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# Waste vs. Challenge! Consumer Insights and Strategic Implications of Unused Technology Product Capabilities and Features[1)]

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**Abstract**

In an effort to provide guidance to designers and product developers globally to minimize and ultimately eliminate product-level waste, and thus slow the rapidly rising levels of eWaste, this paper explores the concept of "waste" from the perspective of consumers and their interactions with technology-related products. The ZMET qualitative research method was applied, through which three distinct categories for the cognitive constructs that respondents held towards the interplay between the "challenge" to optimize utility versus the "waste" of 1) never accessing, 2) understanding or 3) applying this utility were identified. From these findings, three "Key Design Challenges" are proposed and practical examples and guidance are offered for future design innovation. While building on the work of many thought leaders in the field of innovation, manufacturing, design and product marketing, this is the first paper to categorize the consumer experience of product-level "waste", and offer a strategic framework for its elimination.

**Keywords:** *Waste, eWaste, Lean Manufacturing, Product Design, Innovation, New Product Development*

## INTRODUCTION

The effort to eliminate "waste" from within product innovation processes has long been recognized as critical in optimizing product and firm competitiveness (c.f. Clark & Fujimoto, 1991; Eisenhardt & Tabrizi, 1995) with such efforts typically focused on wasted time, energy and resources within the manufacturing process. Built upon principles earlier established by Taylor (1922) and Ford (1926), the Toyota Production System (Ohno, 1978) was crafted through integrating these previous practices together with the Japanese concepts of Just-in-time Manufacturing and constant improvement of a production process, called "Kaizen" (Imai, 1986). The removal of waste from within the production process soon became a prominent characteristic of this revolutionary production management system, and served as the progenitor to Lean Thinking, which has been proposed by Womack and Jones (1996) to be "the antidote to waste."

As such thinking has sparked global waste-reduction movements, it would be logical to conclude then that the actual products that have been created through such lean processes would similarly be free from waste. In reality products themselves have paradoxically evolved to include incrementally more instances of waste. For example, Brombacher et al (2005) found a startling increase over time in the percentage of returned products to a major manufacturer of high-technology, high volume consumer electronics firm that in fact were functioning perfectly and without error. They found that the rate of such returns had grown from less than 5% in 1980 to 50% by the year 2000. In the UK, James (2010) showed that of all technology products purchased, no more than 50% of the inherent capabilities of these devices were used. WDS Global (2008) reported that 80% of the capabilities of modern mobile phones are not regularly used, and 25% of all capabilities are never even "discovered" by end users.

Perhaps the reason that the issue of increasing waste in product development has not received greater research attention until now is related to the recent findings from Zaimou et al (2012), who have shown that modern consumers consider themselves, rather than the complex technology products or their designers to be the ones who are broken. So as product complexity grows, and consumer learning and expertise fail to follow, we collectively experience an increasing growth of wasted components and features of new products, which in turn has sparked both the United Nation's Basel Convention Secretariat (2012) and the OECD (2007) to issue clear warnings related to the impact of the rising amount of technology product waste globally.

In response to the above concerns, this paper proceeds as follows:

1) First, we explore consumer perceptions of "waste" within technology products and its impact on their overall judgments of the products that they have purchased, finding three co-existing dyads of "challenge" versus "waste".
2) Next, integrating these consumer insights with the extant literature, we explore effective strategies to eliminate such waste.
3) Then, we outline three "Key Design Challenges" to serve as guides for developing such strategies
4) And finally, we explore a series of customer-producer value co-creation practices as they relate to solving these Key Design Challenges.

By contributing to the well-established body of knowledge in these ways, we aim to refocus research and practices within the field of product innovation to cope strategically with product-level waste, which will lead to increased value for customers, firms and the global society.

## THE PHILOSOPHY OF WASTE

"Waste" is a complex construct that varies in its existence and intensity between individuals as well as across the different players in the overall product ecosystem. As the old adage goes, "One man's rubbish is another man's treasure". As today's consumers purchase a complete product "package" that includes both the designed-in features that they use and value, coupled with those unused features that they do not, our research efforts begin by exploring whether a product designed with these "wasted" features embedded becomes the consumer's treasure or whether such process does not apply in the world of consumer products. In our exploratory study, we therefore focused solely on understanding how a small sub-segment of consumer perceive these unused features within the products that they have purchased. We specifically focused on technology products as the literature clearly shows widespread consensus that such products are rife with "waste" from their initial conceptualization (c.f. Cooper, 1999). Specifically, we explored whether consumers consider these unused and unvalued features as wasted investments of their time and money that should be eliminated, or as McDonough and Braungart (2002) argue, as inputs or "food" for future activities or needs that they may have.

