

## Communications of the Association for Information Systems

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Volume 30

Article 7

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4-2012

# The Adoption of Generative Customization as an Innovation Strategy in the U.S. Smartphone Market: A Case Study

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### Recommended Citation

Buffington, Jack and McCubbrey, Donald (2012) "The Adoption of Generative Customization as an Innovation Strategy in the U.S. Smartphone Market: A Case Study," *Communications of the Association for Information Systems*: Vol. 30 , Article 7.

DOI: 10.17705/1CAIS.03007

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# Communications of the Association for Information Systems

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## The Adoption of Generative Customization as an Innovation Strategy in the U.S. Smartphone Market: A Case Study

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### Abstract:

With the pace of change and adoption of new products continuing to escalate, even leading edge companies are facing challenges in retaining market leadership. In this case study, the frustration of a talented product designer for a U.S. leader in Smartphone technology leads to bigger questions about his firm's willingness and ability to adopt a new IT-enabled innovation in product design and generative customization. He enlists the aid of an IT support analyst to help convince his organization to consider this new approach to extend and expand the company's existing significant sales growth and market dominance in an increasingly competitive environment. The company must also understand the impact on product design of human cognitive creativity leveraged by an emerging technology, the viability of its closed system model of innovation, and the organizational challenges associated with market volatility and innovation.

**Keywords:** generative customization, discontinuous innovation, teaching case

**Editor's Note:** A teaching note for this case can be obtained from [john.buffington@ltu.se](mailto:john.buffington@ltu.se). Only active faculty who are currently listed in the AIS Faculty Directory are eligible to receive the teaching note.

Volume 30, Article 7, pp. 101-110, April 2012

The manuscript was received 7/22/2010 and was with the authors 3 months for 2 revisions.

## I. INTRODUCTION

Wayne Halverson, the top product designer for one of the *Big Five* Smartphone platform providers in the U.S. market (Apple, BlackBerry, Google, Microsoft, and Simian/Nokia) sent an e-mail to Anthony Chan, an Information Technology (IT) support analyst for Wayne's product line, requesting to meet at a local pub to "discuss business," with no more description regarding the topic. Anthony was surprised to get this e-mail from Wayne, the company's superstar product designer, the top creative mind behind the company's new Smartphone products, which have been responsible for the company's dynamic growth and reputation as an industry innovator. Being the top IT support person for Wayne's product line, Anthony is sometimes invited to product design meetings, but often it is to do nothing more than consult on technical problems, such as operating system glitches, that interface with the products. Anthony was understandably nervous and excited when he got the e-mail invitation from Wayne requesting an offsite meeting.

When Anthony arrived at the pub, Wayne, already sitting at a small table, waved him over. Before Anthony could even sit down, Wayne offered to buy him a beer and made a joke about them being seen together, and how unusual everyone would think that would be. Anthony admittedly did not understand the unique world of product designers, so he was concerned about the discussion. "What's wrong with the company, Wayne? Do you know something that I don't?" "Oh, don't worry, Anthony, there's nothing wrong at all, nothing," Wayne chuckled as he noted, "at least not now." Realizing that a beer would help ease the communication gap between the outgoing and creative product manager and introverted and detailed IT architect, Wayne ordered two beers, and the two started their discussion.

Without much small talk, Wayne immediately began to express his concerns: one, his market researchers found that competitors were replicating Wayne's Smartphone designs in increasingly shorter time windows, and this was leading to tension between Wayne's unit and Stacey Knox, Vice President of Development. "She does not understand what is happening in the market or how the product design process works," Wayne said. "Despite the sales growth we see today in our new Smartphone designs, I don't see how we can keep pace with how quickly the competition catches up, and if a product designer can't keep innovating..." All of a sudden Wayne stopped. "I just don't see how we *can* keep up," he blurted. Anthony was shocked—here was the point person for the company's successful *auteur* approach to product design, responsible for its fastest growing product, feeling vulnerable regarding the company's critical Smartphone market! And Anthony still wasn't sure of why Wayne was confiding this to him, since they really weren't close colleagues. After awhile, Wayne started to realize that talking to Anthony about this was perhaps not a good idea, given Anthony's nervousness and lack of a response, so he slowly changed the topic and eventually found a reason to have to leave. Once Wayne left, Anthony sat at the table reflecting on what had just happened and unsure about all of it. Wayne, on the other hand, left feeling burdened with the feeling of being squeezed between the constant need for creativity and the slowness with which large corporations moved.

