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Bridging the gap between supply chain and consumer experience

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BRIDGING THE GAP BETWEEN SUPPLY CHAIN AND CONSUMER EXPERIENCE

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This thesis consists of the following two articles, formatted in the style used by the Missouri University of Science and Technology:

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Pages 22-44 are intended for submission in INTERNATIONAL JOURNAL OF ELECTRONIC MARKETING AND RETAILING.

ABSTRACT

Many researchers agree that supply chain management is at the root of addressing customer values and increasing customer satisfaction. However, in reality the route to accomplishing these goals is not so clearly defined. The studies herein attempt to shed some insight on a special perspective to bridge the gap between supply chain and customer experience. The ideas behind these studies explore the notion that customer experience can be impacted by a vast spectrum of factors from suppliers to even the specific mobile commerce (m-commerce) tools they use.

To gain insight into the supplier dimension of the supply chain, a survey was conducted to examine quality professionals' familiarity with quality management tools, their organizations' quality assurance programs, as well as training for their suppliers. For the m-commerce aspect, a between-subject experiment was delivered to explore the relationship between physical mobility and consumer behaviour and experiences. The results of these studies show that quality training offered to suppliers enable significant quality increase, significant time saving benefits, and significant financial benefits in the organizations that use these suppliers. Also, the quality increase and time saving in supply chain are usually positively correlated to better customer experience. They also show that walking, or mobility, while shopping increases the time spent on a specific shopping task, which in turn, influences the customer experience.

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1. INTRODUCTION

Overall, the supply chain involves managing a product or service delivery from raw materials to the end user, or customer. Many factors impact this chain including, but not limited to, suppliers, logistics, processes, customers, and technology. This study intends to take a broader view of supply chain management and look at various aspects of the customer in the supply chain. Quality management has, and continues to be, a critical part of customer loyalty and impacts purchasing decisions. Also, technology also has proven to be a critical role in not only managing the individual components within the supply chain itself, but also how customers make purchases, thereby influencing the customer experience.

Paper I presents a study of how quality management, and knowledge of quality management tools, can impact the overall organization providing a product or service to a customer. Over many years of study, quality management still proves to play a role in brand loyalty and customer engagement. Knowledge of quality management within an organization and its supply chain was demonstrated by the use of a questionnaire distributed to quality professionals working in industry as well as end-user customers. It was shown that while quality plays an important role in the supply chain and to customers' experiences, many industry professionals are unaware of their organizations overall quality management approaches, including their suppliers. Paper II presents a study on the impact of mobile technology during consumer shopping experiences, which is ultimately one of the end stages in the supply chain. It was demonstrated by asking participants to shop for a specific product on a mobile device while walking on a treadmill in a controlled environment.

Overall, this study has explored the role of quality management and the use of technology within the supply chain and sought to understand the impact it may have on the consumer.

PAPER

I. QUALITY'S IMPACT ON THE SUPPLY CHAIN: A SUPPLIER TO CUSTOMER VIEW

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ABSTRACT

An integral part of supply chain management is the area of quality management. Quality management ultimately impacts the supply chain from several angles. Quality management impacts the overall function of the supply chain through reducing costs, as well as by improving the product or service being produced so that marketing efforts can more successful. This study explored the understanding and insights of quality management topics in industrial professionals who are working within the supply chain in industrial organizations. Questions regarding familiarity with quality management tools, their organizations' quality assurance programs, as well as suppliers' quality measures were explored. Overall, it is seen that the quality management tools and assurance programs are progressing; however, quality management professionals who participated in this study are unaware of suppliers' quality procedures and the implementation of many useful quality tools that may improve the overall supply chain.

Keywords: Quality management; supply chain management; continuous improvement; marketing impact

1. INTRODUCTION

Marketing and supply chain management have been linked in a variety of ways for decades. In higher education, the two departments are often even housed together. For example, Rutgers, a leading business school, hosts the department of Supply Chain Management and Marketing Science. In practice, there are also many areas of overlap between supply chain management and marketing. Previous research suggests that different perspectives help to illustrate these overlaps, such as inter-functional integration, process integration, and business concepts (Jüttner, Martin et al. 2010).

One perspective used to quantify the overlap between marketing and supply chain management is the inter-functional perspective (Jüttner, Martin et al. 2010). Much like the combining of academic departments in business schools to achieve efficiency, it has been shown that the coordination of marketing and supply chain departments in traditional businesses often result in improved customer service related performance (Ellinger, Daugherty et al. 2000). This perceived relationship between marketing and manufacturing goes back to the late 1970's when Shapiro wrote an essay discussing the benefits of managing the integration in these two areas to resolve the conflict that often arose from turf wars (Shapiro 1977).

The process integration perspective examines the intercept of marketing and supply chain as it relates to the consumer perspective. In this way, individual business processes that cannot be wholly qualified as supply chain or marketing may exist in the overlap. For instance, looking at where marketing specifications, customer service and quality expectations are directly impacted by issues of supply chain such manufacturing and logistics. This perspective examines the value chain, the role of supply chain, and its impact

on consumer value (Bagchi and Skjoett-Larsen 2005, Jüttner, Martin et al. 2010, Singh, Sohani et al. 2013).

The last perspective analyzing the overlap between supply chain and marketing is the direct analysis of the new business concepts that seem to have sprung up as a way to integrate the two functional areas more effectively (Jüttner, Godsell et al. 2006, Jüttner, Martin et al. 2010). New business models such as quick response (Christopher 2000, Mo 2015), agile supply chain management (Yusuf, Sarhadi et al. 1999, Routroy and Shankar 2015), and demand chain management (Santos and D'Antone 2014, Park, Shintaku et al. 2015) have been improving company efficiency and their ability to respond to market demands. In any case, many of these perspectives hinge on the idea of quality and how it relates to both marketing and supply chain management.

2. BACKGROUND

Quality management has experienced different phases. From the initial stage of quality inspection to later quality control, to further development into quality assurance era, and total quality management (TQM), it is beneficial to examine how quality management evolves into current stage (Garvin 1988).

Quality inspection existed as early as in ancient China, Greek, and Egypt. In the Middle Ages, the quality of high skilled craft activities was ensured with apprentices working under master craftsmen to make sure only acceptable goods were sold to customers (Juran 1995). During this period it was the craftsmen to monitor and take charge over the production quality and they were proud to provide high quality products (Feigenbaum 1983). However, when the industrial revolution started, mass production became dominant in many organizations. Advocated by the school of scientific management, the labor went to much more specialization to cater to higher demand (Taylor 1919). Consequently, the foremen who managed groups of specialized workers became more important in guaranteeing and controlling the quality (Weckenmann, Akkasoglu et al. 2012).

World War I further speed up mass production and required even higher quality and on-time delivery. To achieve those goals, quality professionals extended their inspection and sampling not only on the finished goods but also on the raw materials and goods in process. (Juran 1995).

Due to the widening focus for quality, people realized that it was much more efficient to find and eliminate the root causes of errors than to simply inspect for defects and correct them. Accordingly, the need for control quality emerged (Yong and Wilkinson

2002). Shewhart, a physicist at the Western Electric Company, invented a statistical chart in 1924 to control product variables. He applied simple statistical techniques to calculate the variation limits and graphic methods to plot values to determine if they were acceptable. His work is now recognized as the "process control chart" and marked as the beginning of statistical quality control (SQC) (Shewhart 1931).