## RESEARCH METHODOLOGY

As there is a dearth of research focused on the consumer experience of such "wasted" features and capabilities of technology products, we chose to apply the Zaltman Metaphor Elicitation Technique (ZMET) (Zaltman & Coulter, 1995; Coulter, 1994) for our initial exploratory efforts. ZMET has been widely applied across a number of product categories, consumer segments and cultures because of its proven ability to collect rich insights into how consumers truly think and feel about a specific product, service or issue, through the use of metaphors in the form of images, photographs and sensory perceptions (Belk, 2007). Through the ZMET research process respondents provide rich visual and related sensory images relative to a specific research topic, and through the collection of such rich imagery in the form of metaphors, researchers are enabled to gain deep insights into the underlying mental processes of research respondents (Lakoff & Johnson, 2008). As ZMET has also been successfully applied to the study of technology products in the past (Chan-Olmsted et al., 2013; Sugai, 2005), it was therefore chosen as an appropriate research method to explore the concept of technology product "waste".

Eight (8) research participants were recruited to participate in this exploratory study. All were Japanese MBA students within a top-ranked Business School in Japan. All participants were male, with ages ranging between 27 - 36 years old. All participants signed a written consent form, agreeing to allow the results of their research interviews to be used in writing papers or articles as long as no specific information was shared that could be used to identify them.

The research was conducted between November 2012 and March 2013 and interviews were conducted in English, were recorded in full before being transcribed, coded and analyzed. The data collection and analysis process proceeded through the following phases.

Phase 1 – pre-interview. During the pre-interview stage, respondents were given the following instructions "When you think of the unused features or capabilities of a technology product that you have recently purchased, what images come to your mind?" Respondents were then instructed to collect 8-10 pictures from magazines, newspapers, personal photographs or other sources with the full interview scheduled one to two weeks later.

Phase 2 – interview. Each interview lasted between 90 and 120 minutes, and followed each of the ZMET interview steps including "storytelling", "missed images", "sorting task", "construct elicitation", most representative picture", "opposite images", "sensory images", "the mental map", "the summary image", and "consensus map" (Coulter, 1994, pp. 502-6).

Phase 3 – transcription and coding. After transcription, all interview texts were input into the specialized qualitative data analysis software package, Atlas.ti; a specially-designed program for qualitative data analysis. Using this software, each transcript was assigned individual codes created to represent the thoughts and ideas outlined during each interview. Open coding was applied by strictly adhering to the grounded approach presented by Glaser and Strauss (1967) and Strauss and Corbin (1994). Transcripts were first coded in the order that their corresponding interviews were conducted, and codes were assigned to each transcript. After coding was competed, redundant codes were grouped into code "families" and assigned a descriptive construct name.

Phase 4: developing cognitive maps. After codes families were developed, the next phase of analysis included the development of links between constructs and an overall organizational structure was developed to visualize the collective insights of the research panel.

For this paper, we focus only upon the mental model that research participants held towards defining the unused features of their technology devices, and do not include the broader insights into their feelings about such "wasted" features, or the manufacturers who produce them.

## OVERALL THEME: "CHALLENGE" VERSUS "WASTE"

As shown in Figure 1, respondents held dual views of the unused features that exist within the technology products that they purchased. They either viewed them as untapped or unexplored value that offered them opportunities for greater learning and use or conversely, they viewed these unused features as wastes of inaccessibility, failure of understanding and inability to apply.

