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Analysis of the Evolutaion of Scope Management and Needs Identification in Agile Methodologies

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Analysis of the Evolution of Scope Management and Needs Identification in Agile Methodologies



Honors Thesis

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Department: Management Information Systems

Advisor: Craig Letavec, MSPM

April 2021

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Abstract

Identifying stakeholders, identifying metrics, and analyzing specific aspects of agile development. This has led to a variety of questions around scope management such as “How do scope changes impact the velocity throughout the course of a project?”, “What factors help determine the overall viability of adopting different scope measures?”, and “What are the roles of project owners and managers in facilitating scope changes in project cycles?” This research encompasses a review of previous literature, an analysis of structured project progression, and semi-structured interviews in order to investigate the evolution of scope management and needs identification in agile methodologies.

Acknowledgements

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Table of Contents

Introduction	1
Literature Review	2
Defining Scope: Project Scope Vs. Product Scope	2
Needs Identification In Project Management	5
Project Stakeholders Involved Scope Management	6
Influence Of Various Methodologies On Scope	9
Scope Evolution: Scope Change Vs. Scope Creep	12
Management & Measurement Techniques	15
Case Study: Flyer Consulting	18
Background	19
Methodology	23
Case Study	24
Conclusion	30
Appendix A	32
References	34

Introduction

The research I have conducted to date has been formed around a basic understanding of the project management environment: Identifying stakeholders, identifying metrics, and analyzing specific aspects of agile development. This research encompasses a review of previous literature, an analysis of structured project progression, and a case study on five separate external client projects of a student consulting organization in order to investigate the evolution of scope management and needs identification in agile methodologies. The questions I set out to address through this research are: How does scope evolve along the course of a client project? What are the main influencers of a change of scope? How does project velocity evolve throughout the course of a project? How do scope changes impact the velocity? How does project backlog impact the burnup/burndown structure of a project? What factors help determine the overall viability of adopting different scope measures? What determines scope change versus feature development? How can projects be structured to absorb the impact of scope changes?

The first part of this research focused on a literature review around scope management and practices defined by the Project Management Institute through its guidebook. I first explored the different types of scope defined on a project to understand the types of scope I'm aiming to measure in this research. I then looked at how scope is defined at the onset of a project and how different project requirements and client needs come together to form the features of scope. With this understanding of scope types, I attempted to define the project agents involved in managing scope and handling requirements through the course of a project. As a project progresses, I looked how this needs identification

process can evolve and change scope and what the main contributing factors of this change are. This led to research about the distinction between scope creep and scope change and what external and project factors influence this shift. I then looked at the variations in project impact based on the elements of the scope changed. The final piece of this research focused on the metrics and tools used to measure and monitor project scope and how project agents utilize them.

I then coupled this research with a case study conducted over a semester of client projects with a pro-bono student consulting organization. The case study centered around the hybrid agile methodology that the projects were organized around and how scope evolved throughout the course of them. Throughout the course of the projects, documentation was collected about specific risk, milestones, and external impact factors to measure overall impact. I then analyzed this information to understand if the case study projects confirmed or disproved the literature research conducted to date.

Literature Review

Defining Scope: Project scope vs. product scope

The broad purpose of a project is to render an end result whether that be a product or service, an overarching goal that can be described as the scope of the project. In valuing scope, projects can run more efficiently by limiting cost overruns, preventing schedule waste, and organizing work allocation and task management so as to improve overall productivity towards a specific objective (Fageha). The Project Management

Institute defines scope as the “sum of the products, services, and results to be provided as a project” (“A Guide to the Project Management Body of Knowledge” 2017). The challenge with this definition is that it infers scope as a future objective thus limiting the understanding of the scope at the beginning of and throughout the development of the project. This is because the end result of a project is very rarely ever clearly understood and defined at the initial start of a project. For example, in a study conducted by the Wellington Company in 2020, only 34% of organizations surveyed completed projects on time and/or on budget, and only 36% had projects deliver on their full scope defined. These results indicate that a majority of organizations improperly understand scope at the initial onset of the project.

Scope can be understood as factors such as user feedback, features testing, and needs identification that unsurface the value that the project is developing. Due to variety of influences affecting the evolution of a project such as work uncertainty, stakeholder communication, project risk management, and feature specifications that all contribute to changes within the general scope of a project, it can be difficult to define a narrow scope at the onset of a project (Ajmal). These influences lead to challenges such as scope creep and change management which can change the course of a project and if not handled correctly, can decrease the value of the end result, cause deadline lapses, and cost additional resources and capital. It is important to understand these influences and challenges in order to structure guardrails around scope management to ensure timely delivery and create efficient value throughout the project.

There are two types of scope that affect project management and that will be discussed in this paper: Project scope and product scope. These two are differentiated by the main objectives to which they are structured to characterize. Project scope is defined as “The work performed to deliver a product, service, or result with the specified features and functions” (“A Guide to the Project Management Body of Knowledge” 2017 169). Project scope is defined by the stakeholders of the project through a commitment of work, seen in documents such as a project chart or a letter of engagement. This type of scope is specifically documented to create an end objective for which the project managers and other agents are held to account for. Product scope, in contrast, is developed through the value created by the end result in both the features and functions of the product. It is defined by the Project Management Institute as “The features and functions that characterize a product, service, or result” (“A Guide to the Project Management Body of Knowledge” 2017 169). Within this type of scope, the objective centers around an agile focus of product development, and priority shifts from milestone completion to value benefited to the end-users and stakeholders. When analyzing the evolution of scope management, it’s important to make the distinction between these two types and understand how both influence project management (*see figure 1.1*).

	PMI Definition	Objective	Influencers
Project Scope	The work performed to deliver a product, service, or result with the specified features and functions	Define the work to be performed	Requirements, Schedule, Costs
Product Scope	The features and functions that characterize a product, service, or result	Define the product to be created	Stories, Change Requests

Figure 1.1. *Project Scope v. Product Scope*

Needs Identification in Project Management

The first step in understanding scope evolution within a project is to understand how it is initially defined (in both the context of project and product scope). Project agents use “requirements” to define scope elements and develop the broader plan for the project. These requirements are a collaboration between project agents, stakeholders, and business users and result from the communications between these various parties. Requirements form the basis for product design and are used to evaluate various planning aspects of a project such as cost estimation and schedule development (Burström 494). The main tools used to generate an understanding of requirements for a project scope are expert analysis and data gathering (“A Guide to the Project Management Body of Knowledge” 2017 180).

