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The Application of Paperless Processes to Improve Data Management within Small to Medium Businesses

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The Application of Paperless Processes to Improve Data Management within Small to Medium Businesses

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ABSTRACT

Businesses are creating new value by implementing new processes built on modern tools. Small businesses, though, with much fewer resources than the most significant competitors, cannot follow the same path. How can these businesses use standard, widely available tools and techniques to improve their processes and create value within their business? This paper discusses the implementation of paperless processes using the electronic form technology, Google Forms, within the Honors Program at Georgia Southern University over two years. Action research methods were used to guide the research and implementation of new processes. Through the introduction of cloud-based electronic forms and process automation, process steps relying on paper and manual entry of data were reduced, increasing overall process quality.

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For Dr. Cuellar and his desire to form students.

For my parents and all those close to me for their support and encouragement.

1   Motivation and Problem Statement

The management of data and data collection is a critical process capability in modern businesses. As developing technology provides the capability to more efficiently manage data and data collection, businesses are driven to migrate towards digital data management. The goal of such a migration is to allow for easier data management which improves storage and retrieval as well as the overall quality of the data (Haneem, Azmi, & Kama, 2017). The businesses incapable of adopting new digital methods are often left competitively disadvantaged. Migrating to these new technology-enabled processes involves restructuring everything from the business's goals to the way they do things. McKinsey asserts that business processes need to be reconstructed to allow for easier facilitation of data collection (McKinsey Analytics, 2016). Such a migration requires knowledge of the new technologies and how businesses can utilize them. This creates issues for smaller businesses with limited budget and staff. Because of the limited budget and talent inherent in many small businesses, a feasible solution may only extend as far as a full or partial renovation of a limited number of processes. Organizations can likely be limited to free and standard programs like the Google and Microsoft app suites to facilitate the restructuring of data processes.

The research question we investigate: how can smaller organizations, given limited resources, successfully make the transition to modern data collection methods and what technologies can they implement as part of this transition?

Current literature is limited to discussion of the implementation of paperless processes and survey data describing the attributes of undergoing these transformations. Likewise, existing literature on data quality and management is abundant, but it does not step back

and discuss in depth the source of this data and how it is collected. The literature on the process and methods used to go paperless and the results of such implementations are equally sparse. The solutions implemented here take research on the attributes of paperless form technologies and the overall results of implementing these technologies and add the results of a case study that utilized these present findings. Existing research on data management picks up after this point.

This study followed Action Research methods to guide the implementation and analysis of new technologies and methods through an improvement project within Georgia Southern University's Honors Program which implemented electronic form technology. Through the course of this research, we found that through the introduction of the simple, free electronic form technology, Google Forms, and an associated add-on, Form Publisher, the process undergoing improvement had a steep reduction in paper-based steps and steps involving manual data manipulation. The introduction of these tools decreased the amount of paper needed to execute this process and the potential for error introduced through human involvement yet without a requirement for extensive capital or consulting expenditures.

This paper will continue with an explanation of the research site and the Action Research methodology, a review of the existing literature surrounding this subject area, a description of the research site and specific problem and the resulting action research interventions, and finish with the results of the interventions and conclusions.

2 Methods

2.1 Research Site

This study took place within the Honors Program at Georgia Southern University. This program operates with six full-time staff, one half time graduate assistant, and eight part-time student workers. Four staff, one graduate assistant, and six student workers work at the Statesboro campus office, and two staff and three student assistants work at the Armstrong campus office, fifty miles away. None of the full-time staff possess a background in information systems or business in general. Two of the staff do, however, possess research and statistical backgrounds and are adept at analyzing many periods of data for trends. The graduate assistant and two of the student workers at the Statesboro campus function as the Data team for the entire program. This group directs the data processes that occur throughout the academic year and maintain student records both in the digital file system and in the university's data warehouse. These processes encompass the entire life cycle of a student within the honors program, collecting data as students apply, fulfill the requirements of the program, and finally graduate. I (the author of this paper and primary researcher) worked in conjunction with the full-time staff and other student workers to take our changing external requirements and create new processes that can meet those requirements and anticipate future needs.