When respondents viewed these unused features and capabilities in a positive light, attributing some level of untapped utility to them, they expressed the "challenge" of exploring the unexplored,

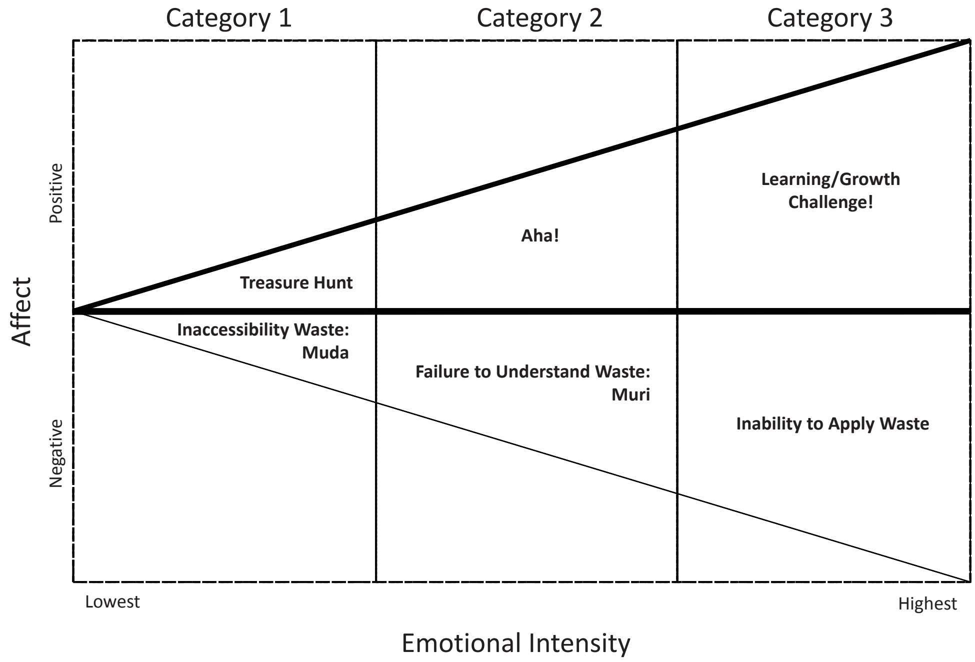



**Figure 1: The Three Categories of Challenge vs. Waste**

or learning what had been previously unknown, which is directly in line with McDonough and Braungart's (2002) argument that these unused features can be considered as inputs or "food" for future actions or needs. Conversely, when these unused features were viewed negatively, they matched with Ohno's (1978, p. 54) definition of "waste" as elements that "increase costs without adding value".

And as Figure 1 shows, we found that respondents defined three positive/negative dyads of their conceptual experience of the unused features of products, progressing in the intensity of the experienced emotions from the relatively relaxed Category 1 or treasure hunt versus "Inaccessibility" waste, to the more serious Category 2 interplay between "Aha!" experience versus "Failure to Understand" waste, finally to the emotionally-charged Category 3, the self challenge of "Ganbaru" versus "Inability to Apply" waste.

### *Category 1: Access (Treasure Hunt versus Inaccessibility Waste)*

<u>Category 1: Positive Affect: Treasure Hunt:</u>
When facing the issues of simply accessing all of the features or capabilities of technology products, on the positive side, respondents found their lack of knowledge of this full set of capabilities encapsulated in the products that they purchase to hold latent value and therefore challenge themselves to uncover such unexplored utility like a "treasure hunt".

> *"It's just sometimes it's for me like a treasure hunt. If I find some useful function accidentally, I feel very good. Even if I didn't know such a function existed when I bought the devices, but when I find it, I feel good and it's kind of a treasure. Nowadays a lot of devices have some hidden functions and finding them to be useful is very good feeling."* - Respondent #8

Therefore the possession of the perception of utility for these undiscovered features enabled consumers to experience value for the devices that included such unexplored "treasure" awaiting their direct or serendipitous search.

<u>Category1: Negative Affect: Inaccessibility Waste</u>
On the other hand, other respondents clearly explained their concerns and feelings of disappoint-

ment because of the abundance of features that they had paid for but never accessed. We call this category of unused features "Inaccessibility Waste" as they exist in the purchased product, but because they can not be or are never accessed by the end user, add no incremental utility or value.