Another key element of SQC was Dodge and Romig's sampling technique, which was the idea of only checking a portion of the total products and then deciding whether the entire batch of products was acceptable. This advanced practice of sampling avoided time-consuming 100% inspection (Yong and Wilkinson 2002). However, before World War II industries didn't recognize the value of SQC and hence didn't use those mathematical and statistical tools broadly. During the quality control era, management was not as actively involved in the implementation of sampling techniques as the shop-floor workers and engineers (Yong and Wilkinson 2002).

When the earlier history of quality management was based on detection and fire-fighting activities, the quality assurance (QA) era was focused on preventing defects. Customers joined in auditing and assessing suppliers' quality without consensus standards. In an effort to make QA more efficient, British Standard – BS 5750 was introduced and adopted by British industries in 1979, which served as "a structure of QA bodies with mutual acceptance of approvals to avoid multiple assessments" (Warner 1977). Later, ISO 9000, initiated by the International Organization of Standardization, replaced BS 5750 and became the new standard for industry.

Apart from standards, quality costs were also drew attention from organizations. Before the 1950s, in general people believed that they must create more costs to improve

quality. However, Juran challenged this point by measuring costs of quality (COQ) thoroughly. He divided COQ into unavoidable and avoidable costs. The unavoidable costs are the expenses spent on prevention activities, including inspection, sampling, etc. While avoidable costs are those expenses related to rework, repair, scrap, and customer service dealing with complaints. According to Juran, those avoidable costs could be diminished through quality improvement programs and should get more attention throughout the organization (Juran 1951). Feigenbaum advanced Juran's COQ concept by developing "total quality control (TQC)", which addresses the importance of cooperation among all divisions and control throughout every step (Feigenbaum 1983).

During the QA era, reliability engineering and the principal of zero defects were also developed and adopted widely in the USA. While reliability engineering focused on adapting the laws of probability to predict equipment stress (Garvin 1987), the zero defects philosophy centered on changing the attitudes of employees and giving them constructive criticism (Garvin 1988). The QA era saw the quality prevention was more important than the pure inspection and control. Both the quality management tools and cross functions teamwork were needed to achieve the goal to filter root causes of failure and eliminate them (Dale 1999).

Total quality management (TQM) was originally developed in U.S.; however, it was then exported to Japan and gained a wide and successful application in manufacturing industries. Being considered as the secrets of Japanese business success, TQM was subsequently re-exported to the West (Pollitt and Bouckaert 1996). It permeated the manufacturing industry, then the commercial service areas, and finally the public services (Dahlgaard-Park 2011).

Quality management has evolved into new topics of research such as lean and sustainable production (Cudney and Elrod 2010). This research looks at how quality is perceived by individuals in industry who deal with quality on a daily basis. It was designed to better understand where industry practice was with regard to quality management. Does academia have something to learn from practitioners or is industry lagging behind?

3. METHODOLOGY

A questionnaire was created to gain insights related to quality techniques/practices implemented in organizations, the success rates for firms in industry that practiced quality techniques, and also to find possible relationships in the quality training offered to suppliers and its impact on the supply chain. The questionnaire data was collected through distribution on Qualtrics.com to individuals working in the quality management area in industry. The redundant responses were prevented through setting each participant could only complete the questionnaire once. The following analysis includes responses from 65 respondents. Figure 3.1 illustrates the distribution of industries represented by the respondents for the data set for this research. The majority of the subjects were from the manufacturing industry (17%), followed by the computer hardware/software/internet industry (15%).

The respondents were asked to provide their individual functional work areas to ensure their familiarity with quality techniques in their industry. These responses are represented in Figure 3.2. Operations/production was the majority response (18%), followed by engineering (14%). These functional areas are typically quite familiar with quality techniques throughout the supply chain. As shown in Figure 3.3, their occupational title was also requested from the respondents; manager/assistant manager represented the majority of responses (27%) followed by staff (20%).

The length of time each respondent spent working with quality techniques is illustrated in Figure 3.4. Twenty-five per cent of the respondent population spent 1-2 years working with quality techniques, and another 25% of respondent population spent 3-5 years working with quality techniques. The familiarity with quality techniques of the respondent

population is therefore established and the remaining questions can be used regarding the success and failure of quality techniques and how quality techniques impact the supply chain.

To gain insight on the size of the organization the respondents work(ed) for, Figures 3.5 and 3.6 represent the workforce size and annual revenues of the organizations. A variety of organization sizes were represented in this study, which shows a variety of perspectives in industry. Figure 3.6 shows that 18% of the responses were industries with annual revenues of $1,000,000 to $9,999,999 and another 18% are in organizations that net over one billion in revenue.

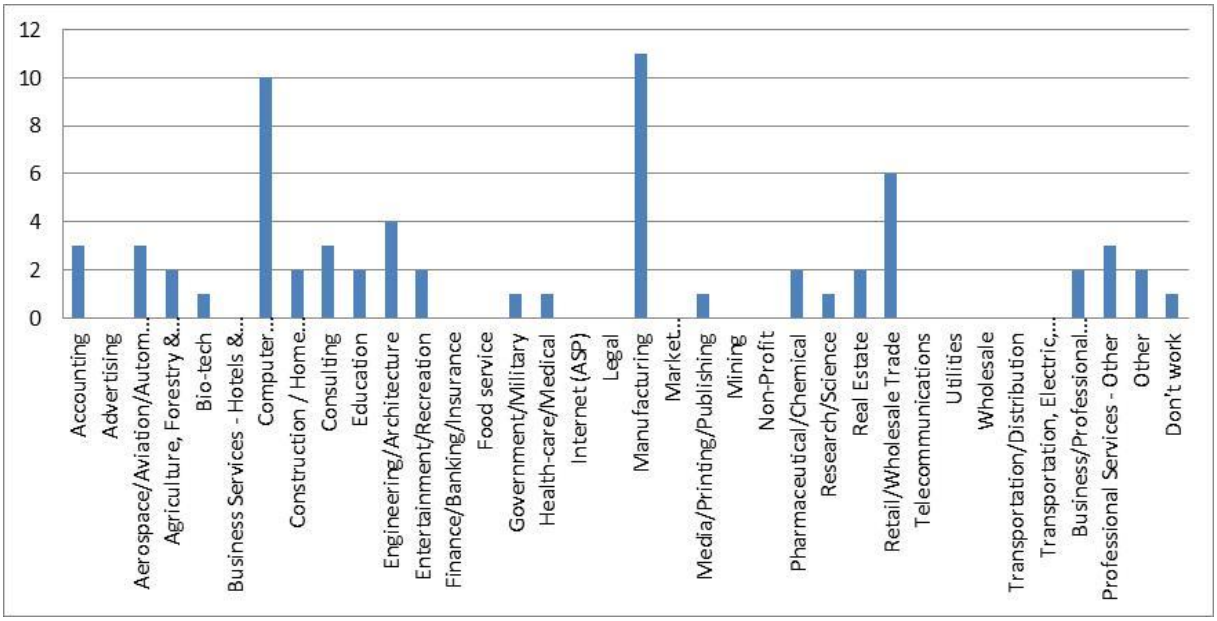

Figure 3.1: Distribution of Respondent Industries

The respondents were asked to indicate what percentage of their organization's business was outsourced. These results are shown in Figure 3.7. The majority indicated that up to 25% of their business is outsources. Figure 3.8 indicates the per cent of products/services that come from an organization's supply base. It is a bit concerning that the largest number of respondents indicated that they did not know how much of their products come from a supply outside of their organization. One possible explanation is the compartmentalization of a large company, meaning that employees may not have knowledge of the whole firm but only team or segment specific information related to quality. The next most common response was 26-50% of supply coming from a base outside of the organization, which is quite substantial.