## II. CASE STUDY

### The U.S. Smartphone Market

A Smartphone is "a cellular telephone with built-in applications and Internet access. Smartphones provide digital voice service as well as text messaging, e-mail, Web browsing, still and video cameras, MP3 player and video viewing. In addition to their built-in functions, smartphones can run myriad applications, turning the once single-minded cellphone into a mobile computer" [PCMag, 2011]. A measurement firm, comScore, estimates that 63.2 million people in the U.S. owned a smartphone device during the last quarter of 2010, compared with around 38.7 million in the final three months of 2009 [Marshall, 2011]. The fact that Smartphones comprise only 20 percent of the mobile phone market in the U.S. points to a great growth opportunity, together with the projection that, by 2011, as many Americans will own a Smartphone as own a feature phone, according to a Nielsen study released in March, 2010 [Nielsen 2010].

The *fuzziness* in the definition of a Smartphone has made it difficult to evaluate the performance of firms who participate in the U.S. market. In general, there are four aspects of the market that can be considered: device purchases, service subscriptions, diffusion of operating system (OS) platforms, and implementation of applications on an OS platform.

The first aspect is the market share of the original equipment manufacturers (OEMs), the producers of the devices themselves. As shown in Table 1, many of these manufacturers can be classified as traditional mobile phone

manufacturers, such as Nokia, Motorola, and Samsung. However, as shown in Table 2, a Smartphone does not appear able to be classified as a function of the device itself, but rather through its embedded operating system (OS).

Table 1: Top Mobile OEMs, comScore, June 2010			
Top Smartphone Platforms 3-month Avg. Ending Sept. 2010 vs. 3-month Avg. Ending June 2010 Total U.S. Smartphone Subscribers Ages 13+			
	Share (%) of Smartphone Subscribers		
	June 2010	Sept. 2010	Point Change
Total Smartphone Subscribers	100.0%	100.0%	N/A
RIM	40.1%	37.3%	-2.8
Apple	24.3%	24.3%	0.0
Google	14.9%	21.4%	6.5
Microsoft	12.8%	10.0%	-2.8
Palm	4.7%	4.2%	-0.5
Source: comScore MobiLens			

While Table 1 is a classification based on all mobile phone subscribers, Table 2 displays only Smartphone subscribers, as defined by the operating system being used, with no concern regarding specific features of the device itself. The widest used Smartphone platform in the U.S. is the RIM Blackberry, which is on a proprietary operating system, as is the case with the second largest, Apple, (running on an iOS, tied to the Mac OS system). While RIM and Apple are closed, proprietary systems, but with scalability in their OSs, Microsoft's Windows Mobile is losing market share, and is challenged (to say the least) to keep up with its competitors [Dignan, 2010]. The fourth largest operating system platform (at the time of the survey in use for this case) is the Google Android platform, which is Linux-based and open source. Furthermore, unlike the top two providers (RIM and Apple), Google Android is a key member of the *open handset alliance*, essentially making itself *device agnostic*. Most likely as a response to Google's open standards on mobile devices, the Symbian Foundation, the world's largest operating system platform in the world (330 million Symbian-based mobile devices) announced in February of 2010 that its system would be migrated to an open source platform.

Table 2: Smartphone Platform Market Share, comScore, February 2010			
Top Smartphone Platforms 3-month Avg. Ending Feb. 2010 vs. 3-month Avg. Ending Nov. 2009 Total U.S. Age 13+			
	Share (%) of Smartphone Subscribers		
	Nov. 2009	Feb. 2010	Point Change
Total Smartphone Subscribers	100.0%	100.0%	N/A
RIM	40.8%	42.1%	1.3
Apple	25.5%	25.4%	-0.1
Microsoft	19.1%	15.1%	-4.0
Google	3.8%	9.0%	5.2
Source: comScore MobiLens			

Table 3 presents a survey from comScore regarding how mobile subscribers are using their devices. While the most prevalent function being utilized on these devices can be best described as basic and not requiring Smartphone Afunctionality, the trend appears to be heading toward a greater utilization of Smartphone-type functionality. Along with Table 2, this presents high growth prospects for the Smartphone market in the United States.