> *"The function I never use has this much volume (pointing to the underwater section of a photo of an iceberg that he has brought to the interview)."* -- Respondent #5
> *"The first group (shows those things) I don't use and don't want to use. This is completely meaningless (to me)."* - Respondent #2
> *"When I see the unused functions I'm disappointed to see it because I don't want to pay (for them), but I have already paid to buy the product. I don't want to pay such fees for these functions."* -- Respondent #7

As these features are never accessed or used by end users, these directly correspond to Ohno's (1978) concept of "Muda" waste. He defines "Type 1" Muda waste as elements that the producer considers fundamental, but in no way add any value to the customer. Therefore we correlate our inaccessibility waste with Ohno's Muda type 1, which serves as the foundation for the first of our Key Design Challenges presented in the next section.

### *Category 2: AHA! versus Failure-to-understand Waste*

Within this second categorization, after users have been able to find specific capabilities within their devices from Category 1, they face the next design barrier in their ability to understand exactly how to apply or use such functions. If they succeed in their learning to use the new product features either gradually or through "Aha!" experiences (Lakshmanan & Krishnan, 2011), then these features are felt to offer some level of enhanced utility or value. If however, they fail to gain this understanding, then respondents felt a more palpable emotional loss in terms of the value of the overall product relative to that experienced in Category 1. We call this lack of ability for consumers to understand features that they have been able to access as " failure-to-understand waste." As the emotional intensity of their responses clearly grew stronger when respondents discussed this next level of "challenge vs. waste" we have integrated the constructs and concepts raised by respondents into Category 2, as shown in Figure 1.

<u>Category 2: Positive Affect: Aha!</u>

> *Maybe it is difficult to express in English, but can you use, Aha? "Aha!" means I find something or I can make sense or something.* -- Respondent #7
> *My hobby is scuba diving so I selected this picture. It is so dark, but this picture shows a light at the top (of the water) so (it shows that in the) past I was a little confused about what this is. But now it is OK, because I can understand this is the use, maybe I can use this for something (in the future). This picture represents the light is shining in my head.* -- Respondent #1

Here then, we find this opportunity for learning provides positive utility to those respondents who view such difficulties as surmountable and within their capabilities to understand.

<u>Category 2: Negative Affect: "Failure-to-understand" Waste</u>

> *" Sometimes it's very difficult to find out the difference between some functions because some functions are very similar and it's very difficult to understand how to use each of them even when I read the instruction manual."* -- Respondent #8
> *"I can't understand the difference of between different modes so I experience stress. I just can't understand the differences between this mode and that mode."* -- Respondent #2

As outlined in Figure 1, we align this second waste category with Ohno's 2nd type of waste, which he called "Muri" in Japanese. Ohno argued that Muri waste occurs when a manufacturer requires a behavior that is impossible to accomplish. Here, we similarly find that the manufacturer has required end users to perform unique behaviors in order to use specific features or functions of a technology product. However, when consumers fail to understand how to perform such behaviors, their ability to use those features becomes impossible, or in Japanese, "Muri". Therefore we have linked our waste of understanding with Ohno's Muri waste, which serves as the foundation for our second Key Design Challenge as discussed in the next section of this paper.

### *Category 3: "Ganbaru" versus Inability-to-apply Waste*

After successfully passing through categories 1 and 2, the final challenge respondents explained dealt with their ability to challenge themselves to not only gain an understanding of how to use a certain feature or functionality, but how then to apply this knowledge within certain use contexts. Conversely, respondents also discussed their failure to effectively apply their knowledge when challenged to do so. We categorize this inability to apply their understanding of how to use a feature as "Inability-to-apply Waste". And we found that though some respondents felt that they were responsible for this lack of ability, at odds with Zaimou et al. (2012) an equal number of respondents placed full responsibility on the designers and manufacturers of these products. This category held the strongest emotional responses as the joys of overcoming a challenge or the frustrations of using unusable designs sparked highly-charged emotions in most all respondents, as outlined in Figure 1.

<u>Category 3: Positive Affect: "Ganbaru" (or in English), "Challenge myself to do my best"</u>

> *"At the same time I accuse myself for my inability to use these functions. I then ask myself, how can I use all of these functions? What is the best way for me to use this more efficiently?"* - Respondent #6

Here, then, we find an active investment by the consumer to personally master the application of all appropriate features designed into their devices.

