Performance on agile teams: Relating iteration objectives and critical decisions to project management success factors

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Abstract

Context: While project management success factors have long been established via the golden triangle, little is known about how project iteration objectives and critical decisions relate to these success factors. It seems logical that teams’ iteration objectives would reflect project management success factors, but this may not always be the case. If not, how are teams’ objectives for iterations differing from the golden triangle of project management success factors?

Objective: This study identifies iteration objectives and the critical decisions that relate to the golden triangle of project management success factors in agile software development teams working in two-week iterations.

Method: The author conducted semi-structured interviews with members across three different agile software development teams using a hybrid of XP and Scrum agile methodologies. Iteration Planning and Retrospective meetings were also observed. Interview data was transcribed, coded and reviewed by the researcher and two independently trained research assistants. Data analysis involved organizing the data to identify iteration objectives and critical decisions to identify whether they relate to project management success factors.

Results: Agile teams discussed four categories of iteration objectives: Functionality, Schedule, Quality and Team Satisfaction. Two of these objectives map directly to two aspects of the golden triangle: schedule and quality. The agile teams’ critical decisions were also examined to understand the types of decisions the teams would have made differently to ensure success, which resulted in four categories of such decisions: Quality, Dividing Work, Iteration Amendments and Team Satisfaction.

Conclusion: This research has contributed to the software development and project management literature by examining iteration objectives on agile teams and how they relate to the golden triangle of project management success factors to see whether these teams incorporate the golden triangle factors in their objectives and whether they include additional objectives in their iterations. What’s more, this research identified four critical decisions related to the golden triangle. These findings provide important insight to the continuing effort to better assess project management success, particularly for agile teams.

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1. Introduction

Simply browse any Gartner survey or Gallup poll on project management (PM) success [e.g. 1] and one finds ample evidence that information technology (IT) projects often fail. While IT projects are becoming larger, on average, large IT projects tend to run 45% over budget, 7% over time and deliver 56% less value than predicted, with software projects experiencing the highest risk of cost and schedule overruns [2]. And irrespective of project size, about half of all projects fail due to functionality issues and substantial delays [3].

These figures are startling when we consider that the Project Management Institute has established global standards for PM guidelines and rules via its PMBOK Guide [4]. It seems likely that with such established standards, success on PM teams should be rampant. But how is PM success defined for IT and information systems (IS) projects? It has long been established that PM teams should use the simple golden triangle comprised of schedule (time), budget and quality to determine their project management success [5,6]. But while this golden, or iron, triangle evaluates the end product of a project, how can we evaluate whether or not our project is on track to be successful from a PM perspective during the project? Certainly it is true that PM teams create project plans, track project milestones and monitor budgets [7]. But still this...
doesn't seem to be enough as clearly so many projects still run over budget, over time and under-deliver.

Aside from using PM standards and tools, it would be useful for teams to understand how objectives map to the golden triangle of PM success factors. This may be particularly useful for agile software development (ASD) teams because these teams use iterative development via regular, short iterations of two-week periods, developing objectives for each iteration and then reviewing them at the end of the iteration [8]. We call these iteration objectives. As agile teams simultaneously designs products and processes rather than designing the process after product design [9], many organizations have transitioned to using ASD methods on project teams to allow for iterative development that (a) incorporates unpredictable events regularly throughout the project [10]; (b) delivers cost-effective and user-driven software to customers [11]; and (c) delivers high-quality products faster, leading to more satisfied customers [12].

Therefore, this paper will examine the following research questions (RQ):

1. What are agile teams' iteration objectives and how do they relate to the project management success factors in the golden triangle?
2. How do agile teams' critical decisions relate to the project management success factors in the golden triangle?

These research questions warrant investigation as research has demonstrated a decline in focus of interpersonal issues and quality management between 1996 and 2006, with an increase in focus on project evaluation and improvement. This increased focus includes topics such as relationship management, resource management, time management, cost management and risk management as major factors of interest and importance to project teams [13].

Essentially, this research examines whether the golden triangle of project management success is discussed in iteration objectives and critical decisions and what other objectives may be discussed beyond the golden triangle PM success factors as little research has focused on how objectives relate to PM success factors and how critical decisions relate to the same. This research examines iteration objectives, the objectives that agile teams make for iterations. Objectives are defined as something specific and measurable that one is trying to do or achieve [14] that is more precise than a goal which refers to more generic actions that may not be as measurable or tangible as an objective. Given ASD’s focus on improved quality and schedule [11,12], it seems likely that agile teams will discuss these in their iteration objectives, thereby relating them to the golden triangle of PM success factors. Within this manuscript, the PM success factors refer to the golden triangle of schedule (time), budget and quality. “PM success factors” and the “golden triangle” terms are used interchangeably to refer to each other. But we may find that these teams discuss other objectives as well.