In the initial requirements phase, data is gathered through interpersonal personal techniques like interviews and focused groups as well as through non-personal data gathering like benchmarking. Previous research indicates that tools such as semi-structured interviews, Joint-Application-Development (JAD), prototyping, card sorting, and laddering are all effective techniques to gather data about product requirements from a group of users and stakeholders, specifically in system development (Emoghene 8). The limitation of most of these techniques is that there is a level trade-off in the information gathering process based on the procedures used to understand the requirements. In the aforementioned research, they conducted a study analyzing several data gathering techniques with the factors of safety, utility, usability, and learnability. The end results of this study indicated that there are generally more effective and less effective techniques to gather data about requirements but there was also a level of variability between

effective techniques and their ability to satisfy all four of the requirements (Emoghene 10). Ultimately this indicates that several rounds of various types of data gathering are most effective in generating requirements used to define scope.

Once requirements are identified, they are then documented and utilized to define the scope of a project. This is typically done within the project scope statement which focuses on the work commitment and defining the project scope. While project scope is defined at this point, product scope continues to evolve and is set up as a broad solution requirements for the project scope. The Project Management Institute recommends that within this statement, a product scope description, list of deliverables, product acceptance criteria, and a list of items excluded from the scope are all defined (“A Guide to the Project Management Body of Knowledge” 2017 154). These items define the project scope as it indicates the work performed to deliver the end product. This accompanies broader requirements about specific features and functionality of the end result that defines the larger context of the product scope. Unlike project scope, at this point product scope is only broadly ideated and defined and continues to grow in clarity as the project evolves.

Project Stakeholders Involved Scope Management

Outside of the individual stakeholders in a project, the main individuals affected by scope changes are those constructing the solution, those overseeing the completion of the project, and those setting the strategic direction for a firm. These can be broken down into the project workers who build the product, project managers who oversee the development and ensure a viable solution, portfolio managers who verify the progress of projects and the quality of the product, and enterprises architects who are tasked with

managing the direction of their firm and provide the tools and resources necessary on the firm's side for project completion. These roles serve the four functions within an organizational project management environment: strategy, portfolio, programs and projects, and operations ("A Guide to the Project Management Body of Knowledge" 2017). When looking at the role data has on agile methodologies, it's important to take into consideration the impact it has on the latter three types of individuals as they provide the most direction in data usage and management.

Project managers are the employees most involved with the inflows and outflows of data within a specific project. They are charged with ensuring that individuals working on their project have the proper tools and resources necessary to complete each sprint and are viable for maintaining the feedback loop with stakeholders on project progress and product elements. While the analysts and other employees on the project are the main users of actionable project data, the project manager is the main conduit for collecting and managing the data. They are ultimately responsible for ensuring control data is being collected and that data is being used properly, preventing misuse and misinterpretation.

Portfolio managers are a level above project managers and oversee the progress of one or more projects across a firm. While there is a variance in the supervision responsibilities and oversight capabilities of these individuals across different companies, their general role in scope management is to perform front-end planning to assess and evaluate resources, timing, and other general estimates for project scope (Too 2017). As controllers of many of the firm's internal resources, these individuals have the greatest capability in dispersing pre-held resources across the projects run by the firm and thus maintain responsibility of the internal data collected that are held firm-wide and shared

among multiple projects. Through their role in engaging with both enterprise architects/senior-level management as well as with project managers, they act as the main drivers of the project towards organizational strategies and objectives (Hyvari 2016).

Enterprise architects are individuals such as the Chief Information Officers and other head strategists in firms regarding the use and control of data. These company executives help push the firm's tools and resources into the future and promote innovation and the continual development of project management techniques (Santos and Resnick 2018). Within agile methodologies and the incorporation into firm processes, enterprise architects lead the charge to shift focus from the project timeline to product development and channeling this into the individuals leading firm projects (Hyvari 2016). While not actual project decision-makers, enterprise architects build and train project managers and portfolio managers on how to make these decisions and how to manage the controls to determine the success of these decisions. In regard to data, these individuals are responsible for the overall firm's data integrity and the means in which that data is shared, managed, and distributed (*see figure 1.5*).

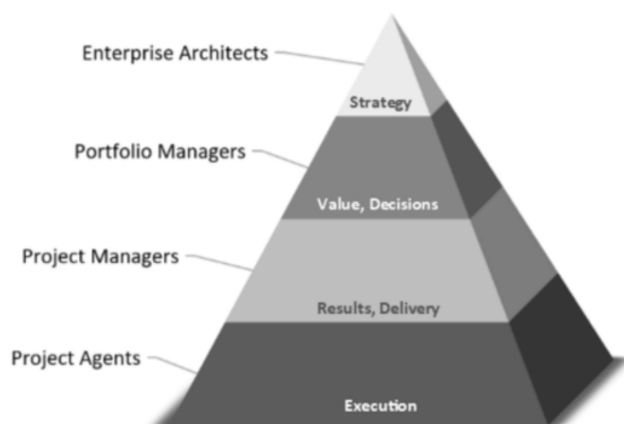


Figure 1.5. Project Agent Hierarchy

In relation to scope management, the individuals with direct responsibility for project scope are the project managers. At the beginning of the project, portfolio managers interact directly with the scope management process by understanding the current needs of stakeholders and turning those needs into a broadly defined project scope (Too 2017). Portfolio managers often support the creation of the project and product scope along with the project manager and serves a front-end planning role in the scope management process as part of their value and decisions responsibilities. Project managers on the other hand are involved in constructing the narrower definition of project and product scope and are tasked with the role of managing the results and delivery of the work. Because of this, project managers are the main agents in project scope management during the execution and delivery phases of the project. Depending on the type of work being conducted, product scope is either managed directly by the project manager or through a product owner. The product owner is typically an agile-centered role with the responsibility for directing product scope and delivering value to the product in conjunction with the project manager (“A Guide to the Project Management Body of Knowledge” 2017).

Influence of Various Methodologies on Scope

Within the last half-century, information systems and technology project management processes have revolved mainly around three methodologies: Waterfall, iterative, and agile (Hotle and Wilson 2018). These processes are segregated through their feedback loop styles and adaptability to changes in project scope. Waterfall, a process angled towards a defined goal, is structured through a series of short-term goals that progress along a linear path. This type of methodology requires a large portion of up-

front knowledge and is extremely reliant on the stability of the project. If there any scope changes or issues that arise during the project life cycle, it throws off the pre-planned project timeline and forces the project managers to reconfigure the structure of the project. This also affects the necessary resources such as time and capital for completion causing possible delays and budget expansion.