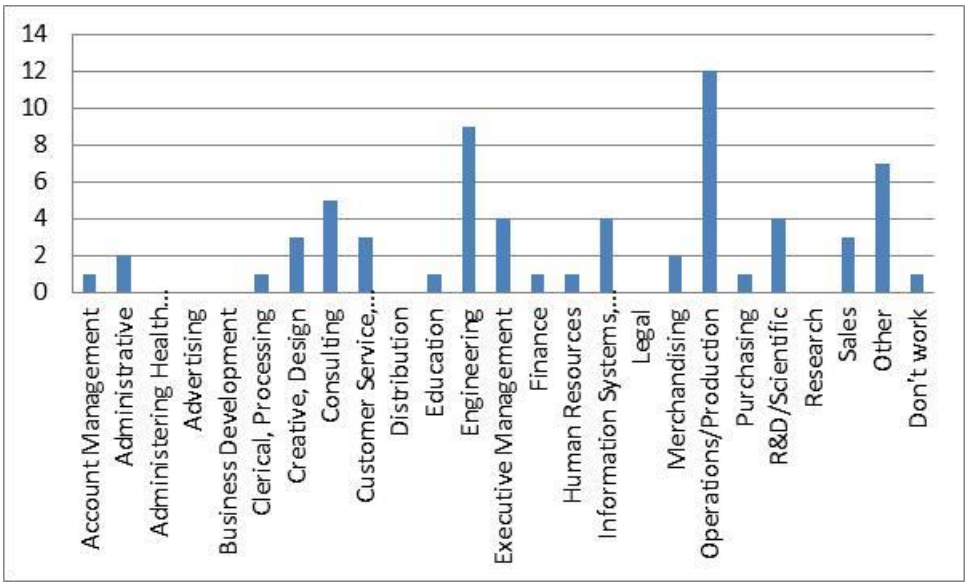

Figure 3.2: Individual Respondent Work Areas

In order to reduce cost throughout a supply chain that contains many cause and effect relationships, steps throughout the chain must be applied in order to reduce the total cost. Introducing quality techniques can aid this process by things such as reducing the amount of defects in the production process or increasing customer satisfaction when a higher quality product/service is produced. As shown in Figure 3.9, the majority of the respondents (30%) questioned indicated that they were unaware if their suppliers use quality techniques. However, 23% of respondents indicated that 51-75% of their suppliers use quality techniques.

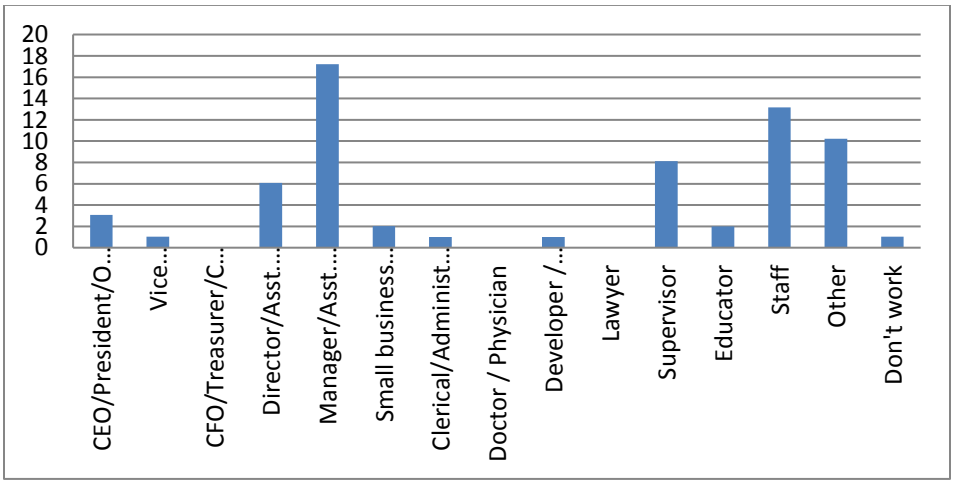

Figure 3.3: Individual Occupational Title

Often, as a means to improve the supply chain process, organizations will offer training to suppliers. The respondents in this study were asked to provide the types of

training that their organizations provide to suppliers. Figure 3.10 shows that 30% do not provide training, while the most common techniques offered via training are flowcharts, check sheets, and cause and effect diagrams. Approximately 3% indicated "other;" these responses were "lean and six sigma," "quality program development," and "n/a." Respondents were also asked what types of quality techniques they have paid for via consultants to assist their suppliers. Almost 40% indicated that no such consultant training was provided to suppliers.

When suppliers did use quality techniques, this study was interested to learn the benefits that organizations realized by using these suppliers. The largest benefit seen (27% of respondents) was "significant quality increase," followed by "significant time saving benefits" (26%). Twenty-one per cent of respondents indicated that their organization had seen "significant financial benefits."

Finally, the respondents were asked for insight on methods their organization had used to encourage their suppliers to implement quality techniques. The majority of responses (33%) indicated the use of "split quality programs savings," followed closely by 31% who "dictated prices to suppliers." The remaining population used things such as "bonus process implementation," and a few respondents were unsure.