### The Generative Customization Concept

Although Anthony did not want to disclose the nature of his meeting Wayne with his manager, Rahul Wadekar, or anyone else at the company, he did discuss it with Li Zhao, one of his closest business colleagues from graduate school and a successful tech entrepreneur. Li Zhao was planning to attend a *Product Design Innovation Conference* upcoming in two weeks in Istanbul, Turkey, and invited Anthony to attend as his guest. After gaining permission to attend the conference from Rahul, Anthony felt more comfortable, feeling that attending the conference would allow him to better understand Wayne's perspective on the market and the intense competitive pressure design was under in the Smartphone sector.



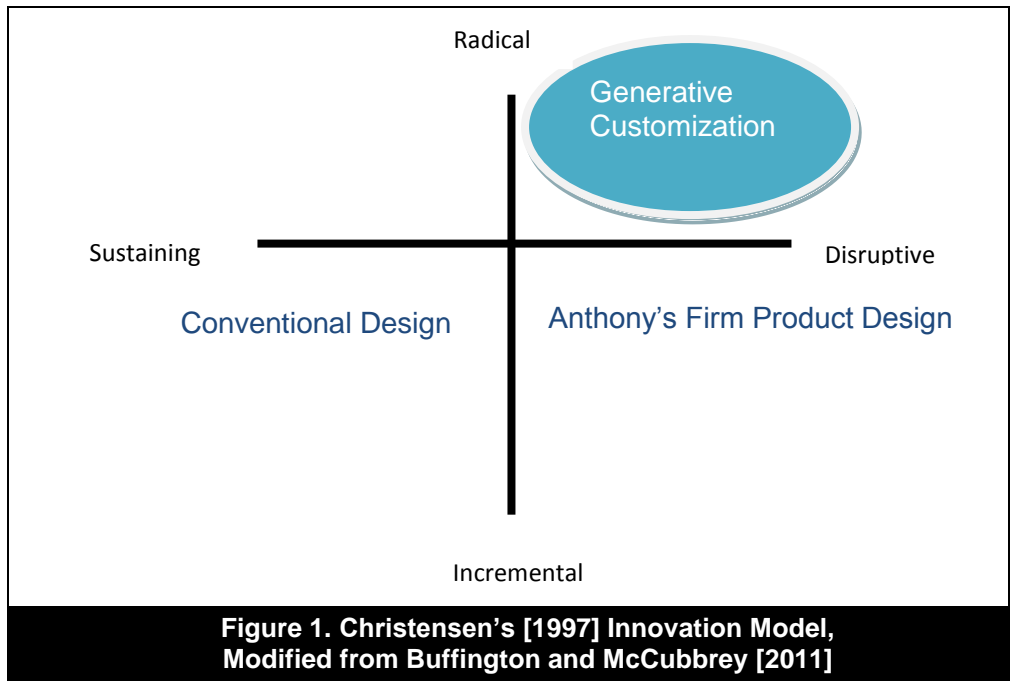
**Table 3: Smartphone Platform Market Share, comScore, February 2010**

Mobile Content Usage 3-month Avg. Ending Feb. 2010 vs. 3-month Avg. Ending Nov. 2009 Total U.S. Age 13+			
	Share (%) of U.S. Mobile Subscribers		
	Nov. 2009	Feb. 2010	Point Change
<i>Total Mobile Subscribers</i>	100.0%	100.0%	N/A
Sent text message to another phone	62.1%	64.0%	1.9
Used browser	27.0%	29.4%	2.4
Used Downloaded Apps	25.7%	27.5%	1.8
Played games	21.4%	21.9%	0.5
Accessed Social Networking Site or Blog	15.1%	18.0%	2.9
Listened to music on mobile phone	11.8%	13.1%	1.3

Source: comScore MobiLens

Beyond visiting with the exhibitors, Anthony sat in on a few conference sessions, one of which was conducted by a university-based researcher from Sweden, Johan Samuelson, who discussed an extension of Buffington and McCubbrey's [2011] concept of *generative customization*, a new product design approach that employed the use of complex adaptive system thinking, generative design techniques, and agent based modeling. While both Anthony and Li Zhao were well-versed in new technologies, neither of them had heard of generative customization and how it could assist in the product design, development, and fulfillment process. Johan's presentation included many examples of how the methodology could be used, including some from the consumer products industry. The concept of generative customization had an immediate appeal to Anthony, so he took the opportunity to introduce himself to Johan.