Further, we examine the critical decisions agile teams make because these are the decisions that stretch the expert team member’s knowledge and skills, thereby eliciting specific, detailed information about the important cues, choice points, options, action plans and the role of experience in decision making [15,16] on agile teams. Critical decisions indicate the important cues that trigger knowledge and reasoning in a given situation [16] and are the decisions that the team would have made differently to ensure PM success.

The remainder of this manuscript is structured as follows. Section 2 reviews the literature on both PM success factors and agile software development. Section 3 discusses the research design and methods used to conduct this study. The findings of the three case studies conducted with hybrid agile teams to examine how iteration objectives and critical decisions relate to the golden triangle are revealed in Section 4 and discussed in Section 5. Section 6 provides the limitations of this study and potential avenues for future research. The manuscript ends with the overall conclusions discussed in Section 7.

2. Project management success for agile software development teams

This section reviews the literature on both the golden triangle of PM success factors and ASD to indicate why this research examines how iteration objectives on agile teams relate to that team’s PM success factors.

2.1. Project management

In order to understand how we define the success of PM, we must first define PM. The PMBOK Guide [4] defines a project as a temporary group activity that produces a unique product, service or result with PM being:

The application of knowledge, skills and techniques to execute projects effectively and efficiently. It’s a strategic competency for organizations, enabling them to tie project results to business objectives – and thus, better compete in their markets.

PM refers to the planning, monitoring and controlling of all aspects of a project, with the people involved in the project aiming to achieve the objectives on time and on budget to a specific quality standard [17]. It is the method for solving complex organizational problems and handling organizational activity [18]. One of the earliest perspectives defines PM as the use of tools and techniques applied to diverse resources in order to accomplish a unique, complex, one-time task within time, cost and quality constraints [19].

As can be seen, multiple definitions exist for PM, though they all have common elements. Essentially, PM refers to the tools and processes used to accomplish a temporary and unique piece of work, a project, within specific time, budget and quality controls. Thus, it is no wonder how the golden triangle came to signify the success of PM. For if there are schedule (time), budget and quality controls established it makes sense that a PM team can measure those controls, particularly the time and budget elements.

2.2. Project management success

Let us now turn to defining the three components of this golden triangle in more detail as PM success is assessed by this triangle to evaluate a project’s adherence to schedule, budget and specified requirements [6,20,21]. First, we must distinguish between project success and PM success as these are different terms. Project success is measured against a project’s overall achievement of the project’s objectives, whereas PM success is measured using the traditional and oft-used measures of time (schedule), cost (budget) and quality [22,23]. Thus throughout this manuscript, the term “golden triangle” refers to the PM success factors of schedule (time), budget and quality and “PM success factors” refers to this golden triangle. The time element naturally refers to the scheduling of tasks and completion dates, whereas the budget refers to the overall cost of the project. Finally, quality refers to how well the finished product functions. Often these three components compete against one another as higher quality generally requires more time and budget to complete [4].

The golden triangle was developed to help project managers assess the management of their projects [22]. It provided them with a framework for tracking and monitoring their projects by balancing these three competing demands. Over time, it became the default method for measuring PM success as the triangle
focuses on specific project outputs [24]. The project triangle success factors are from the point of view of the project manager who see their job as successfully completed when they complete a project on time, within their budget and according to quality requirements [25]. One study has revealed that project managers rank order the importance of each of these three sides of the triangle in the following order from most to least important: quality of project outcome meets client expectations, project was completed within the scheduled timeframe, and project was completed within budget [26].

But many studies claim this golden triangle is not enough as we need to look beyond PM success at general project success [22] (see 25 for detailed literature review on project success). Studies in the early 1980s began examining behavioral factors and organizational aspects as criteria for project success beyond the three factors in the golden triangle for PM success [27]. Some claim the golden triangle is not always enough due to the variety of stakeholders involved in a project, with other factors critical for project success including clarity of goals, top management support, clear project plans, client relationship and communication [28]. In its 2008 fourth edition, the PMBOK Guide also put more emphasis on the role of project stakeholders and managing their expectations as success factors for PM, though not as much emphasis as it put on user and management issues [29].