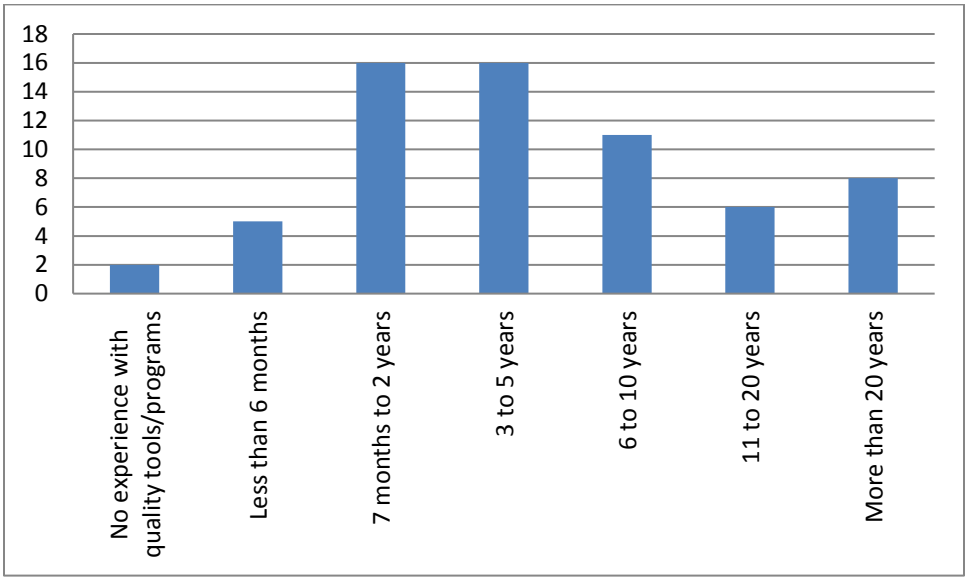

Figure 3.4: Respondents' Length of Time Working with Quality

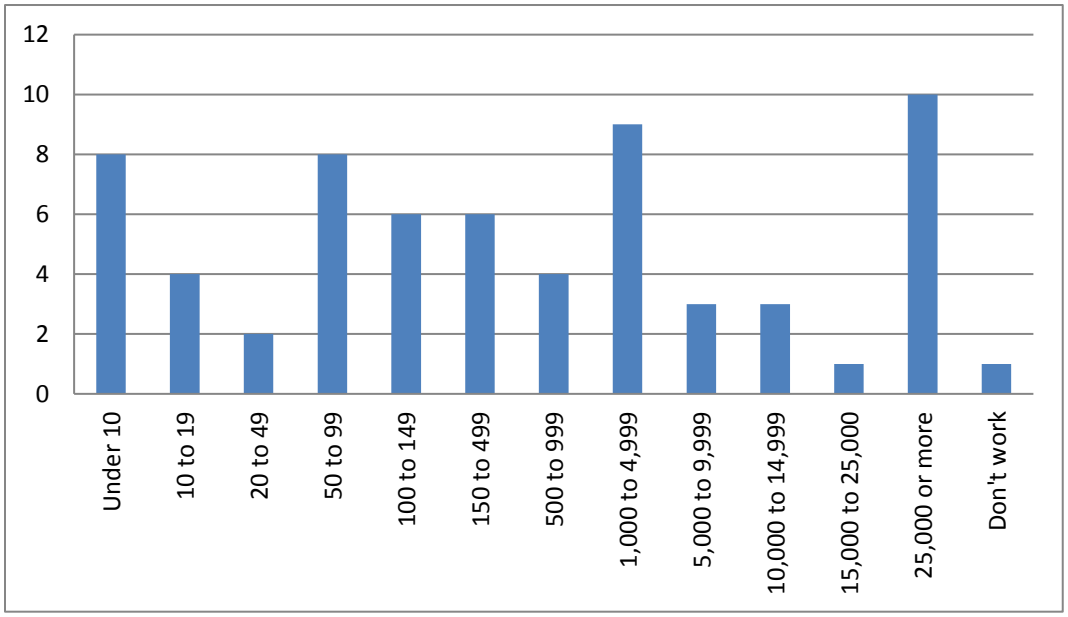

Figure 3.5: Industrial Organization Size

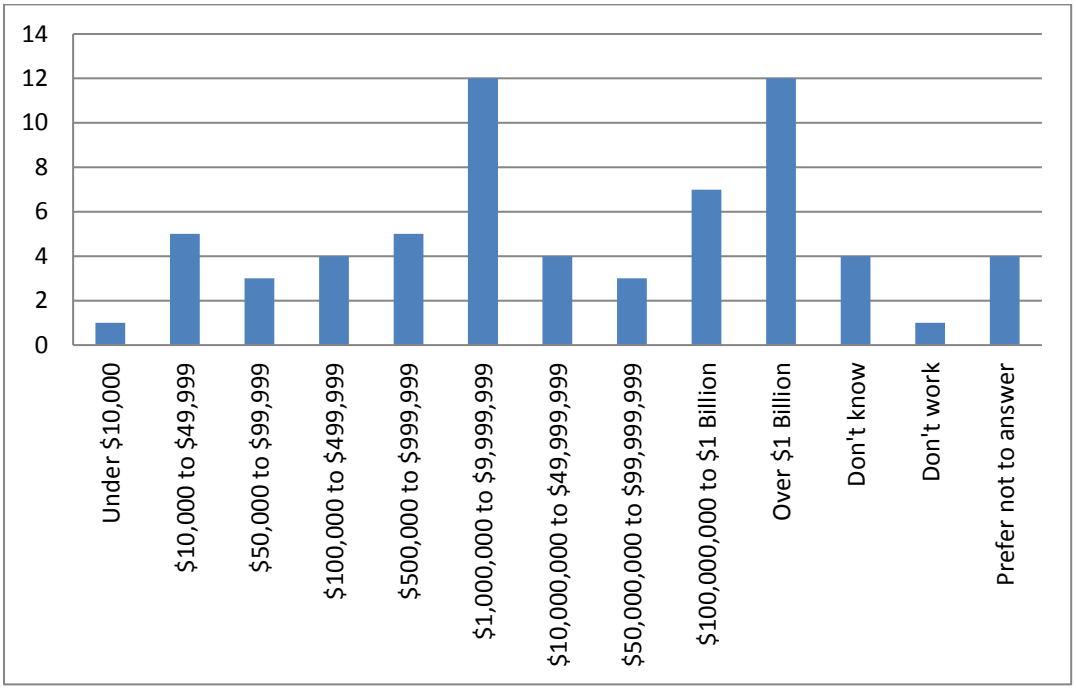

Figure 3.6: Industrial Organization Annual Revenue

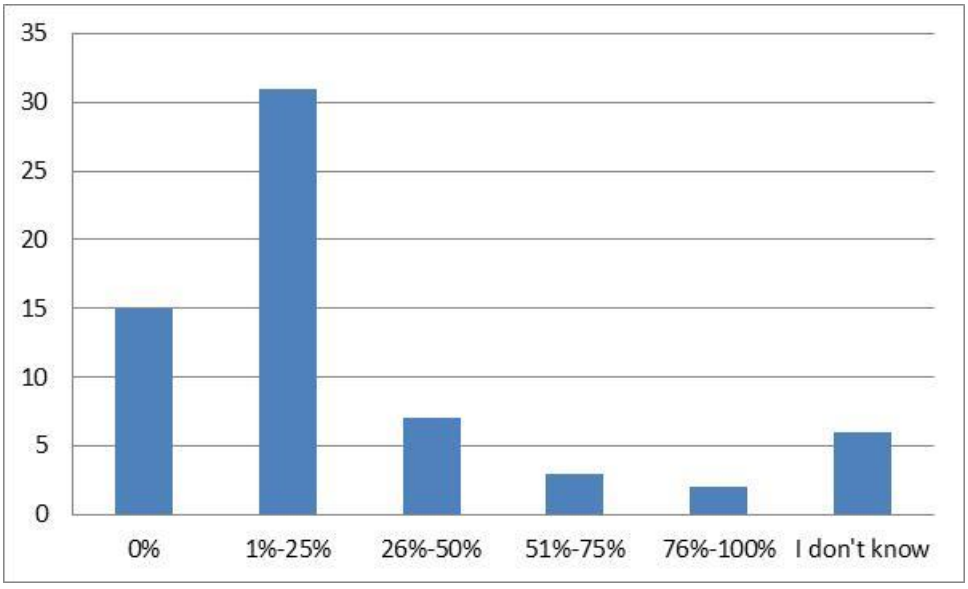

Figure 3.7: Percentage of Business Outsourced By Organization

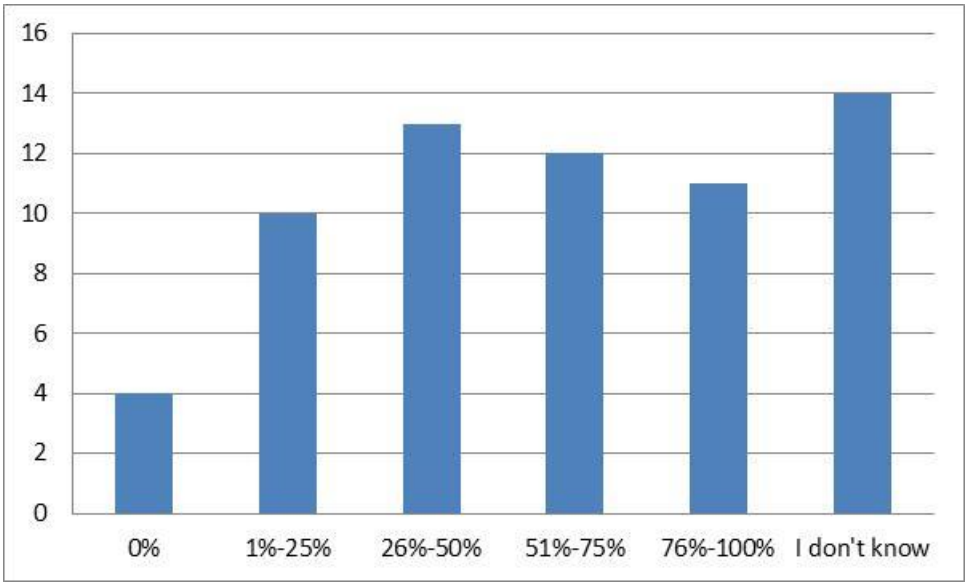

Figure 3.8: Percent of Products/Services That Come From Organization's Supply Base

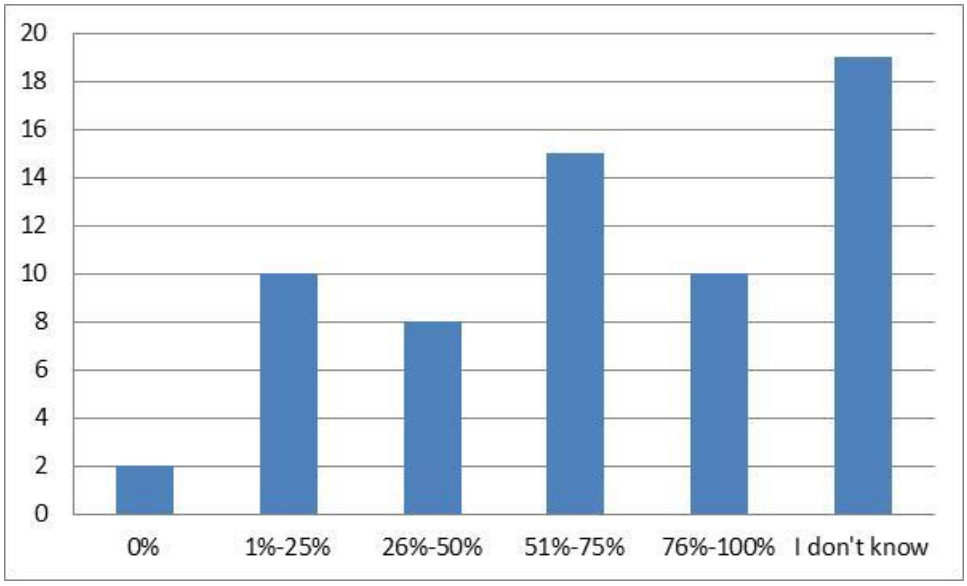

Figure 3.9: Percent of Suppliers That Have Used Quality Techniques

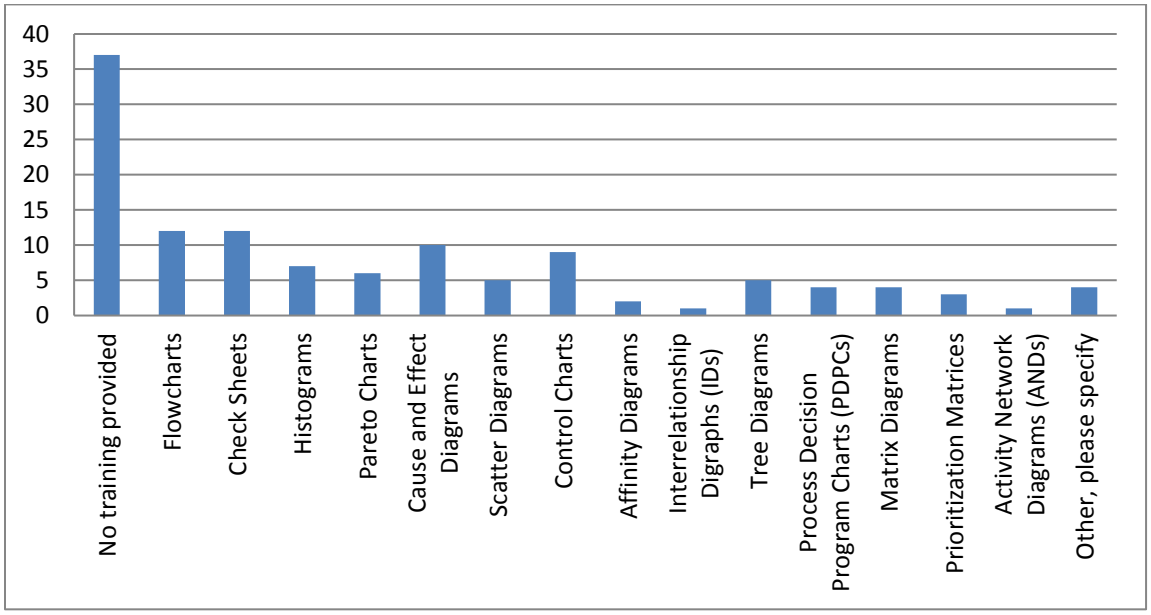

Figure 3.10: Quality Training Provided to Suppliers

4. DISCUSSION AND CONCLUSION

This research suggests that while research in quality tools has come a long way, industry is not always keeping pace. While some respondents have worked with their suppliers to assure quality programs are in place even providing incentives for such work, others are not aware of suppliers' quality assurance programs and do not appear to be tracking them. This may be related to several factors, such as the size of the organization, the industry, or the length of time or quality of the partnership arrangement with the supplier. This sample size is not sufficient to parcel these out, but does indicate that this is an area for future study.

In addition, the sample consisted of respondents who self-selected as being in a job related to the quality management area in their respective companies, and yet many claimed to 'not know' the answers to very basic questions regarding the percentage of outsourcing, use of quality management tools, and training for suppliers. This may be an artifact of this sample, or it may be indicative of a much larger problem related to a lack of knowledge regarding a company's commitment to quality improvement among its employees. Quality assurance tools require all employees be 'on the same page' in order to be effective, and yet this does not appear to be the case in this study. A follow-up study would appropriate to better understand the individual respondent, in terms of their role in the company and their personal understanding of quality as it relates to their job or organization.