This research focuses on the intervention in an application process that transformed a paper-based application into an online form. The intervention took place with the process to join the University Honors Program as a currently enrolled student or the "current student application." This process has been the most developed application process in terms of the number of iterations as it moved towards an entirely paperless process. Both

the staff of the office (the client) and I (the researcher) worked closely as this project evolved. This project began in the fall of 2016 with the first iteration implemented in the spring of 2017. During the spring of 2018, the consolidation of the two universities was beginning, and external requirements for this process began to change. The second iteration of this process, post-consolidation, was implemented in the fall of 2018. Two successful executions of the second iteration have occurred before this paper's publication.

This research site is appropriate for our study because it fits the criteria of being a small organization with limited staff, resources or funding for data collection and management. Any improvement to the data management processes will need to be done with existing staff and no additional funding.

2.2   Methodology

For this study, we employed action research. Action research lends itself well to this situation "to address organizational problems while at the same time contributing to scholarly knowledge" (Davison, Martinsons, & Kock, 2004) Following Davison et al. (2004), our study was "iterative, rigorous, and collaborative." When performing action research, both the research interests and problem-solving interests exist co-operatively (McKay & Marshall, 2001). The problem-solving interest of the researcher follows the cycle in Figure 1. These interests mirror the interests of the client closely. They are related to the tangible goals of improvement. If this cycle becomes too much of the focus,

the research interests are lost, and the project mirrors consulting work, not legitimate research. (McKay & Marshall, 2001).
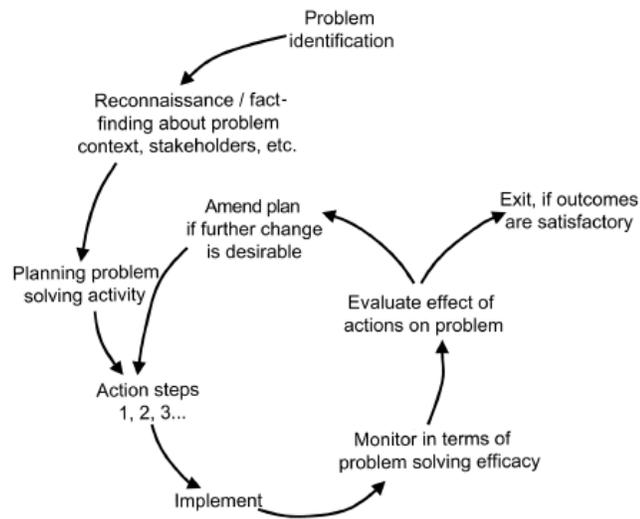

Figure 1 – The problem-solving interest in action research (McKay & Marshall, 2001, p. 50)

The second aspect of action research, the research interest, follows a similar cycle happening parallel to the problem-solving cycle, demonstrated in Figure 2. This second cycle ensures that the research interests of the project are not forgotten and that this project will result in a contribution to the general body of knowledge. By keeping both cycles in consideration while performing action research, "much greater clarity will ensue for both researcher and consumers of research output" (McKay & Marshall, 2001)
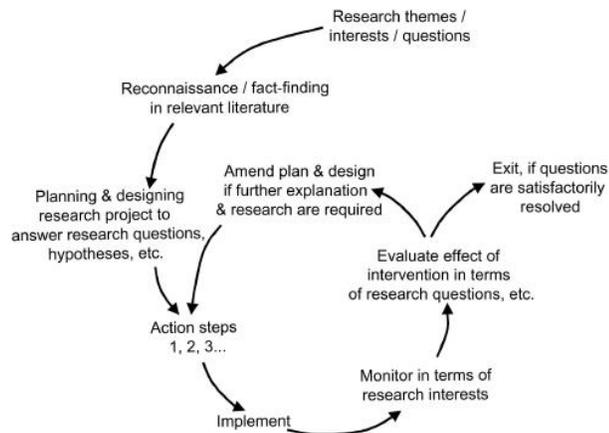

Figure 2 - The research interest in action research (McKay & Marshall, 2001, p. 51)

As can be seen in figures 1 and 2, the process of action research follows an iterative methodology. First, there is problem identification process. Working with the clients, the researchers identify a problem that the clients wish to solve and is of research interest to the researchers. Then the researchers working with the clients, investigate known solutions and plan an intervention into the client's environment. The researchers' investigation of similar situations informs such solutions that have been investigated in the past. This intervention is then implemented, and the effects monitored and evaluated. If the outcome of the intervention is satisfactory to the clients and the researchers have addressed their research questions, the process might end. Otherwise, another intervention is planned and implemented. Such iterations continue until the outcomes are satisfactory to the clients.

