Effects of Internet of Things (IoT) on Business Management

An Honors Thesis (HONR 499)

by

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ABSTRACT
Technology is ever changing, and businesses must adapt. The current technological innovation is called Internet of Things (IoT), an inter-working of physical devices—embedded with software, sensors and network connectivity that allow these objects to collect and exchange data. The purpose of this study is for the reader to gain a better understanding on how IoT can best utilize in business and determine the effects of IoT on general business management across various industry. The main components of this thesis are an introduction to the topic, a review of prior literature, an explanation of new research, a discussion of the research’s results, and a conclusion to the thesis.

ACKNOWLEDGMENTS
I would like to thank Dr. Catherine Chen for advising me through this project. Her guidance has helped shape journey throughout my four-year college career by encouraging me to pursue the difficult but rewarding majors of Computer Information Systems and Business Analytics.

I would like to thank Dr. Fred Kitchens for supporting this endeavor by supplying sources and giving good advice.

I would like to thank Dr. Hamed Zolbanin for encouraging my exploration of IoT from the perspective of a data scientist.

I would like to thank Gayle Hartleroad, the Miller College of Business Honors Program, and the Miller Scholarship for giving me the opportunity to pursue and the tools to succeed in my collegiate career at Ball State University.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process Analysis Statement</td>
<td>1</td>
</tr>
<tr>
<td>Thesis</td>
<td>2</td>
</tr>
<tr>
<td>Introduction</td>
<td>2</td>
</tr>
<tr>
<td>Literature Review</td>
<td>3</td>
</tr>
<tr>
<td>Significance of Study</td>
<td>7</td>
</tr>
<tr>
<td>Methodology</td>
<td>8</td>
</tr>
<tr>
<td>Data Collection and Understanding</td>
<td>8</td>
</tr>
<tr>
<td>Analysis</td>
<td>10</td>
</tr>
<tr>
<td>Results</td>
<td>12</td>
</tr>
<tr>
<td>Conclusion</td>
<td>12</td>
</tr>
<tr>
<td>Present Effects of IoT on Business Management</td>
<td>12</td>
</tr>
<tr>
<td>Future Effects of IoT on Business Management</td>
<td>14</td>
</tr>
<tr>
<td>Importance of Thesis Findings</td>
<td>15</td>
</tr>
<tr>
<td>Research Limitations</td>
<td>16</td>
</tr>
<tr>
<td>Next Steps</td>
<td>16</td>
</tr>
<tr>
<td>References</td>
<td>17</td>
</tr>
<tr>
<td>Appendix A: IRB Form</td>
<td>20</td>
</tr>
</tbody>
</table>
PROCESS ANALYSIS STATEMENT

I am a senior with a double-major in Computer Information Systems and Business Analytics. As such, new technology and its integration into business is extremely fascinating and pertinent to me and my future in business IT. It is with this mindset that I chose my thesis topic of the Internet of Things (IoT) effects on business management. I felt that studying this topic would provide a significant application of my academic knowledge because it explores the current adoption of a new technology, IoT, by business management. As well, I could better understand the importance of higher education in business, technology and analytics.

My project was conducted using literature review and frequency comparison to determine the effects of IoT adoption on general business management across a variety of industries. The research examines three categories of the IoT market, including sellers, buyers, and business articles, to obtain an overview of the trends in business management despite industry. While engaged in this project, I learned about IoT’s ability to enhance business efficiency and productivity. This discovery led to gaining a better understanding of my future role as an IT Analyst within business IT. Additionally, I found that my learning is extremely relevant for the technological wave sweeping toward business. Some insight gained from this project is better understanding of problems I could face in the future, including expenditure justification and security risk management for new technology like IoT. I also faced challenges in formatting this thesis, battling timing constraints, and making the IoT adoption analysis as thorough as possible.

Overall, this project means that there are many effects both positive and negative on business management’s use of IoT. However, it still an early phase of adoption so analysis results could be skewed. The audience should approach the thesis from the mindset of a technologist eager to understand business trends and where how they fit in it, but cautious of the ever-changing field.