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II. SHOPPING ON THE GO: HOW WALKING INFLUENCES MOBILE SHOPPING PERFORMANCE

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ABSTRACT

Given the growth in use and capabilities of mobile devices, the mobile commerce (m-commerce) market is also continuing to grow and become more sophisticated. The majority of consumers in the United States (US), more than 90%, between the ages of 18 and 34 own a smartphone. These numbers are even higher in the United Kingdom (UK) and Canada. Studies have been conducted exploring the results of m-commerce and the use of mobile devices, however, most past studies on the topic are done in a stationary setting. This is an exploratory study seeking to examine how m-commerce is impacted by the use of mobile devices in a stationary, or walking, setting. Treadmill desks were used to replicate mobile shopping while using mobile devices and then compared the results with the same task completed on mobile devices in a stationary manner. Results indicate that shopping while walking increases the time it takes to compete the shopping task but not the price spent for the product in question.

Keywords: M-Commerce, mobile commerce, mobility, walking, shopping, treadmill desk

1. INTRODUCTION

Mobile devices are changing the world one consumer at a time, leaving retailers struggling to catch up. In the US alone, over 90% of consumers between the ages of 18 and 34 own a smartphone and the numbers are even higher in the UK and Canada (Lella, Lipsman, & Martin, 2015). As such, most consumers are now multi-channel shoppers, who flow seamlessly between traditional, social, and mobile commerce (Lella et al., 2015; Melis, Campo, Breugelmans, & Lamey, 2015). This study looks at a more specific phenomenon of consumers who are truly 'mobile' as they shop. Those consumers who are walking, whether it through a retail store or down a city street, while shopping online. More specifically, this paper examines the shopping behavior of active consumers through the use of mobile technology while walking on a treadmill as compared to sitting at a desk.

2. LITERATURE REVIEW

Wireless devices, like cell phones, tablets, personal digital assistants (PDAs), and other handheld devices have proliferated in the last decade and have enabled real-time communication and anytime-anywhere access to contacts, the internet, and mobile shopping (Hu, Yang, Yeh, & Hu, 2008; Melis et al., 2015). According to Internet Retailer, of the 49.6 billion visits to the top 500 e-retailers in 2014, 26.4 billion (53.2 percent) stem from smartphones (Siwicki, 2012). Similarly, the percentage of online retail sales placed via mobile devices grew from 11 percent in 2012 to 25 percent by 2017 (eMarketer, 2013). Thus, more and more people consider m-commerce to be the next wave of electronic commerce (Liang & Wei, 2004; Punj, 2012).

With the proliferation of wireless devices came the expectation of a satisfactory mobile shopping experience among customers. In fact, a recent study showed that, on a global scale, consumers are more satisfied with their online shopping experience as compared to in-store (Liang & Wei, 2004). So, in order to encourage brand loyalty, stores are more frequently incorporating online experiences into the store, through kiosks, apps, and mobile websites (Hu et al., 2008; Khansa, Zobel, & Goicochea, 2012; Demangeot & Broderick, 2010). In addition to increased consumer experience through direct interaction, many stores also provide indirect use of such technology through internal mobile marketing, or mobile applications geared toward front-line staff to allow for a better customer service experience (Clifford, 2009). This integration of traditional shopping with mobile interactivity has been shown to increase brand attitude, drive traffic to stores, increase sales and improve loyalty (Husson & Ask, 2011; Khansa, 2011; Mallat, Rossi, Tuunainen, & Öörni, 2009).

From the consumers' perspective, they expect this interactivity. In fact, time spent on mobile apps is up 52% in the past year, and time spent on mobile websites is up 17% (Lella et al., 2015). While only 5% of the time consumers spend on apps is dedicated to retail shopping, Amazon and eBay still rank in the top 10 most used mobile apps (Lella et al., 2015). Even more telling is the apparent trend of consumers who are nearly never without their smartphone (Shankar & Balasubramanian, 2009). In fact, smartphones have become the utilitarian device akin to Swiss Army Knives, that encompass everything from a flashlight and compass to a translator and navigator (Lella, 2015).

With the growth of mobile device capabilities and use, follows the growth of mobile commerce. M-commerce, or mobile business, means any transaction, either direct or indirect, with a monetary value, conducted through a wireless telecommunication network (Barnes, 2002). The evolution of m-commerce has been swift and one way to break down the progress is to examine the shifts in technology. For instance, Khansa, Zobel et al studied more than 2,300 U.S. patent applications related to m-commerce from 2001 to 2010 to map the evolution of m-commerce innovations to understand how m-commerce has matured over the years. Since this trend toward mobile commerce continues to this day, this study has extended this past the original 2010 research to include the subsequent years. Table 2.1 identifies the most important m-commerce technology advancements from a year by year aspect (Alba, 2014; Barrese, 2014; Greenberg, 2015; Hughes, 2013; Kelley, 2013; Khansa, 2011; Marcus, 2015; Nakache, 2014; Wohlsen, 2015). During the process of m-commerce development, six main categories are contributing for the m-commerce ecosystem: Mobile Payments, Retail Enablement, Mobile Retail, Marketplaces, On-Demand Services, and App-Based Services (Nakache, 2014).

Table 2.1: Evolution of M-Commerce Innovations (2001-2015) (Khansa et al., 2012)

Year	M-commerce Innovations
2001	Push mobile marketing
2002	Secure mobile banking
2003	Pull mobile marketing
2004	Privacy protection policies
2005	Mobile ticketing
2006	Identity and access management
2007	Customer engagement and empowerment
2008	Intelligent personalization
2009	Recommender systems; Mobile word of mouth; and consumer co-creation
2010	Social networking-based mobile marketing; social networking-based m-commerce and entertainment
2011	Virtual wallets
2012	QR code, Augment reality
2013	Fingerprint technology
2014	NFC-enabled payment technology
2015	In-app shopping; on-demand service

As shown in Table 2.1, mobile marketing in early stages put more efforts on utilizing data relevant to the behaviors of customers (e.g. location) to push targeted advertisements to them (Khansa et al., 2012; Zhang & Mao, 2008). However, push-based

marketing was replaced by pull-based marketing from 2003, partially due to the privacy laws that protected the mobile users from unsolicited advertising (Clifford, 2009). Starting in 2010, m-commerce has taken advantage of social networks to bring the advertising to global consumers. Therefore, Forrester Research predicted that companies throughout the world would spend more than $24 billion on mobile marketing by 2013 (Husson & Ask, 2011).

Along with the growing need for mobile banking applications, safer and privacy-oriented m-commerce inventions were triggered by privacy protection policies (Table 2.1: 2002, 2004, and 2006) (Khansa, 2011). While in 2006, identity and access management (IAM) technology was employed to further protect the security of mobile banking (Khansa, 2011; Khansa et al., 2012).

Even though mobile ticketing was adopted as early as 2001(Mallat et al., 2009), this patent gained increasing importance in 2005. Innovations including ticket delivery and distributions and location-based technologies have led mobile ticketing to a much higher level. Because of the barcoding and scanning technologies, mobile users can present their electronic tickets via smartphones (Khansa et al., 2012).

When Apple released its iPhone 4 and operating system iOS in 2007, m-commerce finally took off. Designed with entertainment in mind, iPhone 4 was born with a tablet's multi-touch function (Isaacson, 2011). Mobile users can quickly search for prices and go through reviews even while shopping in stores by touching the cellphone screens. Google's Android OS boosted the revolution of m-commerce.

