UNDERSTANDING ORGANIZATIONAL COMPLEXITY

Working Paper

Robert J. Trent, Ph.D.
Supply Chain Management Program Director
Lehigh University
Abstract:

Most CEO’s expect the internal and external complexity that their organizations face to increase in the future, making this a topic that is increasingly on the minds of executive leaders. At many companies the need to manage change is giving way to a need to manage complexity, particularly the complexity that arises from a greater reliance on global supply chains. Some have argued persuasively that organizations that learn how to manage and exploit certain kinds of complexity can generate additional sources of profit and gain competitive advantage. When managed well, complexity can also increase corporate resilience by enhancing the ability to adapt to change. Conversely, when managed poorly complexity increases costs and diminishes organizational performance. While it is often an inevitable outcome of business decisions, excessive complexity should not be a welcome part of today’s organizational landscape. This article defines the concept of complexity, explains why it can be an organizational problem, identifies the causes of complexity, and presents strategies for addressing this emerging topic.

Key words:

Complexity, competitive advantage, value chains, standardization, simplification
A revealing exercise is to visit a major supermarket. During your visit be sure to stop by the Mediterranean bar, the kosher foods section, the florist, the bakery, the pharmacy, the organic and gluten-free foods sections, the part of the store that features fruit, vegetables and seafood brought in daily from around the world, the pre-made and gourmet meals section, and the sections with products targeted to the Hispanic, Asian, and Jewish community. Do you need toothpaste? One analysis found that consumers can choose from over 350 different SKU’s of toothpaste. And, any parent knows that a trip down the diaper aisle with its dozens of choices can be an intimidating experience. Supermarkets today typically stock 40,000-50,000 items, up from around 15,000 in the 1980’s. Welcome to the world of complexity, a condition that at some level affects virtually all organizations and supply chains, not just supermarkets.

Why should businesses be concerned about complexity? The short answer is that most CEO’s expect the internal and external complexity that their organizations face to increase. A recent study by the IBM Institute for Business Value reached several important conclusions. First, 60% of CEO’s surveyed say their organization currently experiences high or very high levels of complexity. Almost 80% say they expect to see high or very high complexity over the next five years. A second finding is that more than half of CEO’s express concerns about their company’s ability to manage increased complexity. To this segment of the population complexity is a real and growing issue. The need to manage change is giving way to a need to manage complexity. And, complexity is expected only to increase.

This article explores the often mentioned but rarely explored topic of complexity by defining the concept, describing why it can be a problem, and explaining why we have business
complexity. The article also presents strategies for addressing an emerging topic that affects almost all businesses.

UNDERSTANDING COMPLEXITY

While we can define business complexity in a variety of ways, one perspective views something as complex if it is hard to separate, analyze, or solve. Another perspective views complexity as something with many parts in an intricate arrangement. Perhaps more revealing are the synonyms that describe the word complex. This includes descriptors such as complicated, intricate, and involved. While there are academics and consultants who have carefully defined this concept, the word complexity, at least conceptually, should not be that complex (Kogut, 2007; Milgate, 2001). Complexity is usually something where we know it when we see it. The sidebar titled “Where do we see Complexity?” provides a diverse set of examples that show the many faces of complexity.

[Insert sidebar—Where do we see Complexity? about here]

The issue is not necessarily whether something is complex or not but rather at what point does something cross a threshold and become excessively complex. A comparison to cholesterol is one way to think about this topic. The human body has good and bad cholesterol, and even the bad cholesterol is tolerable until it reaches a certain level. Complexity is much the same way. Companies that understand how to manage certain kinds of complexity can use it to gain competitive advantage. Others are simply overwhelmed by it.
McKinsey researchers, who have studied the topic of complexity probably as much as anybody, have concluded that two broad categories of complexity exist. The first category, *institutional complexity*, stems from strategic choices, the external context (such as regulations), and from major choices about organizational and operating systems (Haywood, Spungin, & Turnbull, 2007). The second major category is *individual complexity*. Individual complexity deals with how hard it is for employees to perform their jobs. Employee role ambiguities, conflict, administrative burdens, duplicate roles, and ill-defined processes all contribute to individual complexity.