2.3   Literature Review

This literature review will discuss the importance of data in small businesses, paperless processes in small businesses, and the action research methods followed in this paper. The first section makes the business case for having data analysis in small businesses, the second section reviews existing literature on making processes paperless and concludes with where this paper fits into the body of knowledge, and the final section offers validation of our research methods.

2.3.1   The business case for data management in small to medium businesses

Research published by Donnelly and Simmons on loyalty card data and small business marketing describes the environment of small businesses and the impact that the lack of access to data and analysis has (Donnelly & Simmons, 2013a). The authors describe research performed with several small businesses in Ireland. They sought to remove the

cost and the experience barrier that currently exists for small businesses to access data and analysis. Provided with consumer data and accompanied by an analytics firm to help make sense of the data, this research finds that small business owners were better able to "adopt a more formalized approach to market planning" (Donnelly & Simmons, 2013a). This new approach helped business owners by enhancing their existing experience and intuition with data. The authors also make the point that the working environments of these businesses became more collegial and inclusive as everyone was able to see the data and conclusions and offer ideas (Donnelly & Simmons, 2013b). Donnelly & Simmons, 2013b describe the problematic position that small businesses are in because of their lack of access to data and analysis. The authors assert the value of small businesses in the economy but place that value against the fact that data dominated firms are taking away market share. (Donnelly & Simmons, 2013b) These big businesses rely on smaller suppliers, yet they are still taking away market share. This reduction of market share is a problem that has not received much attention and could cause consequences. The authors assert that consumers can be a powerful ally to these small businesses and insist that their data be accessible by all. While data ownership is part of a larger conversation, it carries significant implications in this case.

2.3.2   Application of data management techniques and practices

Chao (2015) provides an annotated bibliography that contains a very organized and useful source of literature available on three different aspects of implementing paperless processes within an SMB. Chao structures this document to act as a resource to "inform organizational executives, manager, and IT leaders" as well as "end-users who handle paper documents regularly" (Chao, 2015). The annotated bibliography describes existing

literature on the costs and benefits of paperless implementation, solutions already documented and researched, and obstacles that people encounter during the implementation process. Chao concludes by saying that "paperless environments provide numerous benefits to organizations, including increased data security, ease of information sharing, and more efficient and cost-effective processes" (Chao, 2015) and that "those organizations that carefully select the right technology and processes for their paperless environments and who plan the transitions carefully will enjoy better outcomes" (Chao, 2015).

Lutteroth and Weber (2011), focusing more specifically on selecting the right technology and processes for a paperless environment, discuss at length the benefits of electronic forms as opposed to traditional paper-based forms. This paper discusses some of the challenges of making a form digital. It includes discussion on three primary form technologies and evaluates each based on fifteen criteria. The criteria cover authentication of users, pre-population of data for each user, basic validation of form data based on basic formatting criteria or referenced against an external database, ability to employ branding in the product, email routing and business process integration, usability and accessibility for users, the ability to add digital signatures and audit the submission, mobile accessibility, development speed and ease of creation, training required to operate the technology, CRM integration, questionnaire style surveys, and deliverability. These qualities thoroughly describe requirements for electronic forms in many circumstances, though this paper concludes with the statement that it is "hard to find a form technology that fulfills all common requirements" and "that there is a tension between ease of use and power." Every technology needs to be thoroughly examined next to business

requirements in order to determine if it is the right fit. The authors continue by saying

"that there are many applications that satisfy some of the requirements while having a

different overall focus" suggesting that tools other than a dedicated electronic form

technology could be a part of the final solution needed. (Lutteroth & Weber, 2011)

2.3.3   Action Research

The action research techniques used in this paper come from the developments of McKay

and Marshall as well as Davison et al. McKay and Marshall build a model for action

research that is both practical and academically rigorous. They propose a cyclical process

with two cycles happening simultaneously. A cycle which focuses on problem-solving,

and a cycle that focuses on the research interest (McKay & Marshall, 2001). There are

two parties involved in action research: the researcher and the problem owner. Both have

vested interest in the success of the project, and both have different skill sets to offer.