Consumer empowerment means more than offering m-commerce applications and saving money for customers (Khansa et al., 2012). Users are now able to provide direct

input on many issues and express opinions at their fingertips. For instance, the Free2Work app empowers consumers to express their concerns directly about the firm's production practices, including hiring forced child labor and unreasonable working hours for employees in developing countries (Free2Work, 2011). Additionally, Amazon Smile provides customers a chance to buy a wide variety of products on Amazon with a portion of each sale going directly to the charity of their choice.

The innovation of intelligent personalization became very important for m-commerce in 2008. Tailoring services to a mobile user's personal profile and integrating users' preferences into their mobile devices, intelligent personalization enhanced the all the advantages of targeted advertising, mobile banking, electronic ticketing, and customer empowerment (Khansa et al., 2012).

In 2009, mobile word-of-mouth (WOM) including recommender systems, together with the consumer co-creation (Füller, Mühlbacher, Matzler, & Jawecki, 2009), provided a smarter and less error-prone consumer shopping experience. For example, Amazon is famous for its rating and review systems based on previous consumer transactions (Zwass, 2010).

From 2010, social networking-based m-commerce became more and more important. With various social networking tools, companies can interact with their customers seamlessly by creating fan sites or fan communities to promote their brands and products (Khansa et al., 2012). Meanwhile, mobile games, a big part of m-commerce, has been considered as one of the largest mobile application area. In fact, users are usually willing to pay the services in games (Penttinen, Rossi, & Tuunainen, 2010; Jung, Min, &

Kellaris, 2011). The iPad, released by Apple in 2010, was widely believed to be aimed at the mobile entertainment market (Isaacson, 2011).

After 2010, m-commerce innovations continued to emerge and enhance in daily life. With mobile consumption on rise in 2011, virtual wallets were used to make the shopping process more convenient (Indvik, 2011). In 2012, marketers heavily integrated QR (quick response) codes and augmented reality into their strategies to boost sales and drive participation to anchor m-commerce success (Kats, 2013). Fingerprint readers and other biometric sensors unleashed mobile users from remembering passwords effectively and easily (Barrese, 2014), further enabling universal m-commerce authentication (Kelley, 2013). Wells Fargo analyst Maynard Um predicted in 2013, that a fingerprint sensor in the iPhone 5S would aid mobile commerce and boost adoption in the corporate environment (Hughes, 2013). NFC (Near Field Communication), though not a new mobile technology, is capable of replacing credit card swipes. Recently, more and more credit card companies, banks, and merchants have adopted this technology, and with a strong marketing push from both Apple and those partners, NFC-enabled payment may become the next service that gains mass adoption among consumers (Alba, 2014; Slade et al., 2015). Now that IT giants like Facebook and Twitter have grown more experienced with in-app advertising, they are pursuing in-app shopping. Shopify, a partner of Facebook is providing services to those who want to sell products via mobile technology easily while staying in Facebook (Greenberg, 2015). Similarly, with a Stripe account, any mobile user can sell on Twitter without leaving Twitter's app (Wohlsen, 2015). Apart from that, Stripe Connect, the latest set of services introduced by Stripe, is catering to the on-demand services such as rides, deliveries, and housecleaning.

3. THEORETICAL BACKGROUND

While the notion of walking while on a mobile device is not new, very little research has looked specifically at the effects of physical movement in m-commerce. M-commerce, or e-commerce transactions through a mobile device using wireless communication networks, has received much recent attention in literature, but in most cases data is collected while the participant is stationary (Siau, Ee-Peng, & Shen, 2001). Such studies fail to account for many factors that may be influenced by physical movement, despite much evidence in m-commerce and related research on similar tasks. For instance, evidence suggests pedestrians on cell phones have diminished recall (Nasar, Hecht, & Wener, 2008), increased distractions (Bungum, Day, & Henry, 2005; Hatfield & Murphy, 2007; Lamberg & Muratori, 2012), reduced speed (Lamberg & Muratori, 2012), and decreased ability to read (Mustonen, Olkkonen, & Hakkinen, 2004).

Past research indicates that in order to walk an obstacle course while interacting with a mobile device, participants needed to either slow down as they walked or lost accuracy in their typing skills to compensate for the distraction caused by walking (Schildbach & Rukzio, 2010). The behavior is becoming more frequent as many papers have researched the 'distracted pedestrian' who is immersed in their phone while walking (Lamberg & Muratori, 2012; Schildbach & Rukzio, 2010). As with all things, consumers must take the good with the bad. In fact, distractions caused by mobile devices are growing with the consumers' dependence on such devices. In addition to walking, many instances of cell phone-related distraction have been identified, affecting driving safety (Stothart, Mitchum, & Yehnert, 2015), classroom performance (Berry & Westfall, 2015; Lepp,

Barkley, & Karpinski, 2015), work ethic (Thornton, Faires, Robbins, & Rollins, 2015), and sleep quality (Li, Lepp, & Barkley, 2015).

Given the growing number of traditional online and mobile device shoppers, this research seeks to compare shoppers that are shopping online in a traditional, stationary, fashion to those actually moving while on a mobile device to flush out differences that can impact electronic and mobile commerce, marketing, and the development of mobile devices and their associated technology. While this research is exploratory, previous research suggests that the time spent completing a task may be affected by both walking, as well as a consumers' previous experience with e-commerce (Sun, Tai, & Tsai, 2010). Thus this research suspects that walking while shopping will increase amount of time required to successfully complete the shopping task

In addition, other indicators of shopping effectiveness might also be impacted by the distracted shopper. So that even if participants were asked to shop for a product and get a good value or price for that product, the walking condition may also have a decreased effectiveness. Thus, we propose that being mobile would increase the likelihood that a consumer spends more on the same product as the condition that is stationary.

4. METHODOLOGY

Seldom do you find someone walking down the street with a smartphone not tethered to their hand. It has been found that walking on a treadmill desk while typing on your computer or while on a conference call is much like walking down the street while using your smartphone (LifeSpan, 2015).

Three treadmill desks were utilized in this study to simulate movement while shopping on the go. The treadmill desks were moved to a common location where each study participate could be monitored for accuracy, conformance to the study guidelines, and safety. Each participate was asked to bring their own mobile device, so that the shopping simulation would most accurately represent how they would naturally shop on the go, and reduce any device unfamiliarity. For the few participants who did not have a mobile device with internet capability, an iPad was provided to them for use. Participants were gathered from a few college courses with a target consumer group that regularly shops online. These participants were asked to sign up for a participation time, and report to the location of the treadmill desks for the study. Studies have indicated that the recommended walking speed for computer work is less than 2 mph (Consumer Reports, 2013). Each treadmill was set to 1 mile per hour to replicate a natural, safe pace for shopping on the go on a mobile device.

When the participant arrived for the study, they were placed on a treadmill desk with a mobile device in hand. The treadmill was started at 1 mile per hour and when they were comfortable with their pace, they began their shopping experience. The instructions were reported to the participant through Qualtrics online software so that each stage of participation could be measured. The participants were given instructions to shop for a

particular item: a Windows Surface Pro 3 with a 512GB hard drive and an Intel Core i7 processor. Each participant was asked to shop for the same item to ensure that they received a similar experience in searching for this specific product, regardless of the method of procurement. The participants were given the option of using a full website and browser, a mobile website and browser, or an app for a particular shopping outlet.