Some have argued persuasively that organizations that learn how to manage and exploit institutional complexity can generate additional sources of profit and gain competitive advantage. When managed well, complexity can also increase corporate resilience by enhancing the ability to adapt to change. On the individual side, McKinsey research has determined that companies reporting the lowest levels of individual complexity have higher returns on capital employed and returns on invested capital compared with companies that indicate high individual complexity (Birkinshaw and Haywood, 2010).

Offshore oil exploration in the Gulf of Mexico provides an ideal example of managing institutional complexity. It became obvious that following the 2010 explosion at BP’s Macondo well an array of new and complex regulations would emerge addressing offshore drilling safety. And, that is exactly what happened. Some observers predicted that drilling in the Gulf of Mexico would not recover for years, if ever. But that does not seem to be the case. In the words of one analyst, “Bottom-line, Gulf of Mexico oil production is in considerably better
shape than even the most ardent optimists envisioned following Macondo (Fowler, 2012).”

Part of the reason for this optimism is the oil industry says it is learning to live with the stricter safety oversight and slower permit reviews that resulted from the catastrophe. Estimates indicate that by 2022 oil output from the Gulf of Mexico will be almost 30% higher compared with recent levels, much of it due to increases from deep water wells. Learning to manage institutional complexity can create competitive strength. Complexity at the individual level is not so easy to overcome.

A second example of managing institutional complexity comes from the retail world, where something called omni-channels is suddenly big news. Major retailers such as Toys ‘R’ Us and Wal-Mart are turning its stores into order-fulfillment centers where workers pick and ship online consumer orders, part of a complicated plan to grow their business. While filling online orders from stores instead of distribution centers adds channel complexity, these retailers expect to gain a competitive edge over online-only rivals by providing customers with greater ordering flexibility and service while offering the retailer an opportunity to better manage its inventory, service levels, and order delivery times (Zimmerman, 2012).

WHY COMPLEXITY IS (USUALLY) BAD

It is not that hard to identify negative outcomes associated with excessive complexity. What are the effects on individuals, including personal frustration and declining morale, when jobs are excessively complex? How much time, overhead, and transactions costs are committed to managing a supplier base that is simply too large and cumbersome? Or, what are
the effects when new products are over designed? An overly complex product or business
process usually brings with it an impressive list of less than desirable outcomes that make life
more complex.

[Insert Sidebar—How Complexity Affects Quality about here]

Few would argue with the notion that complexity usually increases business costs. A
cost that is associated with complexity, and one that is rarely discussed much less calculated, is
complexity’s opportunity cost. Employees who deal with the effects of complexity simply are
not able to focus their attention toward more productive pursuits. Unfortunately, economists
have yet to develop a way to calculate a “complexity tax.” And, it is somewhat futile to argue
that cost accounting systems provide much help here. Not surprisingly, we have yet to see any
key indicators that adequately address organizational complexity.

It should also be evident to most observers that complexity works against speed and
flexibility, two attributes that increasingly define world-class companies. Without question the
way that companies compete today is different than just a few years ago. Characteristics such
as speed and flexibility (what some call dexterity) are becoming as important to competitive
success as quality and cost. It should be intuitive that excessive complexity creates barriers to
achieving these important capabilities.

Even after conceding that certain types of complexity are a natural part of the business
landscape, it is safe to conclude that other types of complexity should not be a welcome
outcome. The one perspective we should all share is that at some point unwelcome complexity
increases costs and affects organizational performance, often with no corresponding financial
return. And higher costs and diminished performance elevate the risk that a company will no longer remain competitive.

**HOW ORGANIZATIONS BECOME COMPLEX**

Most executives understand that complexity is not something that is in short supply. And, most realize that much of the complexity we see across organizations is self-inflicted. This is ironic given that no company has a stated objective of becoming unnecessarily complex. For a variety of reasons, however, complexity is often the state that we find ourselves.