Emily Bartman
Technological developments throughout history have spurred innovation in other areas. Business is no exception. The success of a business depends on that business’ management keeping up with competition, especially when disruptive technology poses a sink-or-swim situation. For example, when the creation of computers and the Internet caused a great change in people’s interactions, business management had to respond quickly with adjusting internal processes, creating online transactions, enhancing customer service, and expanding each business’ presence on the new social platform. While new businesses rose to meet those opportunities like Apple, Google and Amazon, many found themselves sinking fast. Those businesses that remained after the innovation were made more efficient and saw the rise of opportunities in cyber security, web development, systems engineering, etc. Now, a new disruptive technology has appeared. It is called the Internet of Things (IoT), and it holds the potential to once again change business management.

IoT continues where the Internet left off. While the Internet connects networks globally, IoT connects physical devices such as vehicles, home appliances, etc. to networks. The technological advancements supporting this new development includes new software and sensors embedded in these physical objects that enable them to connect on the network. From an outside perspective, IoT provides a new convenience. However, business management should begin to recognize the importance of this new technology and the possible opportunities it provides for the future of business. This study will investigate the benefits and consequences of moving forward with the utilization of IoT by general business management in hopes of discovering an optimal method.

Emily Bartman


**LITERATURE REVIEW**

As a new disruptive technology, IoT offers researchers a frontier for innovative discoveries, and even though IoT is still relatively new, many researchers have begun to publish insightful literature worth reviewing for this study. While many studies focus solely on IoT’s from the perspective of consumers, there are a few prior works that describe IoT from a corporate point of view. To gain a better understanding of the topic, it was important to review these relevant prior works.


While Doukas and Maglogiannis (2012) discuss the integration concerns of IoT and Cloud Computing geared towards pervasive healthcare; the concepts are applicable for general business. These concepts include: utilization of sensor networks, generation of more relevant data, and management of data. In this article, the authors study integration of IoT into healthcare areas like fitness, sleep and diet. Their findings showed that those patients, who used IoT devices and Cloud Computing software to track health, were more likely to get better treatment from health practitioners because patients could more accurately relay their health-related activities.

*Emily Bartman*
In other words, the article points out that sensor networks can be used in healthcare to generate more data than can be effectively managed by Cloud Computing and IoT. This is applicable to business management in that similar utilization of IoT and Cloud Computing would provide similar benefits for general businesses as those experienced by healthcare. These benefits include more efficient data generation, management, storage, processing, and future usage. Some specific examples of IoT devices that are mentioned in the article are mobile and wearable sensors. A modern example of this would be a Fitbit or an Apple watch. While some businesses in industries like pharmaceutical or sports might benefit from the IoT devices, the wide variety of sensors currently available prove that most businesses could gain beneficial data from looking into IoT. Thus, this article gave insight into IoT and its uses, focused on the healthcare industry and integration with Cloud Computing.

Similarly, Westerlund et al (2014) addresses IoT. However, this article focuses on IoT's association with business model changes. While this article looks at IoT in general business, it primarily analyzes business model evolution from pre-IoT to implementation of IoT in 2014. The prior work highlights major changes and attributes these changes to the IoT discovery. The results of this study are the finding of two underlying trends driven by IoT. These trends include a change from business management perceiving IoT as a platform to a business ecosystem, and the move of attention from the traditional business model to designing ecosystem business models. In other words, this article finds that since the discovery of IoT, business management has moved to integrate IoT into businesses' models which has caused management to see the integrated IoT and its business model as a singular ecosystem. Altogether, this article focuses on changes in business modeling caused by integration of IoT but does not address effects of IoT.
outside of business modeling nor is the best utilization of IoT explored. Therefore, this article focuses on IoT effects on business modeling and not much more.

Likewise, Dijkman et al (2015) examines the integration of IoT in business models. Despite the similarity in subject matter, Westerlund et al (2014) focuses on IoT’s contributions to business model evolution, while this article approaches the subject of IoT as a building block for a new innovative business model framework. As well, this article spends a great deal of effort in evaluating the new business model’s individual building blocks for value. To understand this, Dijkman et al (2015) conducted research with survey of business practitioners in a variety of industries. The results were the importance of IoT as a primary building block for the new business model. While this article does not seem to offer additional information from Westerlund et al (2014), that is not the case. The relevant information from this article is that practitioners from various industries supported IoT’s importance to the future of business modeling and consequently, its importance in the future of business management. However, this article does have similar limitations to Westerlund et al (2014). Basically, this article narrows its focus of IoT to the general business model; there is no further exploration into the effects IoT inflicts on business management or if there is a best utilization of this new technology. Thus, this article provides information on IoT’s importance to future business but lacks range of subject.