Davison et al. expand on this cyclical framework and add further questions encompassing

the action research process. They offer a foundation of building a relationship between

the researcher and client, how both should go through the cyclical improvement process,

the incorporation of theory in the research, and the importance of creating new

knowledge in both the clients and researcher's communities. (Davison, Martinsons, &

Kock, 2004). These guiding principles "are intended to help assure the quality of [action

research], reporting, and reviewing" (Davison, Martinsons, & Kock, 2004)

2.4   Summary

The need for businesses to improve their value is demonstrated through this body of

knowledge as is the need for effective data management strategies. The literature also

explains the effectiveness and simplicity of paperless forms in enabling paperless

processes. However, there is a gap in the literature when a business decides to make this shift and lack a resource of how to implement new tools in the context of the broader benefits of paperless processes and proper data management.

3 Intervention

3.1 Problem

The processes we studied in this research have evolved over the past two years in response to the consolidation of Georgia Southern University and Armstrong State University. While the creation of new processes to accommodate two remote locations operating as one program was not a voluntary or planned decision, concerted efforts have been taken at this inflection point in the two university's paths to not only adapt to the new situation but also use this opportunity to plan for the future. Steps have been taken to eliminate paper records kept on students and store critical information in a digital filing system, transform existing processes from paper-based to paperless, and maintain data in a way that will be easily accessible and formatted for analysis. This overhaul mandated moving away from paper-based student records and paper-based collection of forms and documents.

The focus of each iteration in the action research process has been to reduce the total steps in the process, to reduce opportunities for human error to be introduced through manual data manipulation, and to minimize the amount of paper involved in the entire process. These goals were to be accomplished by introducing electronic forms and automating steps in the process. The data collected for each iteration consists of procedural documentation as well as digital records created during each execution of the

iterations. The director of the honors program introduced these criteria, and they were

agreed upon by all parties.

3.2   First Intervention

3.2.1   Diagnosis

The first iteration of this process was first introduced in the spring of 2014 and remained

relatively unchanged until the fall of 2016. This iteration of the process was lengthy,

delegated over half of the work to the data team, and relied exclusively on data processes

that were paper-based or involved manual data manipulation. I identified seventeen total

steps to this process. Five are paper-based, seven involve manual data manipulation

(MDM), none are electronic form based, none are automated, and the remaining five are

non-data steps. Of the data related steps, roughly 40% are, and the other 60% involve

manual data manipulation. None incorporate the technologies that our goal requires. A

full diagram of the first iteration of this process is in the appendix.

Paper-based		MDM		E-Form		Automated		Non-Data		Total	
5	29.4%	7	41.2%	0	0%	0	0%	5	29.4%	17	100%

Figure 1 – Breakdown of all process types

Paper-based		MDM		E-Form		Automated		Total	
5	41.7%	7	58.3%	0	0%	0	0%	12	100%

Figure 2 – Breakdown of data related process types

These statistics will act as our baseline for the second and third iterations.

3.2.2   Action Planning

Following the goals of reducing paper-based processes and manual data manipulation,

using available experience at the time, we adopted the plan of introducing electronic

forms as the method of collecting student application data for all the benefits Lutteroth

describes in their article. Lutteroth and Weber (2011) discussed three prominent form

technologies and evaluated each based on fifteen criteria. The features most important to

our research site were basic validation, email routing, business process integration,

usability and accessibility, development speed, ease of creation, required training, and

deliverability. We considered Google Forms, Qualtrics surveys, and Adobe Acrobat. The

product we would choose needed to have the added ability to convert form responses into

spreadsheet data after passing through basic validation, easing the requirement of manual

data entry. We also desired the product to have the ability to automate as much of the

collection, document creation, and notification process steps. Adobe Acrobat was

considered first due to its present acceptance with the staff and ease of use. This option

was rejected, however, because of the inability to quickly convert form responses into

values in a table for storage and manipulation. This product is still in use for different

processes where this is not a critical requirement. Qualtrics could collect form responses

and convert them to a table but was clunky and lacked in ease of use and speed of

development. The data collected from Qualtrics could only take the form of useful tables

after additional processing and storage. Google Forms was the final option considered.

At this point, we only used Google Forms for quick surveys and simple forms. The full

feature set had not been explored. The university already functioned in the Google realm,

so all documents created could remain under the ownership of university accounts.