While complexity within an organization can grow quickly, it often evolves at a pace that ensures it does not draw any unusual attention. The tendency to become more complex over time represents “complexity creep.” This makes the battle against complexity almost always a reactive one. At some point the realization becomes clear that steps have to be taken to regain control, if not the risk of being overwhelmed by complexity starts to become very real. The following reasons, while certainly not exhaustive provide some insight into how organizations become complex. The root causes of complexity are widespread.

**Engineers Gone Wild.** One of the most visible sources of complexity involves products that are overdesigned by engineers. Overdesign may mean a product has too many components, more features than what the customer wants or can use, or are overly complex to produce or distribute. Failing to check whether a previous component is available for reuse, using custom designed components when standard components would satisfy, or failing to
leverage commonalities across product platforms can also contribute to excessive product and supply chain complexity. It is not that engineers necessarily endorse complexity. They simply tend to treat product designs as an opportunity to create the next big thing.

**Marketers Gone Wild.** Product proliferation has clearly resulted in a large increase in SKU’s moving through supply chains. With product proliferation a company has made a conscious decision to extend its brand offerings or develop entirely new products to attract more customers. While new products and product extensions hopefully create market excitement and growth, there is no question they also lead to greater business complexity.

**More Efficient Product Development Processes.** Although it may seem counter-intuitive, complexity can also be a consequence of faster and more efficient product development. While shorter development times, on average, are good, an interesting consequence of improved product development processes is the ability to introduce more new products using few, if any additional resources. And, more new products mean additional complexity. As product development becomes more efficient, the complexity related to product proliferation often increases.

**Lack of Process Thinkers and Ill-Defined Processes.** A process is a set of interrelated tasks or activities designed to achieve a specific objective or outcome. Even though this is a straightforward idea, organizations often suffer from a shortage of process thinkers because most individuals are trained to think functionally and to focus on specific tasks. Unfortunately, most organizational processes cross functional boundaries. Complexity arises when individuals try to optimize their work within a process they do not understand or cannot conceptualize.
Even those individuals who understand processes sometimes fall into the same trap as engineers. They tend to over-engineer a process rather than simplify it.

**Strategic Choices.** Some organizations simply choose to be complex. They make strategic choices about introducing new product lines or expanding into new geographic regions. No one would dispute that FedEx is a more complex organization today compared to when it served only the U.S. market. Expansion brings complexity, and that’s the way it will always be. Successful companies learn how to manage the institutional complexity that results from strategic choices.

**Continuous Reorganizations and New Programs.** Continuously reorganizing the corporate governance structure or introducing new programs is often seen as a way to show visible progress toward some real or perceived challenge. Continuous reorganizations, however, also can lead to chaos, confusion, and complexity. The same is true about new programs. It seems like every challenge can be overcome with a program that has a clever acronym. Programs to improve quality, reduce costs, improve customer satisfaction, enhance supplier relationships, promote diversity, or improve employee morale and retention are constantly being added, revised, and sometimes deleted. A constant churning of programs breeds not only complexity; it also breeds cynicism.

**Bureaucracy.** Bureaucracies are systems of administration characterized by red tape and a proliferation of rules, procedures, and positions. It would be hard to argue that bureaucracies are not complex. They notoriously stifle innovation, lengthen decision making times, and erect barriers to change. Being referred to as a bureaucrat, at least in most circles, is
not a compliment. While we often think that bureaucracy relates to government, corporate structure and governance, particularly at larger corporations, can rival some of the worst public bureaucracies.

Most individuals find bureaucracies to be frustrating and stifling to their individual goals. Tim Cook, the CEO of Apple summarizes his views regarding bureaucracy clearly when he said,

“No bureaucracy. We want a fast-moving, agile company where there are no politics, no agenda. When you do that, things become pretty simple. You don’t have all of these things that companies generally worry about. You don’t have silos built up where everybody is trying to optimize their silo and figuring out how to grab turf. It makes all of our jobs easier so we’re freed up to focus on the things that truly matter (Tyrangiel, 2012).”