Additionally, Xiaocong and Jidong (2010) examines the structure of IoT business operation support platforms (BOSP). While Xiaocong and Jidong (2010) begin by introducing IoT, the focus of their article is on carriers that fill leadership roles in the IoT industry chain. In general, Xiaocong and Jidong (2010) analyze carriers’ demands on operating IoT services and details the importance of creating BOSP for carriers. In the end, this article proposes a BOSP formed by an access layer, device management layer, and ability formation layer. The relevant
information that can be ascertained from this article is that one of the most important utilizes of IoT can be in business operational support. It is critical that this knowledge be collected before moving forward because it provides guidance into areas that deserve additional exploration. However, despite the helpful guidance, Xiaocong and Jidong (2010) do not explore IoT outside of its uses as a business operation support platform. Thus, Xiaocong and Jidong (2010) provide relevant information that can be employed in the future of this thesis, but they do not analyze the best utilizations of IoT by business management nor the effects it might have on general business management.

Furthermore, Meyer, Ruppen, and Magerkurth (2013) investigate the integration of IoT devices as business resources. In other words, their article runs through the identification and integration of IoT resources in the business process. This is done to see IoT’s utility in facing expansion of resource planning and other such challenges of the future business environment. To summarize, Meyer et al (2013) spends a majority of the paper on resource planning. While resource planning is most definitely an interesting approach to studying IoT in general business, it is a narrowed utilization area. Resources are important for general business operations and management, so this article does hold relevance. In other words, the fact that Meyer et al (2013) highlights resource planning as an important utilization for IoT means that this thesis should take the time to examine resource IoT carefully in the future. However, the narrowed scope of this article, which only focuses on resource planning, means that despite the study’s relevance, Meyer et al (2013) does not answer the question behind this thesis’ purpose. Therefore, Meyer et al (2013) brought attention to the importance of IoT in resource planning but does not have the answers to best utilization of IoT nor its effects on business management.
Effects of IoT on Business Management

Overall, it is important to reiterate the key points from the relevant prior works that have been gathered and summarized. The reiteration is for remembrance and convenience as this information will be important to refer to as this thesis moves forward. First, Doukas and Maglogiannis (2012) gave insight into IoT and its uses in the healthcare industry. The key takeaway is that IoT has a critical role in data collection, management, and utilization for the future of general business. Secondly, Westerlund et al (2014) described IoT effects on business modeling. The key take-away is that IoT is continually pushing the traditional business model into behaving more like an ecosystem. Thirdly, Dijkman et al (2015) provides information on IoT’s importance to future business. The key take-away is the importance emphasized on IoT’s role for future business in various industries. Fourthly, Xiaocong and Jidong (2010) provide information on employing IoT as a business operational support platform. The key take-away is that one of the most important utilizes of IoT can be in business operational support. Fifthly, Meyer et al (2013) brought attention to the importance of IoT in resource planning. The key take-away is that resource planning should be analyzed in a future analysis of IoT utilization for general business management. While each of these five prior works give relevant information that helps identify areas of importance, they lack specifics concerning the best utilization of IoT and its effects on business management.

Significance of Study

The purpose of this thesis is to examine the utilization of IoT and its effects on business management. In other words, IoT is a new technology and as such, not much is known about its utilization and effects, especially in business management and decision making. While some studies have been made on IoT, very few have been geared towards business implementation. Overall, information from Doukas and Maglogiannis (2012), Westerlund et al (2014), Dijkman
et al (2015), Xiaocong and Jidong (2010), and Meyer et al (2013) present a gap in current IoT literature. As a real-world problem currently being faced in business, the gain of information on IoT in business management is imperative because experience with revolutionary technology has shown that quick, efficient adaptation can mean the difference between continuing to exist and running out of business. Despite this, business managers know that it would not be beneficial to merely adopt IoT without a justifiable reason to take on the expenses. Thus, it is necessary to explore the best utilization of IoT and its effects on business management.