Incremental methodologies separate these goals into interdependent portions of the project. As the project life cycle progresses, pieces of the final solution are released to the stakeholders (“A Guide to the Project Management Body of Knowledge” 2017). This is done within the general scope and timeline outlined at the beginning of the project. Feedback during these cycles occurs after the delivery of each increment, giving the project manager opportunity to adjust the project solution or timeline to fit the responses of the stakeholders. The iterative cycle is a step closer to stakeholder feedback than Waterfall since it takes in data about stakeholder experience and perceptions of the project periodically throughout the life cycle and adjusts accordingly. Where waterfall lacks in adaptability, the iterative cycle allows for small adjustments to ensure a more viable solution/product for the stakeholders. While the Iterative cycle lacks ultimate flexibility and client design, agile methodologies offer project managers a solution.

Agile methodologies take this incremental approach a step farther and present products and solutions periodically throughout the whole project life cycle that are dependent on the client feedback loop and independent of serious guidelines set by a project structure (“A Guide to the Project Management Body of Knowledge” 2017). These periods are defined as sprints, each one composed with specific goals that satisfy certain features of the product. Unlike Waterfall and Iterative cycles, agile does not have

a set vision of an end product at the beginning of the project lifecycle. Rather as sprints develop out certain features based on the feedback and needs of the stakeholder, an end product begins to form and incorporate all of the previous sprint developments into one final viable product that has already been tested multiple times throughout the cycle against stakeholders (*see figure 1.6*).

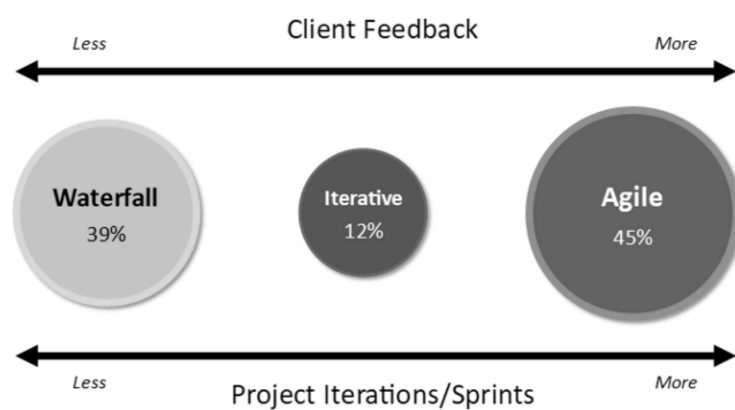


Figure 1.6. Project management methodology users (% of surveyed). (Hotle and Wilson 2018)

As product-centric models such as agile methodologies are predicted to grow from 40% to 79% in 2022, it is crucial that these project managers utilize effective techniques in managing and utilizing all this data (Hotle and Wilson 2018). The agile model mimics how humans process information and set about realizing their true wants and needs. While waterfall and iterative cycles cement a project manager into the stakeholder's upfront beliefs about a product's functionality and requirements, agile allows these to form over time as stakeholders come to realizations about their beliefs on what a final product should satisfy. Having more feedback loops with stakeholders and sprints developing the project cycle forces agile users to collect, manage and consume more data than waterfall and iterative methodologies.

When it comes to scope management, agile is normally the most adaptative to scope changes of the project management methodologies. This is because the iterative sprints allow agile project managers to refocus the project each cycle around new scope changes. These changes are also monitored and controlled through agile techniques such as Kanban boards and project burn charts. Within agile, product owners also split the responsibility of scope management with the project manager and work with the project manager to prioritize value add features. In agile, it can be difficult to define a specific project scope up-front, so benchmarks are often used to guide project costs and schedules to ensure stakeholder satisfaction and a high return on investment to the business.

Scope Evolution: Scope change vs. scope creep

Throughout a project, project scope and product scope may conflict especially when new features and functions are added to product scope that overshadows cost, resource, and time allocations defined in the project scope. This situation is defined by the Project Management Institute as scope creep which is measured as uncontrolled changes to a project that negatively impact time, cost, and resources without accounting for any adjustments (“A Guide to the Project Management Body of Knowledge” 2017 168). Scope creep varies from general scope change in its definition of being “uncontrolled” and not realized in the full scope of the project. The main factors of scope creep as assessed in a study conducted by Shirazi, Kazemipoor, and Tavakkoli-Moghaddam (2017) were poor documentation, poor change control, poor information transformation, and external changes (*see figure 1.2*). These causes mainly result from miscommunication both internally and externally, lack of (adherence to) a process, and outside events. The responsibilities for this creep thus mainly lie on the project agents

with some influence from uncontrollable external events. For the purposes of the case study, the scope creep cause categories will be used to define scope creep occurrences on projects.

Main causes of scope creep		
Main scope creep cause categories	Discretion	Scope creep cause
Poor documentation	<i>Bad definition of scope and the misconception of the project's scope and contract</i>	Defining the scope by inexperienced experts. Misconstruction of the business needs. Bad realization of client's needs in defining the scope. Unrealistic project goals. Variety in the size and the detail of scope statement and not checking it by a third party. Lack of clarity about system boundaries
Poor change control	<i>The duty of the project team based on the assumptions</i>	Define the procedures by inexperienced experts. Not involving the project team for defining the procedures. Not checking the procedures by a third party.
Poor information transformation	<i>Not understanding of the project goals and scope baseline and the situation of the project</i>	Lack of configuration management plan. Lack of communication.
External changes	<i>Change of law, technology, weather and economical situation</i>	Not having risk management.

Figure 1.2. Shirazi, F., Kazemipoor, H., & Tavakkoli-Moghaddam, R. (2017). *Fuzzy decision analysis for project scope change management.*

To understand where the impact of these scope changes and scope creep impact a project, I looked at a study conducted by Tariq, Ahmad, and Usman Ashraf (2020) which measured the impact of scope change in Earned Value Management (EVM) against the original baseline plan. They used a Monte Carlo simulation to calculate the impact on 45 specific scope elements which created a relational structure that also measured the impact that scope elements had on each other. The simulation resulted in eight major scope elements being defined in relation to their impact on project success (*see figure 1.3*). This study indicates that changes to the project mission, stakeholder expectations, or capable team members have the greatest risk of causing project failure. Using this information, project managers can attempt to quantify the effect of scope changes through EVM and properly evaluate scope changes and prevent scope creep.