**Mergers and Acquisitions.** Probably the quickest way to create complexity, not to mention anxiety and role confusion, is through mergers and acquisitions. The M&A process almost always features a complex set of legal and financial issues. After the ink is dry on an agreement it becomes evident how much duplication, overlap, and even conflict exists between the combined entities, a complexity that does not go away simply because the legal part of the process is complete. When brought together organizations bring different cultures, systems, policies, procedures, suppliers, customers, employee contracts, and part numbering schemes, something United and Continental Airlines discovered firsthand after a less-than-stellar merger. Some companies, such as Oracle, have created competitive advantage by assimilating newly acquired companies quickly into the corporate portfolio. Mastering the complexity brought about by mergers and acquisitions is an example of managing complexity to create a business advantage.
**Complexity Equals Job Security.** It should come as no surprise that some individuals, and even organizations, have a vested interest in keeping complexity alive and well. Some will fight vigorously against anything that seeks to make life simpler. We all know someone who works hard to protect the status quo by resisting even the most reasonable change. These individuals may earn their living formulating or enforcing the many rules, policies, laws, and regulations that others must follow. Or perhaps they earn their living managing supply chains that probably should not be as complex as they have become. What would happen to accountants and IRS personnel if tax returns were simplified to one-page? We have complexity because some people want complexity—they owe their livelihood to it.

**Complacency.** At some point corporations, particularly larger ones commit a sin that brings forth a swift and painful decline. That sin is complacency, which reflects a high level of self-satisfaction with the status quo, often with an unawareness of actual dangers or deficiencies. Complacent organizations have no idea of the costs, dangers, or deficiencies associated with being overly complex, nor do they probably care, at least in the short run. A lack of urgency leads these organizations to ignore the subject until it is far too late.

**Let’s Go Global.** Statistics showing a steady growth in international commerce over the last 25 years are impossible to refute. While most international decisions likely reflect sound courses of action, something that is often overlooked is the impact these decisions have on business operations. Figure 1 illustrates the logistical issues that arise when doing business on a worldwide basis, issues that require time and resources to manage. Unfortunately, few
companies fully account for the total costs of logistical complexity when making global decisions.

[Insert Figure 1 about here]

Other areas where complexity may arise because of worldwide networks include working across different cultures, language and communication barriers, different legal systems, time differences, unreliable information, countertrade demands, a total landed cost that never equals the unit cost of what is being purchased, and increased risk management requirements, particularly regarding the protection of intellectual property and currency fluctuations. Globalization brings with it no shortage of issues to manage, which drives increased complexity. Some observers argue that a fair portion of the increased risk and complexity faced by businesses today are largely a result of globalization.

**Increased Oversight and Regulation.** The last eight years has featured the issuance of thousands of new regulatory edicts and laws. New laws and regulations such as Dodd-Frank, conflict mineral rules; the pending Food Safety Modernization Act; assorted transportation anti-terror Acts; anti-slavery laws out of Great Britain; catastrophes leading to new regulations (such as Gulf of Mexico oil explosion); and numerous rulings by entities such as the National Labor Relations Board and the Environmental Protection Agency have combined to make business a much more complicated endeavor. Needless to say, it is safe to say that few regulations have been eliminated during this period. It is also safe to say that those who make these new regulations are not the ones that have to live by them.
APPROACHES FOR BATTLING COMPLEXITY

In some ways the battle against complexity represents a logical progression after lean, which is a mature concept that is often applied far too narrowly. Most sources address complexity by putting forth general rather than specific approaches for tackling this issue. While these approaches are well and good, they are insufficient in the battle against business complexity. In a business context, complexity management deals with eliminating bad complexity while exploiting the kinds of complexity that can lead to a competitive advantage. The first step in battling complexity is recognizing that complexity exists and that it must be managed. Fortunately, some powerful remedies exist for addressing complexity once a firm moves past the awareness stage.