Creating the form and connecting it to the spreadsheet was simple. The tool is intuitive,

and with some basic knowledge, the fields of the old physical form were replicated in the

digital form. The full-time staff received training on using Google Forms so that they

would be able to replicate it in the future for different processes. Google Sheets, the host

of this spreadsheet and destination of the form data, has full revision history, auto-save after an edit, and the ability to integrate third-party add-ons to extend functionality. While Lutteroth and Weber do not discuss Google Forms, the solution we chose to implement, it scores well at basic validation, process integration, email routing, usability and accessibility, mobile functionality, development speed, ease of creation, low training required, questionnaire style surveys, and deliverability. All criteria needed for this intervention are present in this technology as well as added features that could be useful in future iterations.

Lutteroth and Weber's fifteen criteria were able to address almost all of the desired revisions and improvements. Business process integration, ease of use, creation, and development, and email routing were essential features that were well discussed and important to our intervention. Still, the process step of converting the application information into a document that is usable for human evaluation remained unaltered causing many points for potential human errors to be introduced. Subsequent process interventions address this lack of functionality

3.2.3 Evaluation

The second iteration of this process, post-intervention, still resembles the first iteration in many ways. Switching to Google Forms to collect the application data changed the first step from paper-based to electronic form entry, and it also eliminated the need for the administrative assistant to collect paper applications and enter application data into a spreadsheet. The second iteration has one fewer step overall due to the removal of the student's transcript as part of their application. The honors advisor uses an online tool to

see a student's course history should they need it in the evaluation of an application. Full

diagrams of this iteration are in the appendix.

Paper-based		MDM		E-Form		Automated		Non-Data		Total	
3	18.8%	6	37.5%	1	6.3%	1	6.3%	5	31.3%	16	100%

Figure 3 – Breakdown of all process types

Paper-based		MDM		E-Form		Automated		Total	
3	27.3%	6	54.5%	1	9.1%	1	9.1%	11	100%

Figure 4 – Breakdown of data related process types

3.2.4   Reflection

This intervention caused an improvement in the process. The number of paper-based

steps was reduced by two, steps involving manual data manipulation were reduced by

one, and one each increased the number of the electronic form and automated steps. The

total number of steps was reduced by one. By all metrics, this intervention succeeded.

However, improvements are still possible. More than half of the data related steps

involve manual data manipulation and paper still is used throughout this process.

3.3   Second Intervention

3.3.1   Overview

The second intervention cycle of this process needed to address reducing paper and

human error within the overall process. The second intervention also needed to make the

process wholly decentralized and able to be completed from either campus. Taking place

a year and a half after the first intervention, I had more experience with data processes

and current technology for this second iteration. Enthusiasm for paperless processes was

still high in the office, and the staff had more experience with forms and their various

uses.

3.3.2 Action Planning

With the first intervention, Google Forms was introduced into the process to replace the paper application. For this second intervention, an add-on was introduced to augment the functionality of Google Forms. The add on, called Form Publisher, enabled documents to be created and emailed right from the form, triggered by the submission of a form. This additional functionality would allow us to collect letters of recommendation from professors via a Google Form sent to them once a student applied. The link to this form accompanied a copy of the student's application that was generated by Form Publisher. In Lutteroth and Weber's terms, this add-on greatly enhanced the qualities of "email routing" and further streamlined "business process integration" (Lutteroth & Weber, 2011).

3.3.3 Intervention

The add-on, Form Publisher, was integrated to automatically email professors with a link to another Google Form that would collect their letter of recommendation for the student. All data from the electronic form-based processes automatically got inserted as new rows on the appropriate table within the Google Spreadsheet. Students, once accepted, also filled out a second form which acted as their offer acceptance and request for advising. This data followed the same process and got added to the appropriate tables.

3.3.4 Evaluation

The second intervention was very transformative to the overall process. Form Publisher, once fully integrated, functioned as planned during the fall and spring executions of the process. Overall, the process went from sixteen steps to fourteen, and less than half of the data related steps involved paper or manual data management. Reducing the steps

happened because of Form-Publisher's ability to generate documents from form data

using pre-defined templates automatically. Diagrams for this process are in the appendix

Paper-based		MDM		E-Form		Automated		Non-Data		Total	
1	7.1%	3	21.4%	3	21.4%	3	21.4%	4	28.6%	14	100%

Figure 5 – Breakdown of all process types

Paper-based		MDM		E-Form		Automated		Total	
1	10%	3	30%	3	30%	3	30%	10	100%

Figure 6 – Breakdown of data related process types

3.3.5   Reflection

Form Publisher's ability to generate documents did some of the work that the data

assistant did in the previous iterations. Creating an application became as simple as

combining the pre-made application and letter of recommendation documents, and all

responses to any of the forms were automatically recorded in a spreadsheet and

documents to back up the records were created and stored. The single paper-based

process, "make face sheets" remains the only piece of paper kept for each student at the

request of the administrative assistant. This paper will probably disappear in the next

iteration of this process. Our research team exited the cycle at the end of this iteration.