No	Scope Elements	Weight	Duration	Total Cost
1	e7 Project Mission	97.67	5	2240
2	e8 Stakeholder Expectations	75.44	1	1900
3	e10 Capable Team Members	64.33	3	1110
4	e21 Project Schedule	56.92	4	430
5	e23 Initial Cost Estimates	51.37	2	1800
6	e24 Technology	46.92	3	900
7	e43 Key Deliverables	43.22	8	700
8	e29 Business plan /vision	40.05	3	960

Figure 1.3: Tariq, S., Ahmad, N., Usman Ashraf, M., Alghamdi, A. M., & Alfakeeh, A. S. (2020). *Measuring the Impact of Scope Changes on Project Plan Using EVM.*

By combining Shirazi, et. al's scope creep study along with Tariq, et. al's scope change quantification research, the larger network of cause and effects around scope can be drawn together. Controlled scope changes processed through change management techniques coupled with scope creep, as a result of previously mentioned causes, start the process of scope change. This process results in changes directly to specific elements of the scope such as the project's mission, team members, or the expectations of stakeholders. These elements all have varying influences on the success of a project. Through EVM, this impact can be quantified into weighted impacts on project success in order to understand more broadly, the impact of scope changes on a project (*see figure 1.4*). This constitutes the network of scope change in relation to the overall project impact.

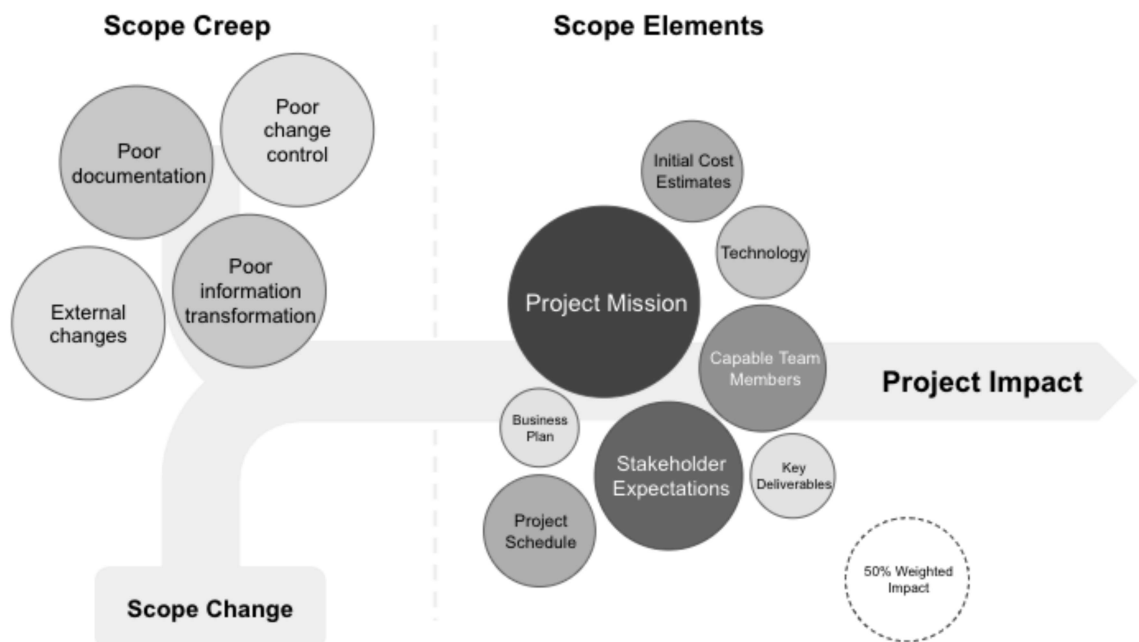


Figure 1.4. Scope Change Impact Network

Over the course of a project, project agents will most likely see this process go through multiple iterations. This process results in a larger evolution of scope from the initial needs identification and definition of the scope to the end result of the completion of scope.

Management & Measurement Techniques

As stated before, the vast majority of projects ran by organizations collect information from projects regarding their time, cost, scope, and value delivery along with additional information about items such as project risk (“A Guide to the Project Management Body of Knowledge” 2017). These metrics are gathered in different forms within a project and are used and varying amounts dependent on organizational priorities and capabilities regarding the collection of this data. In agile, these metrics take different forms and are collected in ways different than typical project-centric methodologies. In agile methodology, data such as cost, scope, and time which are typically defined at the

beginning with waterfall and measured against the initial value, are instead evaluated as the project progresses against the needs of the organization. This difference is due to the prioritization of the product within agile which causes variation in project progression. Variation as a result of features constantly evolving causes these metrics to be compared to an external value rather than a historic one. These external values are agile-specific metrics such as velocity, burn up, burn down, defect density, and earned business value (EBV) (Alderton 2012). In relation to scope management, these metrics give project managers and stakeholders insights into the scope completion progression, especially when evaluating completion in agile methodologies can be fairly challenging.

Burnup/Burndown Structures

Burnup helps these same organizations measure the demand by stakeholders for specific features within the product. This data is collected to create a backlog of work that ideally is constantly being reprioritized and focuses on the features being added to the product (“A Guide to the Project Management Body of Knowledge” 2017). Project-centric methodologies measure this through a task list that is set to accomplish a specifically defined product. Agile allows these projects to adapt to the highest value features and prevent some of the waste that occurs through more traditional methods. Burndown charts, like velocity, help project managers see how many features are being completed. While velocity focuses more on the productivity of the team and how quickly these features are being turned over, burndown is a more effective measure of project completion. These features over time define pieces of product scope and function as elements of that scope.

Velocity

Velocity in agile is a measurement of how quickly teams turn over features during a sprint and is used as a gauge to measure team productivity and efficiency (“A Guide to the Project Management Body of Knowledge” 2017). Unlike project-centric methodologies which do this by checking task completion or through task schedules, velocity allows agile to measure these same concepts without the need for a specific scope defined. The uses of velocity focus more on the relation of project scope and product scope through product scope completion and project scope time commitments. This enables the project managers and portfolio managers to understand what impact product scope is having on project scope and where risk areas exist in changes made to both scopes.

Earned Value Management

Earned Value Management or EVM is a tool used by project professionals to evaluate project performance quantitatively and forecast future project scope change needs (“A Guide to the Project Management Body of Knowledge” 2017). Through comparing earned value, quantified as the percent of project completed to the current date of the total budget or schedule allocated to the project. This represented the value that the project has earned the business to date and allows for comparisons against what was originally forecasted and what has accumulated to that date. The difference between earned value and planned value, which is based on the original forecast, can indicate that

a project is ahead of or behind schedule (Reichel 2006). The difference between earned value and the value of the actual costs to date give insight into whether the current earned value is overbudget or underbudget. Together, this analysis tool helps tie together the three components of project scope to understand total performance. With a formalized scope change management process, this tool can be used to measure the impact of scope changes and forecast out future project impact.