<u>Category 3: Negative Affect: "Inability to Apply" Waste</u>

> *After my baby was born, the opportunity to use a camera greatly increased. I felt I wanted to use the camera, but I couldn't use all functions when I needed them. I was very anxious.* -- Respondent #2
> *These (unused functions) really create an obstacle for my use of other functions."* -- Respondent #3

Here, although respondents clearly could (1) access the features they needed, and (2) understand how to use such features, when acting within a context in which they needed to then smoothly apply their understanding, many expressed their lack of ability to do so. We call this inability to smoothly apply their understanding in context, "inability-to-apply" waste. This third waste then provides the foundation for our third and final Key Design Challenge outlined in the next section of our paper.

It is important to note here that though Ohno proposed a third type of waste within the manufacturing process, which he called "Mura" to represent the irregularities or variability within the production process, we found no similar construct from our research data. Instead, our findings indicate an additional, non-identical characteristic of waste experienced by the consumer. This different perspective implies the perceptual gap between producer and consumer, and paves the way for our next section proposing a strategic framework to cope with the wastes we have identified.

## COPING WITH WASTE: THREE KEY DESIGN CHALLENGES

We derive from these initial interviews three fundamental challenges that face product designers in guiding end users away from the experiences of "Waste" as outlined in the negative affect categories of Figure 1, towards the positive, value-filled challenge of recognizing and ultimately unlocking the untapped latent utility within the products that they have purchased.

*Key Design Challenge #1: Eliminating Inaccessibility Waste, or Muda:*

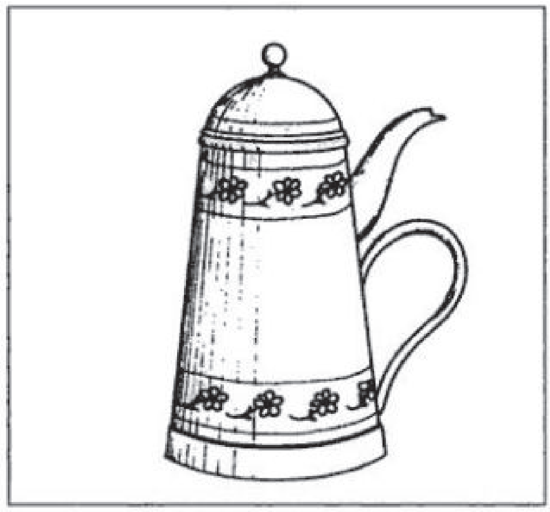
In line with our discussion above, consumers have been shown to attach value to a product not only from their usage, but also from their perceptions of the component features of products. Such value has been found to exist in initial pre-purchase expectations (Son & Han, 2011; Bhattacherjee, 2001) as well as to be significantly influenced by normative factors (Hamilton et al., 2010).

Recent developments within mass customization suggest that the modularization of product development will yield significant efficiencies for firms and their customers. For example, the relatively new "Apps Ecosystem" that has emerged from Apple, Google and other technology providers suggests that consumers will buy a "basic" hardware package, and subsequently customize it to their own specific needs through the purchase of specialized Apps.

While this model has not yet reached its optimal level, it suggests that one solution to Inaccessibility or Muda waste is to develop baseline products, which are developed in a way to be improved upon collaboratively by customers and the producing firms. For example, when Apple or Google would like to improve the functionality of the underlying operating systems of their technologies, they also now have the ability to update these systems across all interested users, who can then because of this, upgrade the types of applications that they are able to download and use on their hardware devices. This approach builds upon Thomke & von Hippel's (2002) work in user-led innovations, where firms create a platform for innovation that is accessible to all users and which empowers them to drive further innovation by themselves.

*Key Design Challenge #2 - Eliminating "Failure to Understand" Waste or Muri*

French artist Jacques Carelman's Masochist's coffee pot (shown right[2)]) graces the cover of Norman's (1988) seminal work on product design. Within this discourse into the elements of good product design, Norman introduces the concept of the "Gulf of Execution" which offers a direct parallel to Ohno's conceptualization of Muri within the production



process. Norton's measure for this gulf was "how well the system allows the person to do the intended actions directly, without extra effort: Do the actions provided by the system match those intended by the person?"

This gulf has evolved into a its own broad area of research on growing product "complexity" (c.f. Scholz, et al., 2010) in which products technical features are becoming increasingly complex, mandating that users must learn how to use a product correctly rather than having the natural knowledge and skills to use the product to its fully intended levels at their time of purchase. Zaimou et al.'s (2012) exploration of consumers' abilities to "get it or not" clearly underline the predicament of modern consumers. As such complexity requires both learning and a resulting state of expertise in order for such consumers to "get" such complex technologies, both have been proven to have a direct influence on the overall value consumers attributed to a product.