**METHODOLOGY**

**Data Collection and Understanding**

To provide a comprehensive status of IoT in business management, data are collected from three different categories: IoT sellers, IoT buyers, and IoT awareness. IoT sellers include businesses that offer IoT services such as Amazon, Microsoft, IBM, Cisco, AT&T, and Intel. IoT buyers include businesses that are known to have successfully integrates IoT into their business management such as Disney, Amazon, OnStar, Google, and Apple. IoT awareness includes business articles from Business Insider and Forbes; while these articles are not technically studies that should be included in the literature review section, they are valuable sources for quick insight into current business trends. For this project, there are no additional notes for the completion of data collection.

The first data to be collected belongs to the subset called IoT sellers. To examine and collect current and relevant data, the search was limited to the IoT market bench-markers. These bench-markers include Amazon, Microsoft, IBM, Cisco, AT&T, and Intel. This data should be useful based on the idea that sellers only offer products and/or services that appeal to the market buyers. Going off that assumption, data from this collection should give insight into trends in IoT
as recognized by sellers. The method chosen to gather this data is website inspection of all sellers to understand their service offerings and compare the trends between sellers. Thus, IoT sellers’ collection will be employed to understand IoT trends.

The second data to be collected is in the subset called IoT buyers. To study and capture up-to-date and appropriate data, the pursuit was focused on a few well-known companies that have successfully started the integration of IoT into their business management. These include Disney, Amazon, OnStar, Google, and Apple. This importance of studying this data is based on the assumption that while businesses each attempt to customized integration of new technology, there is usually some underlining common threads. Based on that assumption, data from this collection should offer awareness of implementations of IoT as demonstrated by buyers. The chosen method to get this data is from first-hand knowledge of customers and employees which can be found on news sites, forums, and social networks. Therefore, IoT buyers’ collection will be used to understand commonality between implementations of IoT by business management.

The third data to be collected is from the subset called business articles. To explore and gather recent and applicable data, the investigation was geared toward a couple reputable journals that follow business trends across industries. These journals include Business Insider and Forbes. Business Insider and Forbes were selected because they are well-known and respected within business, meaning that business management has a high likelihood of exposure to these journals and their related articles. Additionally, Business Insider and Forbes each have articles detailing IoT’s role in business applications. For data collection purposes, three articles, published between August 2016 and April 2017, were analyzed from each journal. The Business Insider articles include one by BI Intelligence (2016), and two by Meola (2016). The Forbes articles include DeMers (2017), Marr (2016), and Morgan (2017). The basis for collection of this
data is the assumption that outsiders constantly watching the industries may capture insight into successful utilizations of new technology across those industries. Based on this assumption, data from this collection should provide insight into the most popular utilizations across industries. The method of choice for getting this data is article comparison, during which the frequency of topics related to IoT in business will be recorded from each IoT article made by the different journals. Therefore, business articles' collection will be utilized to study business management trends associated with the implementation of IoT from an outside perspective.

**Analysis**

Four separate frequency analyses were conducted for this project. First, each of the individual data collections had its own frequency analysis to see current trends in in each distinct subset. Then, the results from those three tests were compared with one another in a fourth frequency analysis. This fourth analysis was important because it allowed for understanding of any overarching trends between the subsets. Table 1 shows the frequency of IoT service offerings from benchmark sellers. Below are the analyses.

<table>
<thead>
<tr>
<th></th>
<th>Data Management</th>
<th>Device Management</th>
<th>Analytics</th>
<th>Security</th>
<th>Customization</th>
<th>Misc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amazon</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Microsoft</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>IBM</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Cisco</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>AT&amp;T</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Intel</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td><strong>Frequency</strong></td>
<td><strong>7</strong></td>
<td><strong>7</strong></td>
<td><strong>7</strong></td>
<td><strong>2</strong></td>
<td><strong>7</strong></td>
<td><strong>2</strong></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Table 1: IoT Seller Services Comparison*
Table 2 illustrates the frequency of IoT implementation in various companies. Please note that most of these IoT devices are used to capture customer data.

Table 2: IoT Buyer Implementation Comparison

<table>
<thead>
<tr>
<th>Company</th>
<th>Wristbands</th>
<th>Phones</th>
<th>Vehicles</th>
<th>Assistant</th>
<th>Misc.</th>
<th>Total by Device</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disney</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>3</td>
</tr>
<tr>
<td>Amazon</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>1</td>
</tr>
<tr>
<td>OnStar</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>1</td>
</tr>
<tr>
<td>Apple</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>2</td>
</tr>
<tr>
<td>Google</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total by Device</strong></td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>10</td>
</tr>
</tbody>
</table>

Table 3 illustrates the frequency of IoT topic coverage in the various IoT articles by the sample journals. Most of these topics center around analytical decision-making.