Case Study: Flyer Consulting

Flyer Consulting is a student organization that works to provide business consulting services to nonprofits. It was founded back in 2009 and currently works with 5-6 clients a semester with 5-6 students positioned on each project. These student teams are broken down into 3-4 consultants who execute the work on the project, a project lead who acts as a project manager, and a managing director who initially defines and oversees the project scope. Each project runs on a 5-month timeline over the course of the school semester. The deliverables of these projects range from technical tool implementations to new venture feasibility studies falling into the categories of marketing, business development, and technical work.

To understand scope evolution in the context of industry practice, I have structured a case study around client engagements conducted by this organization. This case study will encompass the five Flyer Consulting nonprofit consulting projects operating during the Fall 2020 semester. These five projects incorporate business development, marketing, and technical work. While these projects will not be a definitive

sample group, the work is diverse enough to explore applicability in multiple industries. In collecting information about specific project metrics over the course of the semester and analyzing those metrics against qualitative documentation made, the goal is to understand how scope evolution develops. While there will be some variability given the external impact of COVID-19 and the limited project management experience of these students, this case study will still allow for me to more thoroughly understand the factors of scope change on these projects and how the subscribed to project management practices impact the overall scope evolution.

Background

Flyer Consulting has operated on a defined hybrid agile methodology for the past two years. This process is based around a proposed approach by Blosch, Brand, and Osmand that incorporates lean startup and design thinking practices with an agile process to create iterative cycles that pass through concrete and abstract phases and is structured around identifying the customers problem and designing its solution (*see figure 2.1*). It was initially adopted around the concept of product scope development, prioritizing scope over costs and time. This approach worked particularly well for Flyer Consulting since the work conducted within the organization is pro-bono and there are typically minimal investments by clients of capital in these projects. The initial start of the project begins with the design thinking phase where a customer problem is beginning to be understood and defined into a specific objective. Within Flyer Consulting, the work in this phase is done by the managing directors of the project who review initial client applications and set up an initial client meeting to collect client stories and pain points to

understand the main features of the product scope. The action points taken from these meetings form the scope requirements collection process for the organization. This information is then processed through the board of managing directors who define project engagement elements through a Letter of Engagement (LOE) with the client. These engagement elements take main objectives of the problem understood from the initial client meeting in the “empathize” stage and translates those points into broad objectives for the project. These engagement elements represent the initial definition of the project scope and product scope. Internal practices prioritize these elements being broad enough to allow for variation in the features and requirements of the product scope but still represent tangible deliverables for the client. This phase is referred to as the design thinking phase due to the focus on the product scope and the specific features and requirements necessary to begin prototyping and designing the product. The resulting requirements and scope defined by this process is referred to the client for feedback and to develop a consistent understanding of the product scope.

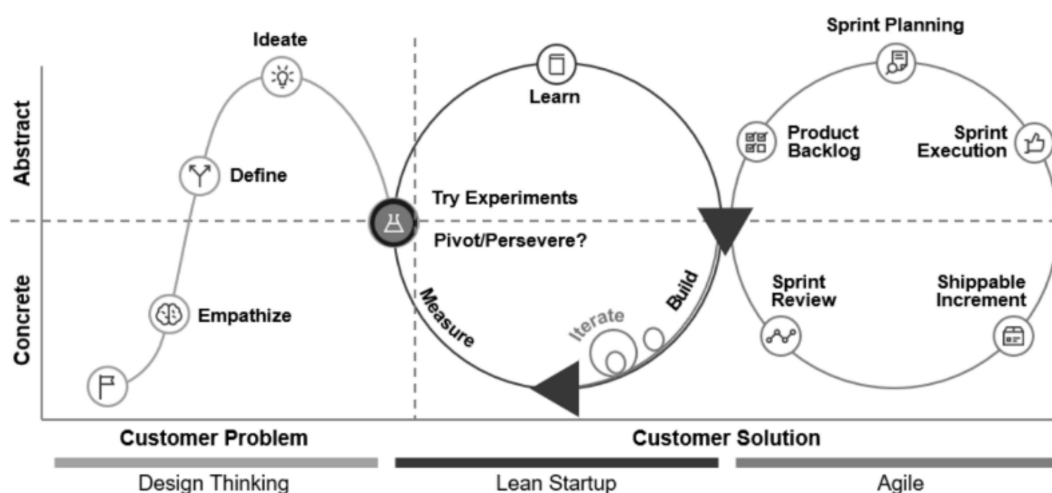


Figure 2.1. Blosch, Marcus, et al. *Enterprise Architects Combine Design Thinking, Lean Startup and Agile to Drive Digital Innovation*. Gartner, 29 June 2019. Use of a Combination of Iterative, Experimental Approaches.

The next phase in the process is the lean startup phase which presents the development of project scope and product deliverables for the client. The project leads (project managers) are responsible for the overall development of the customer solution in both this phase and the agile phases. Consultants on the projects typically operate on 3 to 4-week sprints in the lean start-up phase where they dedicate the first couple weeks of the sprint to the “learn” step and conduct research on the specific project elements. For both marketing, technical and business development projects, this research is centered around understanding the current context and background information that would be valuable in the product design. This information is then processed in the “build” step where it turns into actionable insights, tools, and recommendations for the client. The developed product from this step is then presented as a prototype to the client to collect feedback. This feedback is then channeled back into the cycle where more research is conducted, and the product is further developed and only finished when the scope of the product is satisfactory to the client. The lean startup cycle iterates through multiple sprints (typically 3 to 4) and culminates into final product deliverables to the client. Through this process of testing and validating, product scope becomes more defined through the feedback and collected stories of the client and the understandings of the project team.

The final portion of this process centers around standard agile practices such as a product backlog list, sprint planning, and shippable increments to the client. These phases are specifically managed by the project leads who guide the teams through them and conduct the work necessary to complete. The product backlog develops as feedback is collected from the client in the lean startup cycle. This backlog represents stories and

features requested by the client as a part of the overall product scope. Items on the product backlog are prioritized as either scope requirements or features requested to understand what elements constitute product scope. This is all managed within a Kanban board which connects features to the engagement elements initially defined in the LOE as well as its completion status through the “To-Do, Doing, Done” lists. This tool allows for project leads to gauge overall completion of the project scope and manage the deliverable schedule for the client. Sprint planning and execution are conducted through bi-weekly meetings led by the project lead to discuss updates and decide on changes to the project backlog list. Work completed through the lean startup phase is compiled into shippable increments which are represented by our deliverables to the clients. This can range from written reports that contain researched information, insights gathered, and recommendations to developed technical tools and systems. Once the shippable increment is delivered, the project lead conducts a sprint review with the client and team to outline the next sprint and overall product scope development.