While the traditional view of the consumer learning required to overcome such inabilities in proficiency has focused at the aggregate level, Lakshmanan & Krishnan (2011) have recently shown that individuals experience learning in distinct "Aha!" moments which occur at different times for different individuals. This follows previous research in which specific learning models were shown to have varying impact on technology product usage proficiency (Lakshmanan et al, 2010), in line with Kolb's (1984) original view that different individuals learn in different ways.

Forcing the customer to spend extra time learning to use a technology, is therefore considered a "waste", and in fact, a consumer's perceptions of the level of "pain" that they will go through in learning to use a new technology has been shown to influence their initial choice to adopt the technology (Loraas & Diaz, 2011). And as, den Ouden et al (2006) found that consumers spend an average of 20 minutes learning to use a new consumer electronics product before they give up, there is also clear proof that if customers cannot become proficient in using a technology at least to the initial level of their expectations, they will consider using an individual element of a product, or the product as a whole as "MURI" or impossible. Therefore, elimination of MURI waste in product development requires a focus on decreasing learning time and lowering the barriers between being a novice and expert.

### *Key Design Challenge #3: Eliminating the "Inability to Apply" Waste*

The concept of inclusion as proposed by Miller and Katz (2002) requires a commitment to valuing others "for who they are". This lack of inclusive thinking has been the focus of Universal Design, whose seven principles of use (Mueller & Story, 2002) each are focused upon bringing smooth and efficient use of products to consumers with vastly different physical or mental capabilities.

Similarly, Goodhue & Thompson (1995) proposed the concept of task-technology fit to explore the relationship between the end users abilities to complete specific tasks and the technology tools that they use to complete them. And the research that has followed has proven that higher levels of task-technology fit have been linked with higher levels of user acceptance and value across a wide variety of technologies and platforms, ranging from computers (Kerr & Murthy, 2004) to mobile phones (Lee et al., 2012), audio (Gebauer & Ginsburg, 2009) to video (Raven et al., 2010).

"Inability to apply" barriers to product usage then can therefore be directly correlated with those same features targeted by Universal Design specialists to ensure equitable use irrespective of the consumer in question (Karwowski, 2005). Examples such as electric doors that open automatically and without the need for exerting force, to scissors created for both left-hand and right-handed users offer examples of products that have been designed specifically to eliminate barriers that create inefficient interactions between consumers and their products.

## CO-CREATION STRATEGIC APPROACH

Because of the complexity of the issue of Waste and who "owns" the responsibility for the current levels of waste inside of existing and yet to be designed products, the solutions to these challenges require a joint collaboration between both companies and their consumers. For overcoming these Key Design Challenges then, it is imperative that firms partner more closely with the end user community to develop products and services with the highest possible level of mutual value (Ramaswamy & Ozcan, 2014; Prahalad & Ramaswamy, 2004). And for firms to successfully enhance their profitability and competitiveness, this issue of wasteful product development and wasteful feature development within products must be taken seriously and steps to eliminate such practices must be established.

Across each of these three Key Design Challenges, we find already a number of firms who are reaching out to their existing and potential consumers in this way, and through an active and ongoing dialogue, designing new products and services that effectively eliminate these wastes, and spark the positive feelings of "challenge" and exploration of new or undiscovered utility by their end users.

As shown in Table 1, we have identified one example of successfully overcoming the Key Design Challenge in each of the three categories introduced in the sections above.

### *Solving Key Design Challenge #1: Tune Hotels*

One example of a firm that has been constantly striving to eliminate such Muda waste from its products is Malaysia's Tune Hotels. Targeted to executive business travelers, Tune Hotels executives aimed to understand the truly "basic" product that would address these travelers' needs, yet eliminate all other unnecessary aspects that may never have been tried, used or valued by their customers.