Table 3: Business Article IoT Topic Comparison

<table>
<thead>
<tr>
<th></th>
<th>Spending</th>
<th>Efficiency</th>
<th>Productivity</th>
<th>Data</th>
<th>Security</th>
<th>Misc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business Insider</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Forbes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

Table 4 consolidates uses the common features of Tables 1 through 3 to compare subsets and gain understanding of the overall subject, IoT in business management.

Table 4: Overarching Comparison

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>IoT Sellers</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>IoT Buyers</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Business Articles</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>
Results

The results of Table 1 show market trends for Data Management, Device Management, Analytics, and Customization from IoT seller’s perspective. The results of Table 2 demonstrate popular IoT device utilization for Phones, Wristbands, and Virtual Assistants from the perspective of IoT buyers. As well, Table 2 shows that many companies are not only implementing one but various IoT devices to their IoT implementations. The results of Table 3 are that business articles acknowledge the main reasons for IoT utilization across various industries is efficiency and productivity. Finally, Table 4 shows that the top most trends in utilization of IoT by business management across industries include: data-gathering and decision-making sharing the top spot, with device management and security concern coming in a shared second.

CONCLUSION

Present Effects of IoT on Business Management

At present, IoT is the frontier for technological innovation in business. In other words, early adopters in business management are coming to realize the usefulness of IoT to data collection, analysis, and decision-making. While the Internet has chauffeured businesses into the age of data, IoT promises to guide businesses to the next. As the technological frontier for business, IoT offers new opportunities and threats for business management.

As Tables 3 and 4 from the Analysis section show, general business management across a wide variety of industries perceives the positive effects of IoT to be enhancements to businesses’ data gathering, decision-making, device management, efficiency, and productivity. A great example of a successful early adapter to IoT in business management is Disney, specifically their
Effects of IoT on Business Management

theme parks. After booking a vacation package to Disney theme parks, guests are now sent wrist bands that have sensors in them. These wristbands contain guests’ credit card numbers, act as Disney hotel keys, and contain the guests fast passes. Also, the IoT wristbands connect to Guests’ private Disney Vacation accounts, the Disney Map app, and allow vacationers to review all of their park activities including restaurants visited, parks visited, and photos taken with Disney Characters. For Disney customers, these IoT wristbands make visiting the parks more hassle free and feel more personalized. Meanwhile, Disney is not only able to cater better to its customers, but it is able to gather critical information on every customer’s engagement with the parks, including rides, wait times, restaurants, photo areas, and much more. With IoT, Disney can collect massive amounts of data and analyze it to make decisions like ride replacement and partner contracts based on the desires of its customers which increases the profitability for Disney and its partners. Altogether, Disney exemplifies the successful early adoption of IoT for business management.

While there are many in various industries that have been successful with IoT, some early adopters in business management do face the negative effects of current IoT. Tables 3 and 4 also demonstrate some of the negative effects of being an early adopter to IoT. The main concerns of business management in this regard is the cost and security risk associated with implementation of IoT. As many businesses have discovered in the Internet age, staying in front of the technological curve takes money and possess a certain amount of risk. With IoT, business management understands justifiable expenses with projects, but the current security risk being posed by IoT can be damaging to any company. For example, hackers have proven that modern cars with all of the built-in IoT sensors and computer-generated features can be broken into or, in the worst case scenario, caused to crash. This is frightening to customers and as such a great...
Effects of IoT on Business Management

corn for businesses and their management teams. Overall, business management suffers negatively when their IoT implementation efforts result in un-justifiable premiums and/or security breaches that can result in devastation for the business and its customers.

Besides positive and negative impacts on business management, IoT in its current form is quite limited. Tables 1 and 2 illustrate the current limits to IoT implementation as recognized by business management across various industries. These include few IoT devices and services. While in the early adopter phase for businesses, IoT like all technology before it only has a few general features available from sellers. Once business management early adopters find new uses and establish better functionalities for IoT, more buyers and sellers will jump on the bandwagon. With more buyers and sellers entering the market, IoT devices and services will expand.