Furthermore, some researchers have developed their own project success models. One such model is based on systems theory. This model shows PM success as dependent on four dimensions of project success: project manager skills and competencies, organization structure, measurement systems, and management practices [30]. While acknowledging that the golden triangle has been the PM success criteria for over 50 years, Atkinson [6] has developed another model, the Square Route model. This model includes the golden triangle, but includes three other components to assess: the information system developed, including its reliability and maintainability; benefits to the organization, such as improved efficiency and effectiveness, learning and profits; and benefits to stakeholders, such as user satisfaction, environmental impact, personal development and professional learning [6].

Still other research focuses on factors that lead to the failure of PM to achieve the golden triangle. These factors include lack of management support, ineffective project manager, lack of project commitment, poorly defined project tasks, inadequate basis for the project and lack of PM techniques [31]. One particular study examined the factors that led not to the failure of an information systems project but led to the cancellation or abandonment of the project altogether. These factors include a lack of articulate project goals and objectives; a weak project team composition; lack of team expertise or experience; poor PM and control with a lack of measurement system or process to track progress and risks and make critical decisions; lack of adequate assessment of legacy technology infrastructure; lack of senior management monitoring and decision making; and escalating project schedules and budgets [32].

However, although much research supports broadening the definition of project success, the traditional golden triangle prevails in actual PM teams [25,33] as it is considered the predominant approach for measuring PM success in success reports [34] and in organizations [35]. Many researchers purport that the golden triangle is a necessary method for measuring the success of PM, though they also include additional factors such as benefits of the product and stakeholder satisfaction [e.g. 23,36,37]. And researchers argue that it is impossible to distinguish between PM success and project success as these two concepts actually overlap [31]. Thus with PM still referring to the golden triangle as the PM success factors on teams although many studies encourage us to go beyond the golden triangle with other success factors [e.g. 6,22,25], very little research seeks to understand how iteration objectives and critical decisions relate to the golden triangle of PM success factors.

2.3. Agile software development teams

Now that we have described the literature on PM success factors, we will examine what it means to be an agile software development team. Organizations, IT and IS development projects rely on teams to complete work, with a team defined as a group of individuals working together who are dependent upon one another and have one or more tasks to perform collectively that results in a specific outcome [38]. To understand how iteration objectives relate to the golden triangle of PM success factors, the author examined agile teams specifically because their particular team characteristics lend themselves to this type of research as agile teams apply a human-centered approach to software development [39] that delivers high-quality products faster, thereby leading to more satisfied customers [12].

Agile teams do not identify all requirements upfront in the project [10]. For these teams, the start of each two weeks brings about a planning meeting where objectives of the next iteration are discussed and established, with supporting tasks and time estimations for task owners [40]. This Iteration Planning meeting marks the start of each development iteration and consists of a set of activities that plan the work for the agile team in the upcoming iteration [8]. A Retrospective is the meeting at the end of the iteration that provides the agile team with an opportunity to reflect on how it is working together and actively seek out areas to improve [41]. These two meetings relate to the iteration objectives as the former plans the iteration objectives and the latter reviews them. Thus, agile teams regularly revisit objectives.

Agile teams are less structured types of small teams with fewer than nine members [42]. These teams work iteratively [8] as they develop software in short time periods, known as iterations, often as short as two weeks in duration [42]. As these teams develop objectives at the start of each iteration, agile teams therefore work under extreme time pressure to deliver working software in these short iterations [39,43] with frequent, short-term decisions, using minimal documentation [39]. The iteration-based focus enables agile teams to adapt and respond quickly to changing requirements as they deliver working software frequently, each iteration [44], compared to traditional systems development life cycle (SDLC) teams where the end product of projects is typically unavailable to end-users until the very end of the project, which could take months or years to complete [45]. Thus, in agile teams software development is not a sequential development process akin to a linear relay race where the product is passed from one group to the next like in SDLC teams. Instead, it is an interactive group process with a multidisciplinary team working together from start to finish akin to a rugby team [46].

What’s more, an agile team is collaborative [47] and flexible as team members switch roles to gain new experiences [48]. Agile project teams, in general, need to deal with complex and interdependent tasks, and share knowledge and expertise [8,42]. However, agile teams rotate roles and share leadership across the team [48–50], which differs from the SDLC project team where the project manager leads the team [45]. Team members empower each other to make decisions [47] by sharing decision making as the project manager is not the accountable decision-maker but more a coordinator for the agile team [51,52] who facilitates decision-making between all team members rather than just making the final decision him/herself [49]. The project manager’s role as a decision-maker is greatly reduced [53,54], and all team members contribute to decisions as they are made collaboratively [8,48], with the customer continuously involved in this process [55]. Agile
teams sometimes use a rational decision process during their iteration, with their decision making influenced by iteration duration, experience and resource availability [56]. Research has also indicated the decision obstacles that agile teams face include (1) an unwillingness to commit to decisions; (2) conflicting priorities; (3) unstable resource availability; and (4) a lack of implementation, ownership and empowerment [40].