**Table 1: Key Design Challenge Examples**

| Key Design Challenge #1: Eliminating Muda | Key Design Challenge #2: Eliminating Muri | Key Design Challenge #3: Eliminating Inability to Use |
|---|---|---|
| Example: Tune Hotels | Example: Khan Academy | Example: Wii and Kinect |

Finding that (1) a good night's sleep (i.e. a 5-star bed), (2) a hot shower, (3) good location, and finally (4) security all at a 1-star price were the true bare minimum offering, they made all other features of the Tune Hotel experience, ranging from air conditioning to towels, "add-ons" (Lankester, 2009).

***Solving Key Design Challenge #2 : Khan Academy***

An award-winning example of a company focused on eliminating the Muri barrier is the Khan Academy, which is in the process of transforming the global education landscape. By creating a learning ecosystem that customizes learning to each individual students' capabilities, and builds an interlinked curriculum structure so that no subject covered is "Muri", the Khan Academy is transforming learning from rural classrooms in developing economies to the most technically advanced classrooms in developed economies globally. This has all been accomplished by designing the learning experience from the very start with the clear intention of lowering the barriers between becoming a subject expert and a being a pure novice (Schneider, 2012).

***Solving Key Design Challenge #3: Nintendo Wii and Microsoft Xbox***

One example of a product category whose designers are actively innovating with the aim of eliminating the "Inability to apply" waste is in the gaming industry. With Nintendo's initial introduction of the Wii in 2006, whose remote control unit was an innovative leap beyond traditional gaming controls, followed by Microsoft's 2010 launch of the Xbox Kinect which completely eliminated the need for a remote control device at all, both companies focused on making consumer interactions with games far more intuitive and accessible then ever previously imagined. As we can now see from the adoption and use of these consoles across previous non-user segments such as senior citizens (Theng et al., 2010) and those with physical disabilities (Chang et al., 2011), solving this third design challenge offers firms the ability to expand their reach into new and untapped markets.

## FUTURE RESEARCH AND NEXT STEPS

Based on this initial exploration of the consumer experience of waste in technology products, comprehensive empirical studies must now be undertaken in which each of these elements of waste are explored both qualitatively and quantitatively from the joint perspective of consumers and firms.

Additionally, while we have briefly alluded to these factors above, the societal and environmental conceptualization of waste must be explored and similarly defined. Stakeholders from these constituencies surely hold additional perspectives of both waste and the "challenge" of finding untapped or unexplored value from it. As the aggregate savings from waste reductions at both the firm and customer level will have significant impact on the competitiveness and innovativeness within a society, we also feel that this is a very rich area for future research. Additionally, as the global levels of e-Waste continue to grow each year, we believe that further research into the end-of-life element of technology products must be further explored. If the ideas presented in this paper are successfully implemented, we are also hopeful that this will lead to a significant reduction in the number of technology devices that are purchased and subsequently discarded because of their perceived ineffectiveness and uselessness for end users (Royte, 2005).

While Marketing researchers have begun to explore the concepts of Lean Thinking in areas including Lean Product Development (Karlsson & Ahlstrom, 1996), Lean Product Launches (Bowersox et al., 1999), Lean Service (Swank, 2003), and Lean Brands (Oliver et al., 2007), with this new exploration of waste in product innovation and Marketing now in place, the requisite foundation for more expensive and complete exploration of Lean

Principles in product innovation management can now be advanced.

And most importantly, we hope that these three design challenges will serve as a call to action to designers here in Japan and globally to focus on the elimination of these three wastes not only in technology-related products, but across the entire spectrum of complex consumer products and services.

## CONCLUSION

As we have argued, the high and growing levels of product waste at the customer-firm level have led to a precipitous growth in wasted and unused features of modern products, even as Marketers have committed themselves to the Mass Customization movement. This has led to increased costs at the customer, firm and societal levels that can be effectively lowered by a renewed focus on Waste elimination within the innovation and Marketing process.

Through exploring the experience of waste at the consumer level, we hope to provide the foundation for an evolution from the era of Mass Customization that Philip Kotler announced more than 25 years ago to the era of Lean Customization, seeing a further micro-customization of products and features with a complementary and systematic reduction of waste. And as this new era of Lean Customization matures, and product-level wastes we have identified are eliminated, that this in effect will spark a clear and measurable net increase in value for consumers, firms and society.

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## NOTES

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2) Image copyright: Jacques Carelman's 'Masochist's Coffee Pot' from his Catalogue d'objects introuvables, 1969

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