? What is the overall system, or what could it be? And what current subsystems, interrelated or not, are part of that overall system concept?

Design a path from status quo to the desired future. The shared vision of the desired overall system will allow the subsystem providers to come up with creative ideas as to how they can contribute to its realization. Systems innovation will require coordinating and optimizing the interplay of the various subsystem developments. In many cases there must be give and take. Typically, this path-finding process among several interested parties can be accelerated when one of them takes the lead on the basis of conceptual superiority, market strength, or technological leadership.

Implement. Jointly promoting the future overall system concept, stimulating interest among potential customers or users, and demonstrating the power of the innovative system concept will trigger market „pull." This market pull in turn will attract more and more contributors to the overall system structure.

The Roles of System Initiators and Moderators

The challenge is to make the overall system concept so strong in terms of market potential, advantages to users and vendors, technical attractiveness, and costs that it can become a beacon around which to rally a sufficient number of subsystem vendors. The stronger the contribution of the system initiator, the more compelling is his or her case for assuming the leadership in putting forward the systems concept. That is the role that Sun Microsystems has assumed with its integrated home system idea and that the Frankfurt Airport and Lufthansa are playing in the „Best in Europe" project.

At the same time, the system requires technical expertise and enough mediation skills and energy to encourage people to work together who have never before thought of each other as partners. In addition to the initiator/leader, the consortium needs a moderator who cannot be suspected of taking one-sided advantage of agreements. Often the economic and/or operational pressures for aligning neighboring subsystems in the interest of overall systems innovation are not sufficient to trigger the alignment process. Obstacles may include lack of creativity or vision on the part of the subsystem vendors, which may prevent them from seeing the common advantages of optimizing the overall system. Another familiar obstacle is the suspicion that one party may try to take undue advantage of the collaboration and gain disproportionate benefits.

The catalyst for overcoming the obstacles, bringing to life a shared vision, and organizing an alignment process can be the moderator. An effective moderator can get the subsystem vendors to talk to each other and see the longer-term advantage in moving in a coordinated fashion toward a common overall system. In the case of Frankfurt Airport, the moderator has been the joint project team, made up of representatives of Frankfurt Airport Corporation, Lufthansa, and Arthur D. Little. In business information and communication systems, the moderators are more often than not systems integrators and consultants. In large engineering projects, such as those involving ports, major plants, or infrastructure-developments, the moderator can be an engineering/development consultant.

Conclusion

As the markets for many industry segments become more complex and saturated, and as more product and subsystem innovations continue to deliver less in the way of convenience and appeal, systems innovation will increasingly be the answer. We just need conceptually strong and powerful initiators and versatile moderators to help others see a joint future.

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