The next day, Johan and Anthony had an opportunity to discuss generative customization in more detail. First, Johan explained that generative customization is modeled as a *complex adaptive system* (CAS); therefore, it is more dynamic, flexible, and self-organizing than a conventional Stage Gate™ (linear model for new product development) approach. A deterministic and linear process cannot modify the role of principals (consumers) and agents (manufacturers, suppliers, retailers) to be adaptive, self-organizing, and dynamic around the nature of a product's requirements. As a result, generative customization is capable of creating discontinuous or radical innovation of product development and fulfillment, as shown in Figure 1.



Johan noted that Anthony's firm's approach to innovative product design, as shown in Figure 1, could never sustain a strategy of discontinuous innovation, as is more likely with generative customization. Anthony realized that Johan was addressing Wayne's concerns, i.e., not about Wayne's creative abilities to design, but rather his individual capability to sustain an advantage over competitors who were quickly replicating his creativity.

The difference, according to Johan, was the fusion of generative design principles, and agent based modeling computing power to enable the product designer to be even more creative than he/she already is. Johan briefly explained the concept of generative systems, as follows [McCormack et al., 2004]:

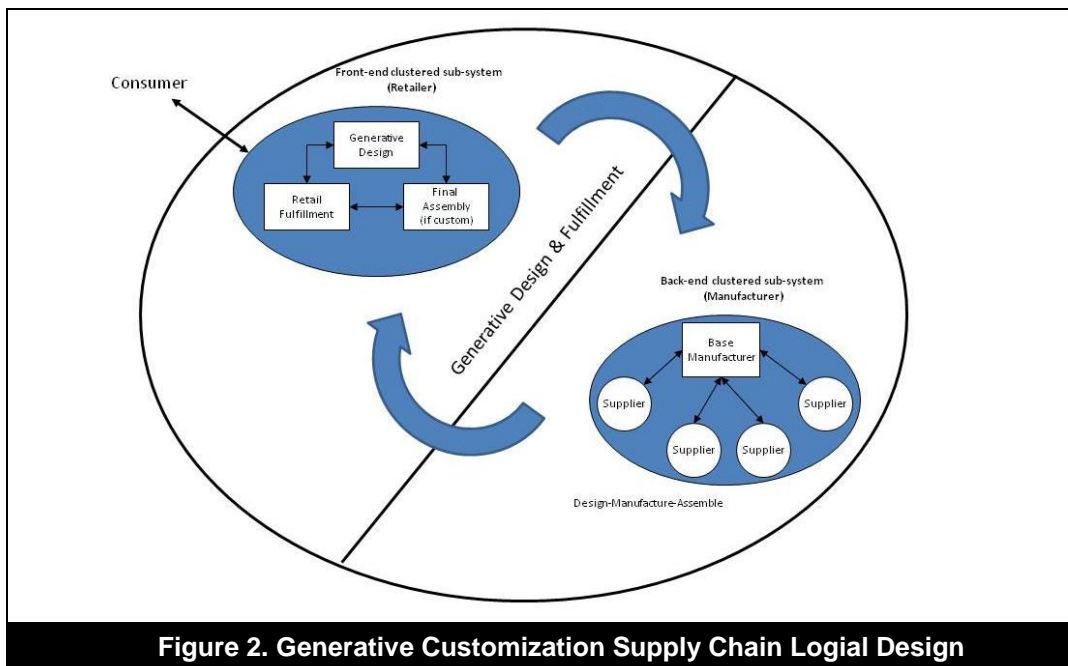
1. *The ability to generate complexity, defined as dynamic hierarchy. Interacting components generating innovations as a result.*
2. *In design, the ability to self-maintain and repair; human designed structures are brittle in the physical sense, whereas generative designs are adaptable.*
3. *The ability to generate novel structures, original and different from anything else before it.*

Through the use of generative design and an integrated generative customization system, humans can control intellectual forces many times more powerful than human minds to design and construct artifacts that would not otherwise exist [Stocking, 2009]. Johan gave examples of the use of generative design, including the innovative building designs from the Beijing 2008 Olympics (*Bird's Nest* and *Water Cube*), which would not have been possible through the use of conventional architectural design techniques. In these instances, designers were able to analyze and prototype thousands of alternatives, with incremental changes to design being relatively quick and inexpensive.