*Simplify Product Designs.* Simplified product designs offer one of the fastest ways to eliminate business complexity. Besides the reduced cost and many supply chain benefits that accrue from simplified product designs (recall the sidebar on the quality benefit of simplifying product designs), the bottom line is that customers appreciate the virtue of simplicity. Although it has been an electronic eternity since Apple introduced the iPhone, the iPhone has remained a hot-selling item. Besides being “cool,” some analysts attribute part of the product’s success to the simplicity of its design and use.

Product design is the time to think about simplification. Industry leaders understand the power of the product development process to satisfy some important objectives. Pre-design objectives can involve setting targets for quality, reliability, serviceability, sustainability, end-of-life recycling, target cost, assembly, cycle time, and simplicity of design and use. The
concept phase of product development is also the time to think about how to tackle overly complex designs and production processes.

**Standardize and Reuse Components.** Few supply managers would dispute the notion that custom designed components almost always cost more than standardized components. And, customized components are often not as readily available when demand patterns shift abruptly. Customized components are usually provided by a limited number of suppliers (often one) that may be unable to respond when market conditions change. Related to the idea of standardized components is the reuse of components. Reuse means using a component that is available from a previous design.

As with product simplification, a way to address the complexity that comes with over-customization is to make standardization and reuse key objectives during product design. A word of caution, however, is required here. Excessive use of standard and reused components creates a risk that customers will not be able to differentiate a new product from a previous product, or one product line from another. As an automotive design engineer noted during a research interview, “If a customer feels it, touches it, sees it, or smells it then it better look new and improved. And it better not look like what we have already designed or like our other new models.”

**Become More Rational.** Rationalization is the continuous process of determining the right mix and number of something to maintain. It is a powerful concept that has wide application across every part of a value chain. It is also a concept that offers one of the best ways to battle complexity. While rationalization should be of ongoing interest, it is usually of
most interest when executive leaders finally realize they have too many of something. Procter and Gamble, for example, announced its desire to eliminate 20,000 suppliers from its worldwide supply base and reduce the number of distribution centers it maintains from 400 to 200 (Teague, 2008). At some point the marginal cost of one more of something outweighs the marginal contribution of that next “something.”

Areas where companies should continuously evaluate the right mix and number of something to maintain include the supply base; component SKU’s; product lines and product features; customers; contracts; retail outlets; distribution centers; production sites; and engineering centers. Figure 2 identifies the variety of advantages from maintaining a supply base that has been rationalized to a manageable level. The rationalization process almost always offers a range of benefits that reduce complexity, many of which are overlooked.

[Insert Figure 2 about here]

**Use Information Technology.** We often take for granted the use of information technology (IT) to make life less complex. Whether we bank online, use ATM machines to get cash, renew library books, shop for the holidays, renew prescriptions over the Internet, or rely on powerful search engines to find information, the use of IT grows daily. Amazon’s one-click feature is a perfect example of removing transaction complexity from the online buying experience.

Whether stated or not, most IT applications are designed to remove, simplify, and streamline transactions. They also make the transfer of data from one system to another seamless while making information more transparent. Given that IT is a complexity killer,
organizations will continue to be relentless in their search for IT applications that simplify business applications. Information technology supports something that we call “complexity transfer.” Systems rather than the users assume the complexity.

One area where businesses still spend too much effort involves the purchase of insignificant items. These items create work that detracts from the time that could be spent on more important activities. Progressive organizations provide internal users with the IT applications that seamlessly manage minor items. Examples of these applications include procurement cards issued to internal users; systems that allow users to issue low-dollar material releases directly to suppliers; online supplier catalogues with ordering capability; electronic purchase orders issued directly to suppliers; electronic purchase requisitions from users to procurement; electronic funds transfers; and electronic data interchange to manage transactions. The battle against complexity demands the reduction of non-value added transactions, particularly for less important items.