To formalize and create cohesion around this process, consultants, project leads, and managing directors all receive training based around the hybrid agile methodology. This training differs by role, focusing on specific tools and documentation that accompany each phase:

- Consultants are trained on the lean startup process of learn, build, test and techniques for how to approach each of these phases.
- Project leads are trained on customer solution development around the agile methodology, client management, task delegation, and process tools.

- Managing directors are trained on scope creation and development, identifying client problems, hosting initial client meetings, and scope change management.

Methodology

To understand the scope evolution and needs identification over the course of an agile project, I analyzed five nonprofit client projects of Flyer Consulting. These projects ran from August of 2020 to December of 2020 and represented various types of work with nonprofit clients from different industries. The clients for these projects have been given placeholder names for the sake of anonymity. They represent a diverse group of program/work types with different nonprofit NTEE groupings. The size of these clients ranged from organizations of around \$125,000 in annual revenue to organizations with just over \$700,000 in annual revenue. The majority of these clients are headquartered out of the Greater Dayton area with one nonprofit headquartered internationally.

Throughout the course of these projects, the managing directors overseeing them recorded risks and milestones each week associated with their project. The risks represented obstacles complicating the project's progression such as difficulties obtaining client feedback, short deployment times, etc. The milestones represented large project deliverables and shippable increments that form a portion of the total product scope. Data collected from each of these risks and milestone documentation were then compiled into an overall analysis of each sprint and their corresponding projects. In addition to the risks and milestones the schedules of each sprint, product deliverables, and the external impacts affecting the project were also recorded. The summarized data was then shared with the managing directors of each project to confirm the information.

Case Study

First looking at the evolution of both project and product scope throughout the course of the projects, there was decent variation in the initially defined scope and the end deliverables. Comparing the engagement elements as defined in the LOE at the beginning of the project with the deliverables turned over to the client, you can see several different outcomes for how the general project scope was fulfilled. In two of the five projects, significant project scope change occurred over the course of the project. This is indicated by specific elements of the initial scope not being covered through a deliverable to the client. Client A did not ultimately see the engagement element to “Develop a donor management and analytics model to provide insights on donor metrics” fulfilled in its final deliverables. This is because the data that Client A had already collected was overestimated and prevented this project from being able to do an in-depth analysis of donor analytics that would be valuable to the client. Instead, this piece of the project scope shifted towards a new product which as a data pipeline purging and integration tool that could be used to clean up the data that the client had already collected to provide analysis capabilities later on. In relation to the project schedule, there would be limited time to clean the client’s data, collect additional information, and perform the full analysis. Client D also saw a significant scope shift from its engagement element to “Construct a 1-3 year strategic growth plan for the expansion of program services”. This project scope shifted from a strategic plan to a marketing strategy due to changing requirements from the client. After the initial two sprints of the project, the client prioritized its donor outreach strategy over the strategic plan based on the deliverables and recommendations provided to them. The feedback from these sprints

shaped the future deliverable to focus on marketing strategy as the client identified it as a greater value add to the product scope than the strategic plan.

The remaining three client projects saw little variation in the defined project scope and instead saw gradual evolution of the product scope as they progressed through the project. Each of the engagement elements for these three clients acted as larger buckets for which the product deliverables presented to them filled in. Client B fulfilled each of its engagement elements with slight variation towards a technical focus on their CRM tool in their donor management strategy research. This acted more as a narrowing in of product scope rather than a shift in it. Client C had a complete scope shift from the first drafted LOE as the client switched our engagement from one program within their organization to another. This was done during the onset of the project and caused minimal delay in the schedule of the project due to its timing. The LOE was adjusted to reflect this change of scope because it occurred prior to the first sprint. Their remaining deliverables again fulfilled the broader buckets of the engagement elements with specific features necessary for the client. Client E followed a similar structure with a larger focus on survey development and analysis as a part of its larger rebranding and volunteer engagement product scopes.

General variation in the product scope is attributed to the broad engagement element definition in all five of these projects. As each of these projects progressed, client needs were reevaluated, and this product scope focused on as the client identified specific elements as having a greater value add to their organization. In these situations, research and work surrounding those areas were prioritized in relation to completion of the broader scope. Only one client saw this shift as a product scope change rather than a

narrowing focus of scope. The other situation which caused a product scope shift was due to limited information at the onset of the project of the client’s capabilities which hindered the project’s ability to complete the scope. Project scope in relation to the committed elements, time, and resources dedicated to each project saw less variation than product scope. In broader terms 10 of the total 12 engagement elements were fully completed (*see figure 2.2*). Each of these projects also finished along the designated schedule committed to at the beginning of the project and none of these projects required outside resources or capital to complete.

Fulfilled	Unfulfilled
Analyze the current donor data collection process and suggest improvements based on discovered bottlenecks	Develop a donor management and analytics model to provide insights on donor metrics
Recommend a client relationship management system based on data and process analyzation	Construct a 1-3 year strategic growth plan for the expansion of program services
Optimize Client B's donor management strategy	
Develop individual donor and corporate partnership target strategies and a comprehensive target market identification	
Create a long-term strategy to execute priority initiatives in fund development plan	
Conduct a feasibility study and develop a business plan for a grocery delivery service for Client C	
Collaborate with a Client C program to aid on key initiatives	
Generate a sustainable funding and donor base strategy to aid in program development	
Facilitate rebranding efforts through structured research including brand perception and brand strengths	
Determine avenues to increase and maintain volunteer engagement specifically with younger audience	

Figure 2.2. Project Scope Engagement Elements

Based on these results, needs identification specifically in defining product requirements at the onset of the project were relatively successful. The majority of these projects satisfied initially designated requirements which indicates that needs identification during the initial client meetings and in the LOE were accurate. As the project progressed, needs identification continued through collecting client feedback during deliverable presentations. This feedback caused new and/or more specific features to be designed for the broader product, expanding the product scope. The evolving clarity of the product scope through continuous needs identification in these projects confirmed the previous literature around scope evolution, that product scope clarity increases over time as a result of successful needs identification.