This decision to exit was unanimous and partly brought on by a shift in part-time staffing

starting fall of 2019.

4   Results

4.1   Overall Results

These two interventions met our goals of minimizing paper within this process and

reducing points where people were performing data entry and manipulation by hand. The

introduction of the electronic form technology, Google forms, accompanied by the add-

on, Form Publisher, enabled us to automate 30% of the data-related steps of this process and have another 30% go through data-validated forms. By all measures, this was a success. While room for error still exists at points through this process, automation, and data validation significantly reduce that chance of error. The reduction in overall process steps also creates fewer points for error to occur. The introduction of automation also allowed for a less strict need to maintain the process as data was collected. Employees were involved at fewer points in the process, freeing up time for other tasks. Lutteroth and Weber created fifteen criteria to judge electronic form technologies against, and while their fifteen criteria are thorough, there improvements that could be made. In this research, there was a need for the automatic creation of documents to be referenced and shared by different actors in the process. This was accomplished through the addition of a third-party add-on to the form technology. Lutteroth and Weber discuss email and business process integration in a way that limits their ability to communicate information to humans. Email Routing was only to "automatically forward form data in machine-consumable emails after form submission," and business process integration was limited to "send[ing] an event once a form has been successfully populated and link this event to a workflow or process." The technology, Google Forms, adds the ability to integrate third-party add-ons that expand automation and notification capabilities. The add-on introduced in the second intervention also introduced the ability to automatically create, save, and share human readable documents populated with the validated form data. Both of these criteria, the addition of third-party add-ons and converting form data into readable documents for human use, greatly improved the functionality of this form technology and improved the automation and flow of documents through the process we

improved. For future researchers considering electronic form technologies for process interventions, these additional criteria should be considered when evaluating an electronic form technology to improve a process.

4.2 Numerical intervention results

The results of the interventions are as follows:

Change in Process steps by type

	Paper-based	MDM	Sub-Total	E-Form	Automated	Sub-Total	Non-Data	Total
First iteration	5	7	12	-	-	-	5	17
Second Iteration	3	6	9	1	1	2	5	16
Third Iteration	1	3	4	3	3	6	4	14
Total Change	(4)	(4)	(8)	3	3	6	(1)	(3)

Change in process steps by type, excluding non-data steps

	Paper-based	MDM	Sub-Total	E-Form	Automated	Sub-Total	Total
First iteration	5	7	12	-	-	-	12
Second Iteration	3	6	9	1	1	2	11
Third Iteration	1	3	4	3	3	6	10
Total Change	(4)	(4)	(8)	3	3	6	(2)

Percent change in process steps by type

	Paper-based	MDM	Sub-Total	E-Form	Automated	Sub-Total	Non-Data	Total
First iteration	29%	41%	71%	0%	0%	0%	29%	-
Second Iteration	19%	38%	56%	6%	6%	13%	31%	-6%
Third Iteration	7%	21%	29%	21%	21%	43%	29%	-13%
Total Pct Change	-80%	-57%	-67%	100%	100%	100%	-20%	-18%

Percent change in process steps by type, excluding non-data steps

	Paper-based	MDM	Sub-Total	E-Form	Automated	Sub-Total	Total
First iteration	42%	58%	100%	0%	0%	0%	-
Second Iteration	27%	55%	82%	9%	9%	18%	-8%
Third Iteration	10%	30%	40%	30%	30%	60%	-9%
Total Pct Change	-80%	-57%	-67%	100%	100%	100%	-17%

5 Conclusion

The introduction of the electronic form technology, Google Forms, augmented by the add-on, Form Publisher, enabled the significant reduction in the amount of paper needed and steps involving manual data manipulation. It also increased the amount of automation in the process, and input data was processed with basic validation. Lutteroth and Weber's criteria provided a helpful framework to inform the selection process for the tool we used. While the criteria they introduced covered most needs that one could have for electronic forms, researchers should also consider the technology's ability to integrate third party add-ons and automatically create, store, and share documents populated with form submission data. Additionally, Google Forms should be included in future evaluations of form technologies in studies like Lutteroth and Weber's. Even the ability to integrate third-party add-ons provided a significant increase in the functionality of the tool for an insignificant amount of time and money, and this functionality remained completely overlooked in Lutteroth and Weber's evaluations.