**Standardize and Redesign Processes.** Process development and redesign efforts should have the removal of waste and complexity as a primary objective. Process modeling using ANSI symbols and value stream mapping are two recommended approaches when standardizing and redesigning work processes. Once an organization is able to conceptualize itself in terms of its core processes, steps can be taken to ensure those processes are efficient, effective, and consistent across operating units.

A center-led group should assume responsibility for designing processes that build in best practices and eliminate duplicate effort. It is hard to justify having every work center
develop essentially its own set of processes. The complexity that results from sub-optimal processes and duplication should not be a source of pride. Unfortunately, some interpret this to mean that every location or group must conform to a narrowly defined process with no deviation or flexibility allowed. Standard processes should provide a best-practice framework or platform that allows modifications where necessary, particularly when working across different geographic locations.

**Streamline the Legal Review Process.** If your legal department is a source of frustration and complexity, welcome to a group that has quite a few members. This frustration is often due to a contract review process that can often take months rather than days. For whatever reason, the legal review process for contracts is often excessively complex. At a leading logistics company supply managers were dismayed to find the longer-term agreements they negotiated with suppliers take months to work their way through the legal review process. They were more dismayed to see nine months of contract benefits unrealized as original contract terms remained in place.

Streamlining the review process can happen in a number of ways. One way is to create contracts that are not overly complex. Most suppliers do not appreciate 50-page contractual agreements. While he was at IBM, the late Gene Richter (IBM’s chief procurement officer) reduced contracts from 40 pages on average to six pages. He understood well the need to reduce contract complexity. Another approach involves the use of preapproved contract language. Instead of reviewing an entire contract, lawyers review and initial only the changes that are made during contract negotiations. The legal department can also designate a
representative to review contracts, presumably resulting in better response times. Finally, metrics can be compiled that track review times. The point here is that various methods exist to take complexity out of the legal review process.

**Survey Stakeholders.** One way to identify where complexity exists is to ask stakeholders directly. Try asking suppliers, customers, and employees directly if your company is doing anything that makes their life unnecessarily complex. With online survey technology readily available the barriers to using these surveys are low. Is it possible that your material planners change release quantities to suppliers right up to their delivery due date? Does your company have an online ordering system that confuses customers? Are employees frustrated over how to enroll in a benefits program? A recent survey conducted on behalf of two OEM’s asked suppliers what these OEM’s were doing to make their relationship with suppliers overly complex. Suppliers provided dozens of responses that offered opportunities to reduce business complexity. If suppliers, customers, and employees take the time to provide feedback, then the requestor must ensure that feedback is reviewed and acted upon where necessary.

**Modify the Organizational Design.** Organizational design involves assessing and selecting the structures and formal systems of communication, division of labor, coordination, control, authority, and responsibility for achieving an organization’s goals and objectives (Hamel & Prahalad, 1994). We often overlook the fact that various design features can directly reduce organizational complexity. Research findings are clear that early supplier involvement on product design teams, for example, helps avoid complex rework as products move through the design process. Co-location models simplify patterns of communication as support personnel
work in close proximity to their internal and sometimes external customers. And, cross-functional teams bring different perspectives together to make important decisions, usually enhancing the decision-making process.

An example of using organizational design to address complexity can be found at Boeing. The company has 9,000 employees outside the U.S. based in 70 countries that face challenges daily involving the laws, regulations, and customs of individual countries and jurisdictions (Seil, 2013). Boeing has created five regional teams to support individual sites and business units. The purpose of these teams is to serve as “one-stop shops” to support Boeing business units as they operate internationally. Previously, each site or unit was forced to navigate some very complex issues on its own. Now, regional teams, acting much like Centers of Excellence, provide expert support to these locations. Boeing is using its organizational design to minimize the complexities of international business.