In all five projects, there were no major delays in schedule due to scope variation. The majority of the projects grew gradually in the length of their sprints as their projects progressed with no major differences. Of the five projects, only Client C's saw a major difference in sprint timing throughout the course of the project (*see figure 2.3*). This variation in schedule was caused by the scope shift at the onset of the project and a lack of information provided by the client as for as the direction of the future scope. While there was a broad understanding of the scope definition, the client did not immediately provide direction as to what the immediate needs and features of the scope need to be prioritized. This then delayed the initial start of the project. In addition to this delay, the project also saw quicker and more sprint cycles as the client required quick turnovers of deliverables. The client deliverables for this project were then smaller in size but at greater iterations than the standard project. This difference also existed in the communication pattern with the client with weekly stand-ups instead of the monthly

meetings most other projects hold. Of the five projects, Client C could also be the closest example to scope creep. Due to the large change in scope, the project had scope management problems that created more demand on the project than what was initially estimated. This example of scope creep aligns with Shirazi et. al's research which lays out change control and poor documentation as two of the major causes. The quick change in scope led to a broad definition that allowed the client to define a large number of requirements which were not fully controlled through the change management process. Client A also saw a small amount of scope creep due to information transformation issues with the client as previously mentioned. While this did not cause schedule delays, it did create a change in project scope.

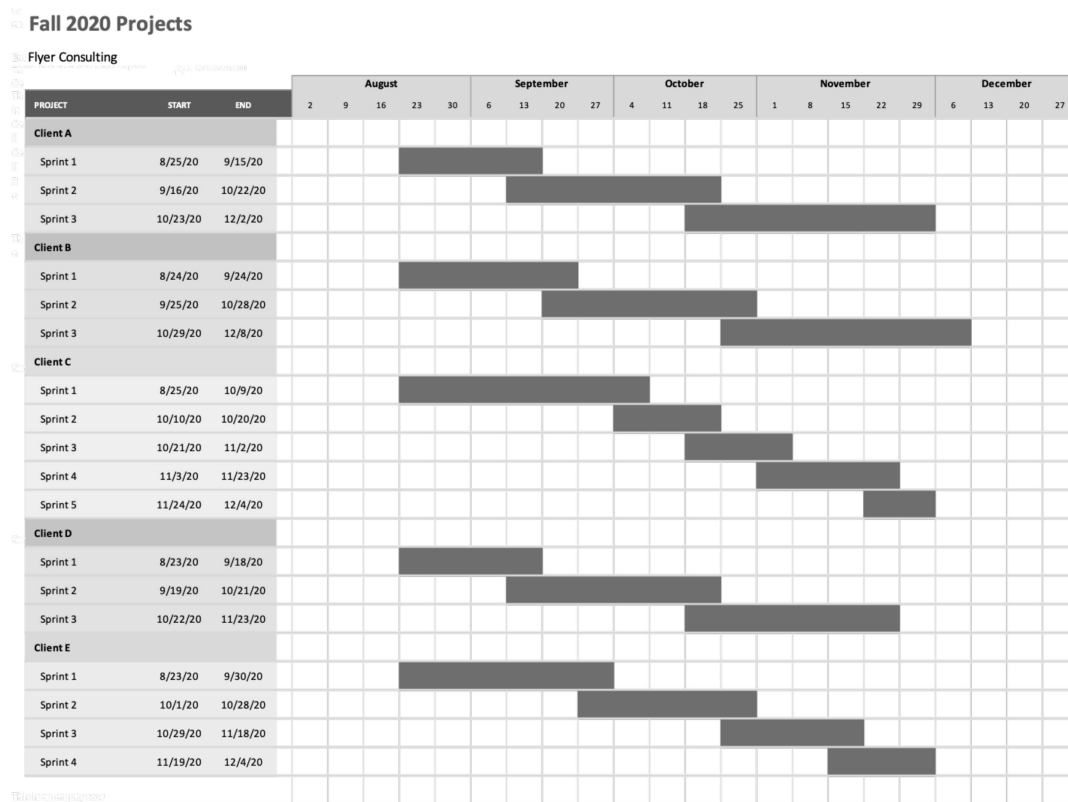


Figure 2.3. Project Sprint Timeline

Of the scope elements impacted project mission, stakeholder expectations, and technology were the only changes to the projects. These changes had varying impacts on the project; the change in project mission of Client C's project created a large delay in schedule, the technology of Client A caused the project to reevaluate its analytics element and shift scope, and stakeholder expectations led to smaller variations which created more specific product scope elements. The impact of these changes aligns fairly well with the weighted impact numbers developed by Tariq et al. Project mission change caused the greatest impact of schedule and scope within the five projects, forcing the Client C project to completely divert project scope and delay the project. Technology had a lesser impact on the Client A project, creating a slight variation in project scope but ultimately little to no difference in schedule. The only project outcome to challenge Tariq et al.'s research was the impact of stakeholder expectations. Because of the broad definition assigned to each of the engagement elements, product scope was allowed to shift with stakeholder expectations within the broader outline of the project scope. Coupled with the hybrid agile methodology, stakeholder expectations had a minimal impact on project scope and schedule and mainly just created more specific stories and features to develop the product scope off of.

External factors contributing to a risk in project development included project team composition changes and virtual COVID-19 business environment. These external factors had minimal impact on the project and product scope compared to the previously mentioned scope and project impact factors. Two projects faced challenges with team composition changes, specifically project leads transitioning off of the project. In one situation, this occurred a few weeks prior to the first sprint and in the other it occurred

after the second sprint. Both of these changes caused the projects to shift responsibilities between project members but caused no major impact to the scope. This can partially be attributed to the adaptability of these members and the project scope defined. There were also no major features or requirements defined that required specific project members, preventing any from being comprisable. The virtual environment created by COVID-19 did not pose a risk to projects since each project had multiple communication touchpoints with their clients. This mitigated any risk that a communication channel could fail, and the project would be delayed by a lack of information or feedback. It did limit projects on their ability to collect information from in-person visits to the site, but this was insignificant due to the type of work being conducted with the clients.

Conclusion

Overall, this case study indicated that agile methodologies are effective in managing scope throughout the duration of a project. Agile tools such as Kanban boards, client stories, and burnup/burndown charts provided effective avenues for project managers to manage product scope and deliver a valuable product in scope. The initial definition of product scope left the project flexible enough to change as product scope definition evolved within the overall project scope constraints. Change requests were then gathered and evaluated at the beginning of each sprint which allowed for a structured evolution of the product scope. Product scope overall had greater variation then project scope as indicated by the case study analysis which also validates previous literature on the evolution and definition of the two different types of scope.

Throughout the course of the five projects, the main elements of scope change were project mission and technology. Project variation did result in the greatest change from a pivot in project mission which aligns with the previous literature studied. This change mainly affected the schedule of the initial sprint for the project. Technology had less of an impact on the project velocity since a pivot was easily doable based on the flexibility on the product scope. While it did cause some impact on the product scope, it did not impact the overall project scope. Results from the case study broadly confirm the measures of impact of different scope elements on project progression. Scope creep was also limited throughout the five projects, so confirmation of these factors was not able to be supported through the case study findings.