Electronic form technologies provide significant benefits as explained by Lutteroth and Weber, and as this research notes, with the added integration of third party applications and automatic creation, storage, and sharing of form data in a human consumable form can provide an even higher level of functionality to organizations looking to improve their processes by reducing steps relying on paper use and manual data manipulation.

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Appendix

Iteration 1

Current Student Applications, First Iteration
Spring 2014 to Fall 2016
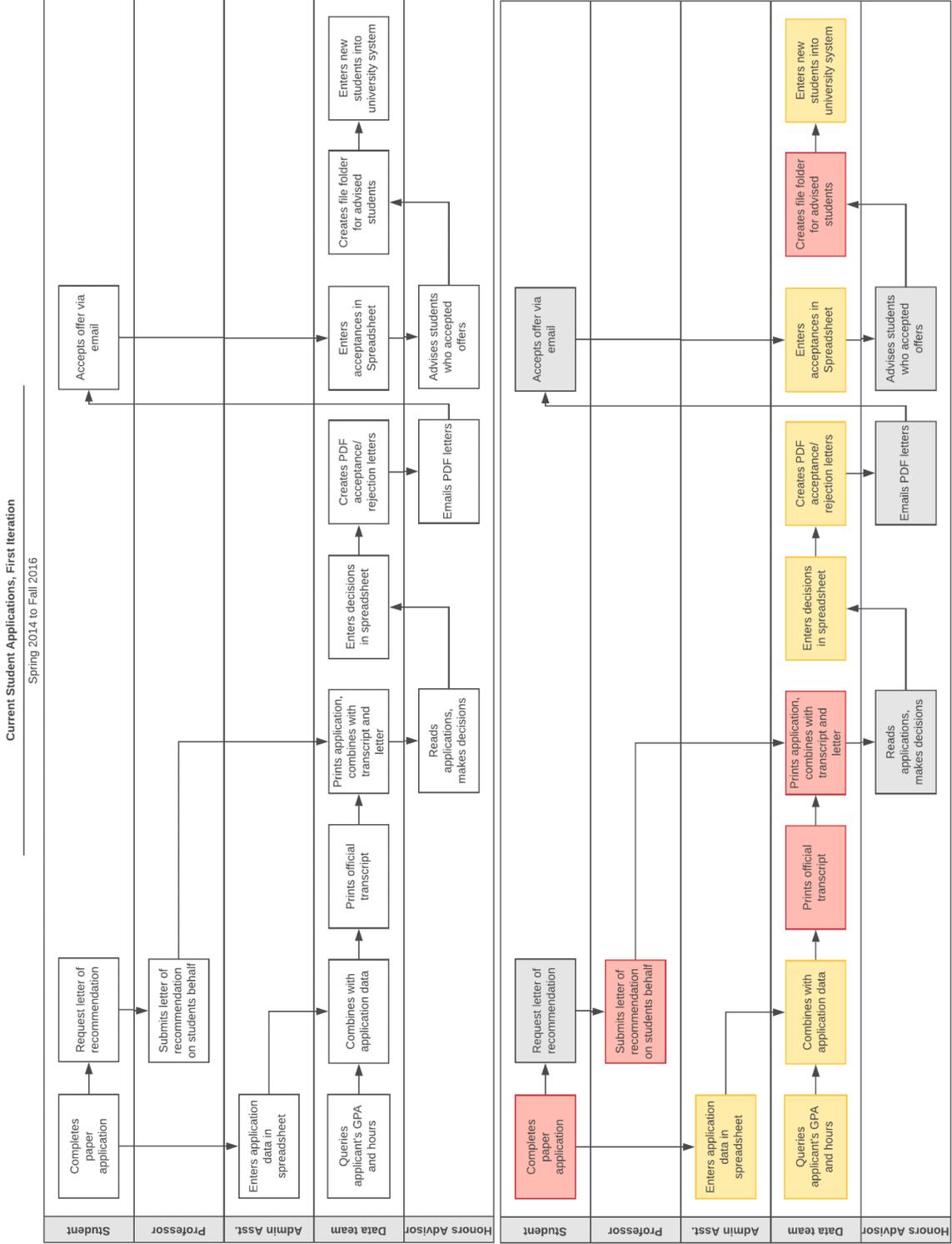
Iteration 2