Further, Johan provided a chart (as shown in Table 4, from Avital and Te'eni, 2009) that articulated the paradigm shift between a conventional approach to product design and fulfillment (defined as operational efficiency) and generative capacity, which is the foundation of generative customization. Again, Anthony felt as if Johan was responding directly to the concerns that Wayne had brought to his attention!

Table 4: Operational Efficiency vs. Generative Capacity [Avital and Te'eni, 2009]		
Dimension	Operational Efficiency	Generative Capacity
<i>Cognitive Process</i>	<i>Convergent</i>	<i>Divergent</i>
<i>Nature of task</i>	<i>Low Ambiguity</i>	<i>High Ambiguity</i>
<i>Boundary of task</i>	<i>Restricted</i>	<i>Open-ended</i>
<i>Nature of outcome</i>	<i>Known in advance</i>	<i>Unknown, at least in part</i>
<i>Desired Action/Process</i>	<i>Follow procedure</i>	<i>Be creative, innovate</i>
<i>Orientation of outcome</i>	<i>Close gaps</i>	<i>Open gaps</i>
<i>Success criterion</i>	<i>Efficiency, accuracy, punctuality</i>	<i>Making a difference, rejuvenating</i>

A layout of the IT system design was helpful to Anthony as well. Figure 2 is a mock representation of the logical system design, showing the integration between the front-end (product design focused) and back-end (supply chain fulfillment focused), within and outside of the dominant firm. In this design, the creative component of the product design process is not separated from the supply chain fulfillment aspect; as Johan quoted Buffington and McCubbrey [2011], "a product invention is not an innovation until it is fulfilled."



**Figure 2. Generative Customization Supply Chain Logical Design**

Bridging his experience in IT solutions with a burgeoning understanding of a CAS IT system and generative design, Anthony began to think of the possibilities associated with such an open and adaptive system across a supply chain. In its most theoretical terms, Anthony saw the foundation of this issue to be an agency problem between the principal (consumer) and agents (producers/suppliers) in a supply chain system, as proposed by Eisenhardt [1989].

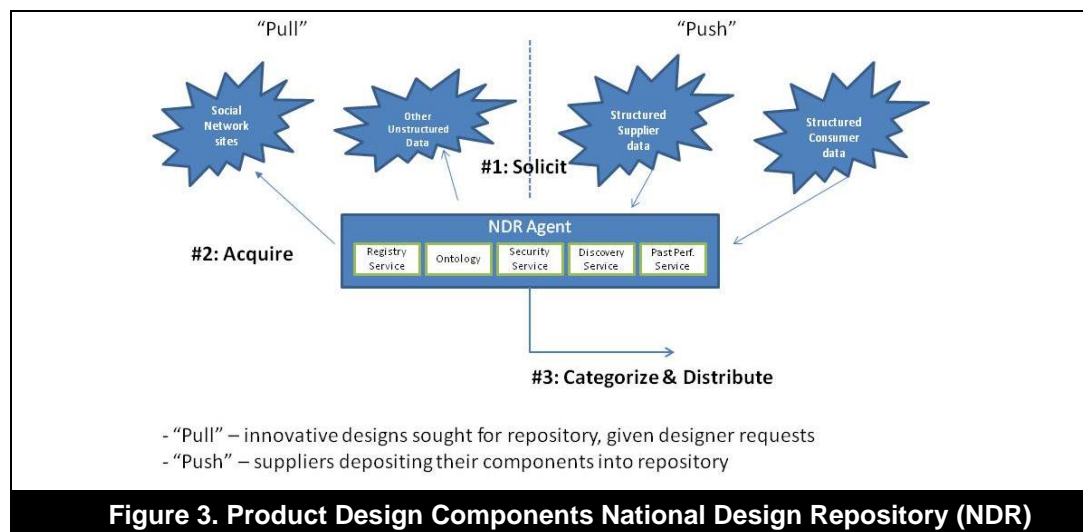
As successful as one designer (Wayne) could be, an *auteur design* approach solely from human cognition could never achieve the degree of innovation that an open system model including consumers and suppliers can become, if the right technology is in place to implement product design innovation into an efficient supply chain system.