In the broader context of scope management and the field of study around it, this case study portrayed a specific context in which scope management is conducted in projects. Limitations surrounded the measurement of cost across projects as well as time constraints around the overall project schedule (i.e., 5-month basis rather than larger industry projects). Future research should center on the results of long-term projects and the overall impact of product and project scope on both cost and schedule. In practice of project management, these results indicate that agile methodologies are effective in managing scope variation and change. It also indicates that structured responsibilities around project management and needs identification help mitigate and/or prevent the negative impacts of scope change. Project managers should use this information to prioritize focus around scope change management and reevaluate how they define scope elements at the onset of a project.

Appendix A

Project Analysis Summarized Data (Page 1)

Project Client	Engagement Elements	Type of Work	# of Consultants	Sprint 1	Sprint 2
Client A	<ul style="list-style-type: none"> - Analyze the current donor data collection process and suggest improvements based on discovered bottlenecks - Develop a donor management and analytics model to provide insights on donor metrics - Recommend a client relationship management system based on data and process analysis 	Technical	5	<p>8.25.2020 - 9.15.2020</p> <p>Risks: Client information siloage, primitive data</p> <p>Milestones: Understanding current system and data process, analysis of data structure, CRM research & recommendations</p>	<p>9.15.2020 - 10.22.2020</p> <p>Risks: Client implementation strategy (Onboarding new employee), project pivot towards CRM</p> <p>Milestones: Donor KPI development, data process analysis, Hubspot research, CRM Demos</p>
Client B	<ul style="list-style-type: none"> - Optimize Client B's donor management strategy - Develop individual donor and corporate partnership target strategies and a comprehensive target market identification - Create a long-term strategy to execute priority initiatives in fund development plan 	Business Development	5	<p>8.24.2020 - 9.24.2020</p> <p>Risks: Client responsiveness & line of communication, system access</p> <p>Milestones: CRM research & recommendations, Salesforce implementation guide, donor KPIs, data export</p>	<p>9.24.2020 - 10.28.2020</p> <p>Risks: Client responsiveness, broad/vague work scope, deliverable delayed a week, hard skill learning curve (Tableau)</p> <p>Milestones: Industry research, peer analysis, marketing/partnership strategies and recommendations, target market identification & donor analysis</p>
Client C	<ul style="list-style-type: none"> - Conduct a feasibility study and develop a business plan for a grocery delivery service for Client C - Collaborate with a Client C program to aid on key initiatives 	Business Development	6	<p>8.25.2020 - 10.9.2020</p> <p>Risks: Large scope change, multiple engagement contacts, short deployment timeline</p> <p>Milestones: Delivery service models, interest survey, financial model buildout</p>	<p>10.9.2020 - 10.20.2020</p> <p>Risks: Short deployment timeline, unclear schedule expectations from client,</p> <p>Milestones: Reworked financial model, restaurant interest follow-ups, work shift schedule</p>
Client D	<ul style="list-style-type: none"> - Construct a 1-3 year strategic growth plan for the expansion of program services - Generate a sustainable funding and donor base strategy to aid in program development 	Business Development	5	<p>8.23.2020 - 9.18.2020</p> <p>Risks: New market for client, undeveloped current operations in the US</p> <p>Milestones: Donor outreach strategy, peer research, funding model</p>	<p>9.18.2020 - 10.21.2020</p> <p>Risks: New marketing employee, client expectations about implementation, narrowing program service messaging</p> <p>Milestones: Donor demographic research, identifying key donor networks, Ecuadorian immigrant communities, potential partnership research (Corporated Donors)</p>
Client E	<ul style="list-style-type: none"> - Facilitate rebranding efforts through structured research including brand perception and brand strengths - Determine avenues to increase and maintain volunteer engagement specifically with younger audience 	Marketing	6	<p>8.23.2020 - 9.30.2020</p> <p>Risks: Short survey deployment, vague client feedback, survey data design</p> <p>Milestones: Developed & released survey, market research, industry peer analysis, rebranding</p>	<p>9.30.2020 - 10.28.2020</p> <p>Risks: Scope clarity, feedback from client</p> <p>Milestones: Started analyzing survey data, developed brand concept options, social media audit, identified/benchmarked fundraising KPIs, volunteer engagement strategy</p>

Project Analysis Summarized Data (Page 2)

Project Client	Sprint 3	Sprint 4	Sprint 5	Deliverables	External Impacts
Client A	10.23.2020 - 12.2.2020 Risks: Milestones: Data purging, hubspot functionality, data pipeline merger tool, data practices recommendations and long term data management strategy			- CRM Evaluation - Data Pipeline Purgement & Integration Tool - Data & Technology Practices Strategy	PL Dropped 2/3 way through the semester
Client B	10.29.2020 - 12.8.2020 Risks: Milestones: Partnership strategies, fund development plan, donor data analytics, donor program strategy			- Customer Relationship Management Research Analysis - Salesforce Implementation Guide - Industry Analysis and Target Market Identification - Fund Development Plan	Client conformity with larger organization, limited access to systems
Client C	10.20.2020 - 11.2.2020 Risks: Short deployment timeline, team burnout Milestones: Delivery service Business Plan, sponsorship strategy and agreements, service pitch deck	11.3.2020 - 11.23.2020 Risks: Work scope breach, supporting role Milestones: Service implementation and marketing	11.24.2020 - 12.04.2020 Risks: Separate business vertical, different contacts Milestones: Community market research, financial model for operating classes/other equipment	- Financial Model & Key Assumptions - Survey of Interested Customers & Follow-Up - Delivery Service Business Plan - Shift Schedule - Makerspace Market Research	Major scope shift; Change in timeline; Outside of normal project management structure; Product ownership (Board seat)
Client D	10.22.2020 - 11.23.2020 Risks: Milestones: Newsletter framework, Google Ads marketing campaign, Marketing calendar			- Funding Model & Peer Analysis - Donor Base Strategy - Donor Marketing Strategy (Content & Templates) - Marketing content calendar - Communications overview	Team member went fully virtual halfway through project
Client E	10.29.2020 - 11.18.2020 Risks: Survey data collection bias Milestones: Survey analysis, consumer wants/needs identification, marketing improvement recommendations	11.19.2020 - 12.4.2020 Risks: Milestones: Social media strategy, platform content calendar and guide, volunteer & donor engagement strategy, rebrand of name, logo and design		- Rebranding & Market Analysis - Survey Buildout & Distribution - Rebranding & Colunteeer Engagement - Survey analysis & recommendations - Rebrand (Name, logo, guide) - Volunteer & Donor Engagement Strategy - Social Media Strategy Recommendations & Content Calendar	Onboarded new PL week before project, disconnect between board and ED

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