Current Student Applications, Second Iteration

Spring 2017 to Spring 2018
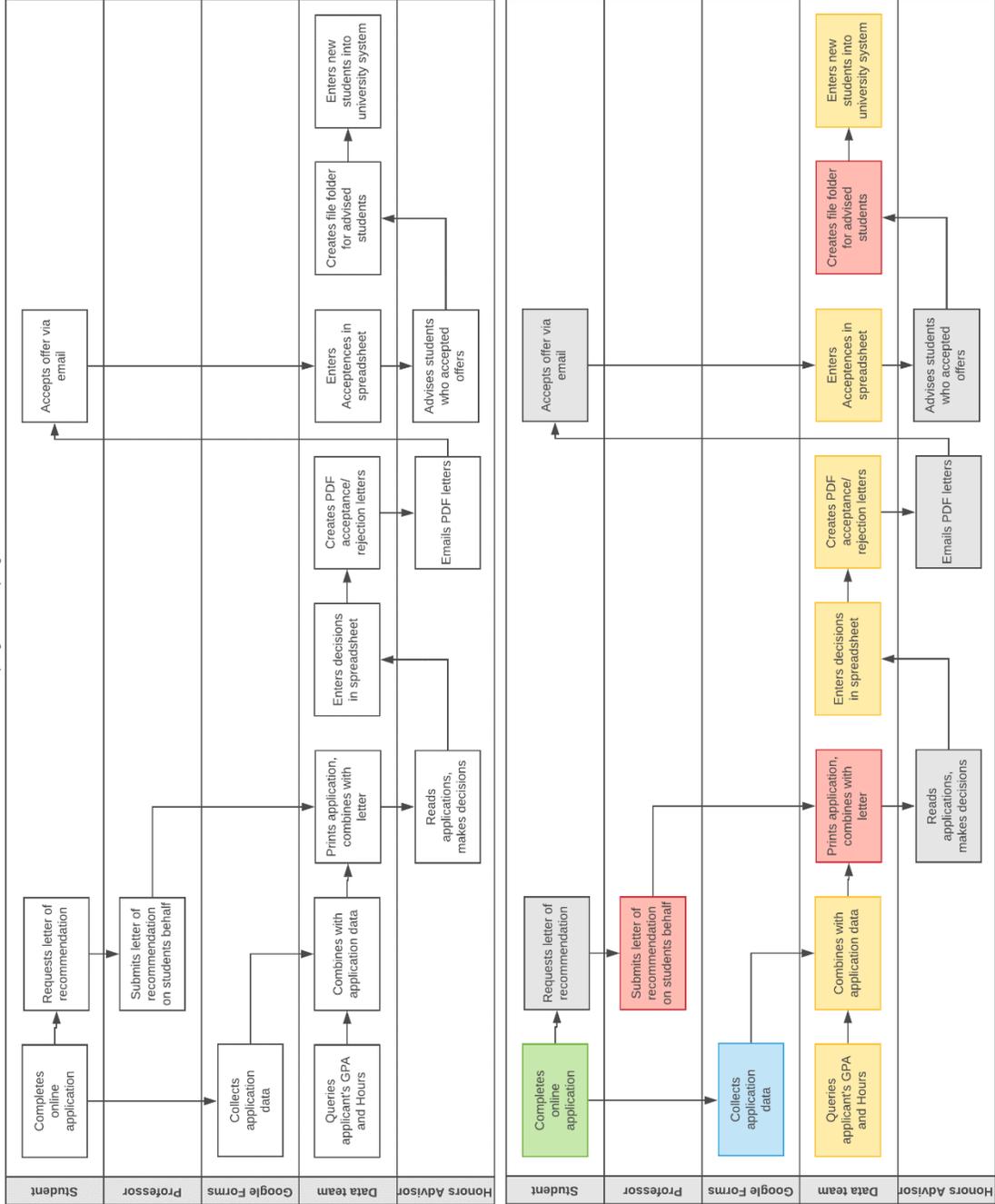
Iteration 3

Current Student Applications, Third Iteration

Fall 2018 to Present