Anthony could foresee a partnership between creative product designers, who would facilitate the process, and IT professionals, who would enable the integration and dynamic attributes associated with new technologies. He was beginning to realize how IT could enhance Wayne's creativity, not through displacing human involvement, but rather through massively leveraging it. After spending the balance of the next day speaking with Johan, Anthony solicited his help to develop an initial business case around generative customization to sell to his company, using the *technology acceptance model (TAM)* approach [Davis, 1989]. The greatest importance was given to the use of TAM in order to get Wayne to understand generative customization's *perceived usefulness* [Davis, 1989]. If Anthony could convince Wayne that generative customization would enhance his skills as a product designer, he and Johan could get funding for a pilot.

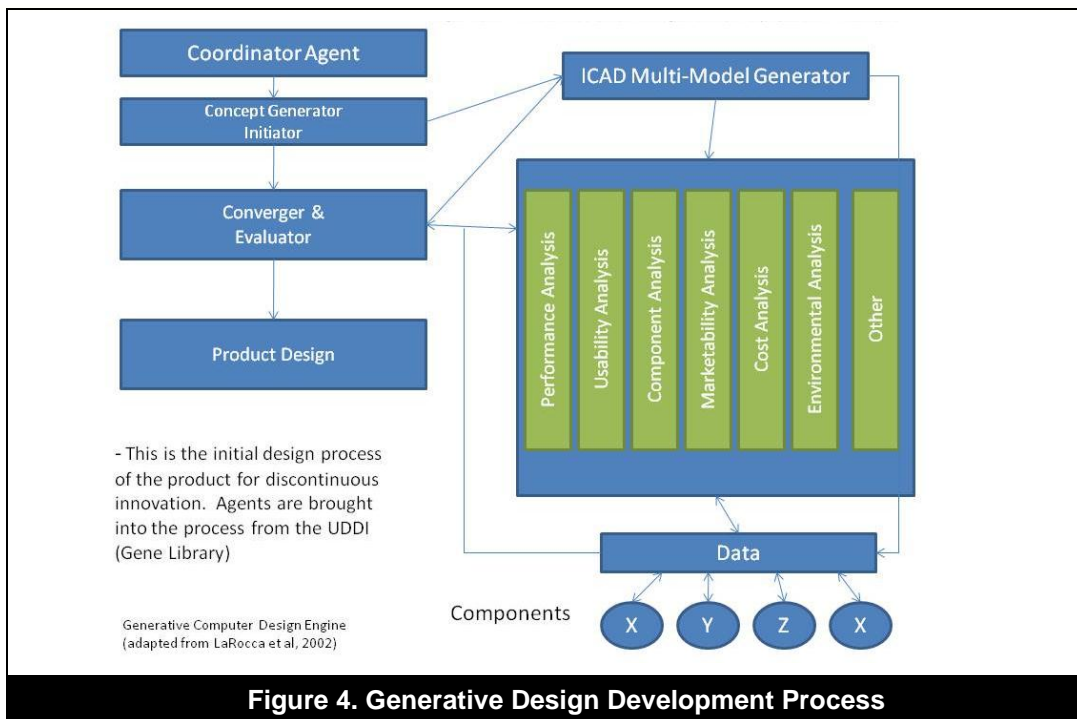
### The Business Case for Generative Customization

Even though Anthony was excited about the concept of generative customization, he was concerned that his boss (Rahul Wadekar) and Wayne's (Stacey Knox) would be reluctant to shift gears and lose focus in the midst of an existing product market achieving 38 percent sales growth, so Anthony believed that the idea was going to be a tough sell. He realized his only hope at gaining company support was in first gaining support from Wayne, who had expressed his deep frustration less than a month ago about the direction in which the company was heading. So first, Anthony and Johan focused on developing a high-level business case to convince Wayne that this was the right thing to do. After verifying that the five major operating system providers are responsible for 95 percent of the global market [Admob, 2010], Anthony felt that Wayne was right, and a bloodbath was about to begin. The thrust of the business case would have to be that now is the time to adopt an innovative approach to product design.

The problem, of course, was that Anthony was not sure how much Wayne would understand generative design, complex adaptive systems open, dynamic, nonlinear and self-organizing systems. Therefore, instead of articulating the IT system representations, as shown in Figures 3 and 4, Anthony and Johan would need to articulate how this approach would improve the role of the designer. One area that Anthony thought would be a bridge between IT and product design was in the use of software agents as an interactive element of design. The use of software agents in generative customization design enables a CAS design through the use of nonlinearity, autonomy, flexibility, and self-organization. A product component (or agent) solicited, acquired, categorized, and distributed into an open, central repository (a repository example, as shown in Figure 3) could become a gold mine for a product designer looking for new concepts and approaches to create discontinuous functionality for an existing product, particularly given access to social networks.