After the participant indicated they had located the item and had satisfied themselves to their shopping standard of purchase, they exited the shopping experience and proceeded to an online questionnaire, also through Qualtrics. Questions pertaining to their preferences, shopping experience, attitudes, overall perceptions, and preferred method of online shopping were included.

Web skills were also measured using a self-report scale developed in previous literature (Mathwick & Rigdon, 2004; Novak, Hoffman, & Yung, 2000). Additionally, participants self-reported age, sex, and price found. Time spent performing the task was captured using an automated timer within Qualtrics.

5. ANALYSIS AND RESULTS

Ninety-five percent of participants (N=95) reported successfully finding the exact item. No participants reported having purchased this item before. Of the initial sample, 7 participants were disqualified for reporting finding the item for an extremely improbable price or no price at all, suggesting confusion about the task. On average, these participants required 4.76 minutes and used 40 clicks to complete the shopping task. The average price found for the product (including shipping) was $1,552.12, which is a reasonable average price for this item. Most (53%) reported using a mobile website to complete the task, though 27% reported using a mobile application and 19% used a normal website.

Approximately 58% reported a preference for online shopping over in-store shopping. As shown in Table 5.1, half of participants (49.47%) indicated that their choice of user interface was governed at least partly because they were familiar with it already. Approximately 17% because it was already on the device they were using, 39% because they perceived it would be faster, 23% because of perceived better product selection, 18% because of best price, 16% because they would learn the most using the user interface, and 8% noted alternative reasons for their choice. Participants were 48% female, and averaged 22 years old (SD = 5). Two participants failed to report their age and in these cases age was imputed using a random forest approach.

A multivariate regression model was specified using task time and final price as dependent variables, and walking (a dummy variable indicating experimental condition), age, and web skills as independent variables. Model results are reported in Table 5.2.

Table 5.1: User preference results

What user interface did you use in your online shopping experience today?						
		Mobile App	Full Website	Mobile Website	Other	Total
Why did you choose the type of user interface you used today? (Please check all that apply)	Familiarity	10 41.67%	10 55.56%	27 52.94%	0 0.00%	47 49.47%
	Had the app on my device already	13 54.17%	1 5.56%	2 3.92%	0 0.00%	16 16.84%
	Faster	9 37.50%	6 33.33%	21 41.18%	1 50.00%	37 38.95%
	I know I can get the best product selection	5 20.83%	5 27.78%	12 23.53%	0 0.00%	22 23.16%
	I know I can get the best price	6 25.00%	2 11.11%	9 17.65%	0 0.00%	17 17.89%
	I know I can learn the most about a product	6 25.00%	1 5.56%	8 15.69%	0 0.00%	15 15.79%
	Other	3 12.50%	2 11.11%	2 3.92%	1 50.00%	8 8.42%
	Total	24 100.00%	18 100.00%	51 100.00%	2 100.00%	95 100.00%

Table 5.2: Multivariate regression results

Overall model variance			
Factors	Pillai's Trace	F(2, 83)	p
Walking	0.13**	6.25	.003
Web Skills	0.12**	5.59	.005
Age	0.06	2.53	.086
Task Time			
Coefficients	Estimate	SE	t value
(Intercept)	414.95	102.47	4.05***
Walking	59.38	25.50	2.33*

Table 5.2: Multivariate regression results (cont.)

Web Skills	-65.37	20.57	-3.18**
Age	4.73	2.24	2.12*
RSE: 109; R^2 = .22; F(3,84) = 7.91; p = .000			
Price Found			
Coefficients	Estimate	SE	t value
(Intercept)	1307.64	318.09	4.11***
Walking	112.79	79.16	1.43
Web Skills	25.72	63.87	0.40
Age	2.70	6.94	0.39
RSE: 337; R^2 = .03; F(3,84) = 0.95; p = .422			

*p < .05; **p < .01; ***p < .001

Walking was associated with a 59-second increase in task completion time. Task time decreased by 65 seconds for every Likert point increase in reported web search skill. Each marginal year of age was associated with a 5 second increase in task time. Walking, web skills, and age had no discernable effects on the price found for the item.

6. DISCUSSION AND CONCLUSIONS

The purpose of this study was to identify the effect of physical mobility on mobile device task performance. The analysis results support the suspected finding that physical mobility would increase the amount of time required to complete a shopping task. However, the expected result that mobility would increase price paid was not supported by the analysis results.

The increase in time to complete the shopping task while walking is strongly supported in the literature as well. While this is the one of the first studies to examine mobile shopping in a walking condition, similar studies looking at texting or web-browsing support this notion (Mustonen, Olkkonen, & Hakkinen, 2004; Schildbach & Rukzio, 2010).

While this research had predicted an increase in price paid as well, this study may not have correctly assessed the complexity of value and, thus, utilized a measure that was overly simplistic. For instance, others have studied elements of value including both monetary (perceived price) and non-monetary (perceived risk, convenience, and pleasure) factors of value (Stothart et al., 2015; Ko, Kim, & Lee, 2009). Pihlström & Brush analyzed the direct effects of four value dimensions (monetary, convenience, emotional, and social value) for mobile content service users (Pihlström & Brush, 2008). This research had restricted its measure to a price to indicate value and may have not adequately captured the concept in order to find significant results. This does not mean, however, that value should not be studied further while looking at mobile shoppers.

Looking forward, other studies may examine the variety of shopping tasks for mobile consumers. In this study, the task was limited to each respondent shopping for the same product. How would that compare to shoppers who were simply asked to buy a gift

for someone? One study in particular suggested that walking may have a strong effect on divergent thinking tasks (such as creative tasks) (Oppezzo & Schwartz, 2014). Thus, one might predict a difference in satisfaction with the shopping experience if allowed to exercise some creativity in the process of shopping.

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SECTION

2. CONCLUSION

Customer experience can be impacted by many things along a supply chain. As Paper I in this study indicated, quality training offered to suppliers may enable a significant quality increase, significant time saving benefits, and significant financial benefits in the organizations who use these suppliers. The quality increase and time saving in the supply chain are typically positively correlated to better customer experience. Paper II proves that mobile technology has an impact on m-commerce by influencing the time on task to complete online shopping, which in turn influences the customer experience. Overall this study has helped to bridge the gap between some of the factors in the supply chain associated with customer experience.

3. FUTURE WORK

This thesis has examined a few factors relating to customer experience, specifically the impact of quality management tools and a customer's mobility on their shopping experience. These studies, however, looked at just a few of the factors that impact their experience and so there are plenty of opportunities for subsequent research streams. More specifically, each paper has led to more research questions that could be tackled in future studies.

As for the quality's impact on the supply chain, more perspectives could be taken into consideration. For example, does the usage/implementation of quality tools increase customer satisfaction and how does that translate to firm performance? Is there a gap between academic and industrial environments when using different quality techniques/tools? And, if so, how can we bridge that gap to maximize the potential impact of such quality tools?

Starting further downstream at the customer experience, the mobile commerce study also led to a several additional research questions. One possibility would be to dig deeper in examining consumers' experience as they walk and shop, such as shopping satisfaction, enjoyment, and attitude toward the task. Also, it could be beneficial to look into the context of different types of products instead of a specific product in this study. Accordingly, the shopping task can be extended to a more creative goal, e.g. buy a birthday gift for your family member. These are just some of the questions that arose out of this research and does not include the exploration of additional dimensions of supply chain and distribution on consumer experience.

VITA

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