**Empower Employees.** To empower means to give an individual or team authority or legitimate power. What most managers fail to recognize is that a failure to empower a team or individual to perform basic tasks or make decisions (up to a point) usually leads to individual complexity. A newly-hired MBA at a global manufacturer was surprised to find, for example, that he could not organize a meeting without going through a cumbersome process to obtain a manager’s signature. Unauthorized meetings of non-managers violated company policy (Ryan, 2010). Treating competent adults like untrustworthy children likely ensures these individuals will not stay too long.
Various types of authority relate to self-directed and self-managed work teams, a featured part of organizations whose use is almost ubiquitous today. Figure 3 defines four kinds of work team authority. After reviewing these it should come as no surprise that granting various kinds of authority to individuals and work teams should streamline the decision-making process, something that supports reduced complexity.

[Insert Figure 3 about here]

**Develop Simple Rules.** A body of research is emerging that counters the notion that complex algorithms and models are always more effective than simple rules of thumb or guidelines when making organizational decisions. Furthermore, a hypothesis put forward is that complex situations create so many possible courses of action that individuals become confounded, often to the point where they delay decisions, default to the safest option, or avoid making choices altogether. Research suggests that simple rules equal, and at times exceed the effectiveness of more complicated analyses across a range of decision areas. Simple rules are most useful when the challenge is not to perform a process repeatedly and efficiently, but rather when a need exists to adapt quickly to changing circumstances (Sull and Eisenhardt, 2012). While the analysis and data that lead to the rules may be sophisticated, and at times will even be complex, the resulting rules should be elegant in their simplicity as they provide guidance to users.

An example of simple rules involves the retailer Zara, a company that is synonymous with fast fashion. Since its inception the company's founder, now the world's third-richest person, has insisted the retailer always follow two simple rules—inventory at stores must be
replenished twice a week and stores must receive their orders within 48 hours (Walt, 2013). These simple rules are strictly adhered to even as the retailer expands globally, thereby influencing the design and placement of Zara’s production facilities.

The ideas put forth here for battling complexity are varied and specific. While part of addressing any problem is recognizing that a problem exists, the other part is understanding how to deal with that problem. Fortunately, relatively low-cost ways exist to address complexity.

**CONCLUDING THOUGHTS**

Complexity is not something that goes away by itself. Unfortunately, we often fail to grasp the extent or seriousness of this concept. This is due partly to today’s accounting systems, which are incapable of capturing the true costs and impact of complexity. Complexity costs are scattered across different entities or buried within dozens of overhead accounts. Organizations that are serious about battling complexity will develop a set of measures that reflect their progress toward reducing complexity.

While it is often an inevitable outcome of business decisions, and there is no question that firms that learn how to manage certain kinds of complexity can gain an advantage over their less competent competitors, unnecessary complexity should not be an accepted part of today’s organization. If that is true, why is business complexity a way of life for so many organizations?
Sidebar: How Complexity Affects Quality

The effect of design complexity on quality provides perhaps the strongest argument for simplifying product designs. The case against product complexity is strong since it can be shown mathematically that overly complex designs affect product defect levels.

Assume a design team creates a product with seven components, each with an average reliability of 99%. The overall reliability of this product is \(0.99^7\), or 93%. This corresponds to a 70,000 part per million (ppm) defect level (7% defects per one million opportunities). Next, a design simplification project eliminates the need for two of the components, making the overall reliability \(0.99^5\), or 95%. A new predicted defect level of 50,000 ppm defects represents almost a 30% reduction from the original defect level. Further assume that another improvement project increases the average reliability of each component to \(0.995\). The overall reliability now becomes \(0.995^5\), or 97.5%. This further reduces the ppm defect level to 25,000 ppm. These numbers, which are nowhere near Six Sigma levels, are used to show how complexity in product design mathematically leads to higher predicted defect levels. More components, which results in not only more defects but also greater supply chain complexity, create more opportunities for error.

Sidebar: Where Do We See Complexity? Just about Everywhere!