**Figure 3. Product Design Components National Design Repository (NDR)**



**Figure 4. Generative Design Development Process**

Figure 4 presents how the product designer will drive a discontinuous innovation process, harnessing the power of emerging technologies.

From their mock system prototype, Anthony and Johan developed the following design possibilities:

1. *Smartphone devices that changed form and function, devices that are radically different from an existing design (such as the iPad being radically different from the iPhone). Generative design methods create new designs, providing a global rather than local range of possibilities.*
2. *An operating system (OS) for a Smartphone device that allows the user to develop software applications, in addition to software developers, representing a new approach to consumer involvement in the production process.*
3. *Radically different applications that changed the nature of the device and OS, as opposed to vice-versa.*

While the balance of the system was related to the critical nature of supply chain fulfillment, Anthony and Johan decided to forgo explanation of this element of its design, other than to note that an adaptive and dynamic approach to integration and collaboration would allow innovative product designs to get developed, manufactured, and brought to market quickly and more efficiently.

### The Meeting

Both Anthony and Johan were excited about discussing the generative customization system business case and design with Wayne. Fully expecting the presentation to be about a CAD system replacement only, Wayne took it upon himself to not only invite Stacey to the meeting (to gain support in funding) in order to support the initiative, but also the rest of the design team as well. After learning that Wayne invited Stacey's entire team to the meeting, Anthony invited his boss Rahul. Anthony began to worry that presenting the concept to a larger group was not a good idea.

After having sat quietly and respectfully throughout the entire presentation, Wayne, Stacey and even Rahul surprised Anthony with the nature of their responses related to generative customization (modified from Krish, 2010 and generative design):

1. *"I'm skeptical of the role of computers in design."*
2. *"Our work processes are very personal and have been developed over a lifetime and not something to be messed with."*
3. *"Design is fun and enjoyable—there is no need to make it more efficient."*



4. "I fear that code-based design will end up continuing to create the same thing."
5. "Design requires thought" (not random numbers).
6. "How can a program do what I do?"
7. "I have absolute faith in my own method of design."
8. "A computer cannot distinguish between the method and results."
9. "This is not how design is done" (a lack of understanding of alternative approaches).
10. "What will happen to us—will we eventually be replaced by computers?"

Anthony was stunned by the responses, from Wayne and Rahul in particular. Philosophically, it was clear that the company's existing strategy of relying on human cognitive brilliance alone (a closed system) was viewed as too valuable an asset to be replaced (as they described it, rather than enhanced) by generative customization. The company was built on the creative abilities of its people: would this be compromised by a system centered around Information Technology and based on an open complex adaptive system?

The fallout from the meeting was dramatic and emotional. Anthony was upset due to a lack of support from Wayne, who had sent him off in this direction in the first place. Wayne felt that Anthony used their haphazard discussion as a springboard to invoke a hare-brained idea that would compromise the firm's existing successful strategy. Rahul was nervous over the repercussions associated with even a perception of his department playing a more significant role in product development. Stacey was enraged over the inclusion of an outsider (Johan) into their proprietary and highly valued world class product design world, the IT department's *stepping on their turf*, and the impact this would have on her superstar product design team.

### III. CONCLUSIONS

At this point, the firm was left with three options to undertake:

1. *Fund a pilot—as is noted in the presentation, generative customization can complement the existing auteur product design approach. An innovative strategy must be undertaken to offset competitors, who are copying their designs, and undertaking "open system" platforms that favor their approach. Johan's research has appeared to "fall into their laps," and they should capitalize on this good fortune.*
2. *Investigate the matter further—given the enormous potential of a "ROI" on this initiative, retain Johan and assign Anthony to further explore the opportunity. Spend up to \$1mm to consider the option as an approach to better understand. The concern with this approach is the potential impact on the morale of the Product Development team, and not making a commitment to Johan may make him move forward with another company.*
3. *Reject the concept—in a market with high growth rates and a reputation as the market innovator, nothing should be done to impact its current momentum.*

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