**Future Effects of IoT on Business Management**

The future holds many innovations, and as business management grows to accept and expand the utility of IoT, there will be many changes to businesses. The most impactful changes that can be seen include increased customer engagement, more remote workers, and enhancement to businesses’ efficiency and productivity. Like the Disney example, most businesses that adopt IoT will be gaining information on both their internal operations and their customers. With more personalized information at business management’s disposal, it is only a matter of time before personal customization is common and expected. Looking forward, this could prove problematic for mass production or business that rely on generic products/services. Likewise, IoT will change the business model as explained in Westerlund et al (2014) and Dijkman et al (2015) from the Literature Review section. This structure will more than likely mimic an ecosystem with many remote workers and a much more unilateral layout than current operations. While a shift in hierarchy appears to be taking place in big companies where there

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are no offices or assigned desks, IoT will allow business management to more effectively track employees without being tied to a physical office at all. Furthermore, by creating more types of IoT devices, business management in the future will be able to tie IoT into every aspect of their business to recognize which areas need optimization and effectively generate solutions with little to no loss in productivity.

With all of these opportunities laid out before future business management, it is important to note that these are mere speculations that could change on a dime depending on the overall successful rate of early adopters. Furthermore, the negative effects that impact current business management would have to be dealt with before businesses would see these future predictions. Thus, expense reduction and security risk must be eliminated as much as possible.

**Importance of Thesis Findings**

Overall, it is too early in business management adoption of IoT to determine if there is a best way for business management to utilize IoT. What can be seen currently is that many factors play into a company’s utilization of IoT including industry, company mission, company capabilities, and customer base. However, IoT in general business management of early adopters has shown the effects of continuing where the Internet left off by encouraging more data analytics, more customer-oriented management, decreasing internal process inefficiency, and replacing some labor-intensive jobs with those that depend on higher education. These are important findings because they demonstrate the critical situation business management is facing in the adoption of ever more technology, and a need for a population with higher education, specifically a better understanding of technology and analytics.
Research Limitations

The samples taken of the industry, while varied, are small and should be taken with caution. Data collection only included three areas of the IoT sector. This means that data is not representative of entire IoT industry, only a small area related to general business practices. The categories of IoT where data collection occurred were based off of prior literature; however, there exists a gap in the literature explaining how these categories were created and defined. Additionally, it is also important to understand that IoT is still in early adaptor stage. This means that IoT experimentation is on-going as developers and business leaders explore the uses of this new technology. Changes are most likely to occur as time goes on. However, that is outside the scope of this project because this project’s purpose was to understand IoT’s business management utilization in the current market of 2018. As well, the ways in which each company utilizes this technology are sure to differ because each company uses tools in different ways for competitive advantage and differentiation on the market.

Next Steps

IoT is still new and as such many things will change as more business management adopt it and make it their own. These changes could vary from product development to data management to integration customization. There is still much that is unknown when it comes to IoT’s future both inside and outside of business. As a result, it is important that this topic continue to be followed up throughout the ongoing years. This way technologists and educators do not lose sight of current business applications as these changes occur. Overall, IoT may continue to change, but the data age that it is leading this generation through is here to stay.
REFERENCES


Emily Bartman
Effects of IoT on Business Management


Effects of IoT on Business Management

APPENDIX A: IRB FORM

The Institutional Review Board received the above protocol. After review and consideration, the IRB concluded that this project does not meet the definition of 'research with human subjects' at this time, as specified by federal regulations at 45 CFR 46.

Research: A systematic investigation, including research development, testing and evaluation, designed to develop or contribute to generalizable knowledge. (Activities which meet this definition constitute research for purposes of this policy, whether or not they are conducted or supported under a program which is considered research for other purposes.)

Human Subject: A living individual about whom an investigator (whether professional or student) conducting research obtains: (1) data through intervention or interaction with the individual or (2) identifiable private information.

Consequently, this project does not require IRB approval as submitted. The IRB accepts this information for our records and will retain it in our files. Thank you for providing the IRB with these materials for review. Please contact the Office of Research Integrity if any details of the study are to change so that the IRB may reconsider the protocol, if necessary.

If you have any questions regarding this decision or would like to respond in person, please contact the Office of Research Integrity.

D. Clark Dickin, PhD/Chair
Institutional Review Board

Christopher Mangelli, JD, MS, MEd, CIP/
Director
Office of Research Integrity

Effects of IoT on Business Management