Identifying examples of excessive complexity is, unfortunately, not hard to do. Consider the following examples:

- A simple sounding proposal to begin collecting state sales tax on online purchases is not all that simple. At Overstock.com it took a team of 20-30 experienced IT professionals 9,142 hours over five months to install, test, and integrate the software that let the company properly calculate use tax in one additional state (Byrne & Johnson, 2012).
- The merger between United and Continental Airlines still presents challenges years after it was announced. In technology alone, the two carriers had 1,400 separate systems, programs, and protocols. Workers were also represented by different unions with dissimilar work rules. It required almost a year of study, with limited success, to arrive at a single coffee to serve on the combined airline (Credeur, 2011).
- A study of overlapping and duplicative federal U.S. programs revealed the U.S. government has 15 different agencies overseeing food safety laws, more than 20 separate programs to help the homeless, 80 programs for economic development, 82
programs to improve teacher quality, 47 programs for job training and employment, and 56 programs to help people understand their finances (Paletta, 2011).

- Spire, LLC, which tracks shopping data from more than 30 million U.S. households, reported in 2011 that U.S. consumers could select from 352 distinct types and sizes of toothpaste at retail outlets. The good news is this figure is down from 412 in 2008 (Byron, 2011).

- Before undergoing a supply chain redesign, 3M’s picture hanging hooks, a relatively simple product made of plastic and strips of sticky foam, were part of a production process that, over 100 days, meandered more than 1,300 miles through four factories in four states. Prior to his retirement, 3M’s CEO waged an active battle against supply chain complexity, referring to these convoluted travels as “hairballs” (Hagertry, 2012).

- Hostess, the now-closed maker of such well-known brands as Wonder Bread and Twinkies, made its final trip into bankruptcy in 2012. The heavily unionized company ended life with 36 plants and more than 500 distribution centers across the U.S., 372 collective-bargaining agreements, a dozen separate unions, several billion dollars in unfunded pension liabilities, 5,500 sometimes duplicative delivery routes, and 40 multi-employer pension plans (Kaplan, 2012).

- A number of years ago a fire destroyed the sole Japanese supplier that provided a critical P-valve brake part to Toyota. During the recovery from the fire Toyota’s engineers came to realize that over time they had designed 200 P-valve variations, many of which had complex tapered orifices that required highly customized jigs and drills. This made the recovery from the fire even more challenging.

REFERENCES


Kaplan, D.A. (July 2, 2012). Hostess is bankrupt...again. Fortune, 166(3), 63.


International Logistics and Business Complexity

Figure 1

Different shipping terms (Incoterms versus U.C.C. terms)

Longer material pipelines in distance and time

Delivery variability

Increased risk (damage, theft, currency, intellectual property)

Increased use of agents and other third parties

Reduced ability to plan due to longer ordering cycle times

Increase in supply chain “touch” points, handlers, and transportation modes

Benefits of Fewer Suppliers

Figure 2

- Fewer contracts or purchase orders to negotiate and write
- Fewer material releases and receipts
- Less effort expended to process and handle material receipts
- Easier material traceability
- Better communication and relationships with suppliers that support value-adding activities
- More attention given to supplier selection, thereby improving the effectiveness of that process

- Lower purchase prices due to leveraging of volumes with fewer suppliers
- Fewer supplier performance reports or scorecards to issue
- Fewer supplier performance review meetings
- Fewer Requests for Quotations or Proposals to manage
- Improved supply base performance as lower performers are removed from the base
- Fewer accounts payable transactions
## Work Team Authority

**Figure 3**

<table>
<thead>
<tr>
<th>Authority</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Scheduling Authority</strong></td>
<td>Ability of a team to schedule its meeting without others approving the decision.</td>
</tr>
<tr>
<td><strong>Selection Authority</strong></td>
<td>Ability of a team to select members or as-needed support as required.</td>
</tr>
<tr>
<td><strong>Internal Authority</strong></td>
<td>Ability of a team to control internal activities, including allocating budget and resources, determining performance goals, and making timing decisions regarding the completion of activities.</td>
</tr>
<tr>
<td><strong>External Decision-Making Authority</strong></td>
<td>Ability of a team to make decisions that bind or commit an organization, thereby allowing a team to operate independently of external managers.</td>
</tr>
</tbody>
</table>