To summarize, agile teams were used in this study because they develop and determine new objectives each iteration as they adapt to change and use a collective problem-solving approach that (a) considers all team members to be skilled and valuable stakeholders; (b) relies on the collective ability of the team to solve problems; and (c) minimizes upfront planning for iterative planning that adapts to changes [57]. Thus, agile teams are suitable teams for understanding how iteration objectives and critical decisions relate to the golden triangle as they regularly address their objectives and related critical decisions each iteration via their Iteration Planning and Retrospective meetings.

3. Research design

As little research exists to relate iteration objectives to overall PM success factors, this study is exploratory in nature and examines agile teams in their natural setting. A qualitative multiple-case study approach was used because case studies are considered a suitable approach for exploratory research [58], with multiple case studies being more robust than single case studies [59]. Additionally, the best way to capture detail and understand people’s actions or motivations is to speak with people [60]. The multiple-case study approach facilitates cross-case analysis and provides an opportunity to examine if the findings are replicated across cases, which provides some foundation for generalization [58,59]. However, the ability to generalize findings from three case studies is limited. Findings replicated across the three cases only suggest that these findings may also be present in other cases.

3.1. Data collection

Data collection consisted primarily of in-depth, face-to-face semi-structured interviews with three different agile teams within the same organization across three teams (see Table 1) using an interview protocol. The interview protocol was developed and pilot tested prior to the study. This pilot test did not result in changes to the protocol but served to develop the codes used for data analysis across all cases. Interviewees were asked specific questions about the objectives they developed for iterations and subsequently reviewed them. The researcher to see and hear how the teams determined their iteration objectives and subsequently reviewed them. The researcher documented observations from these meetings as field notes and sought clarification from team members after the meetings when required. The clarification of the meaning of certain events and behaviors from both the interviews and observations ensured that the researcher did not assign a particular (incorrect) meaning to an event [61]. A list of interviewees and the meetings observed are detailed in Table 1.

3.2. Analysis

The analysis strategy was designed to identify and code the ranked order of importance of iteration objectives and the critical decisions that affect PM success. The multiple sources of data increased the rigor of the study [59]. Collecting interview data from members of agile teams with different roles and types of teams ensured that different viewpoints were obtained and validated the data gathered when two or more participants communicated the same or similar views. Empirical data was also collected from direct observations, which further validated the interview findings.

The qualitative data was effectively analyzed by the use of coding with each code representing a concept represented by the questions asked about the data and making comparisons between data [61]. The data from each case was analyzed using standard coding techniques [62] according to the iteration objective being studied under codes first from the PM success factors in the golden triangle, “Schedule”, “Budget” and “Quality”. Eventually, additional codes emerged from the data as it was grouped into categories of codes. To do this, the researcher imported the source documents
teams used (a) user stories to define what the customer wants the system to do in an estimable and testable way; (b) small releases where teams put a simple system into production quickly then release new versions on a very short cycle; (c) simple design so that the system is designed as simply as possible at any given moment in time; (d) collective ownership where anyone could change any code anywhere in the system at any time; and (e) continuous integration where teams integrate and build the system every time a task is completed [55]. For simplicity, we refer to these teams as “agile teams” throughout this manuscript as they are a hybrid of these two methodologies.

All cases studied (see Table 1) were from the same organization based in Ireland. This organization is the market leader for corporate actions and custody solutions to the investment services industry. Their customer is large financial institutions that handle corporate action events. All agile teams studied worked in two-week iterations. Two teams (Cases 1 and 3) were distributed teams between Dublin, Ireland, and Delhi, India, and included scrum masters (SM), developers (D), Quality Assurance testers (QA) and a business analyst (BA) or product owner (PO) role. Case 2 included the Head of Engineering (HE) and the Head of Product Design (HPD) as overseers to all other agile teams. All team members were employees of the organization.

The first team (Case 1) studied develops and maintains the downstream corporate action processing system that manages the change request from clients by fixing both internet and external issues with the system. The second team (Case 2) is the “Scrum of Scrums”, meaning this team has oversight over all agile teams in the organization. These members are very senior and provide a slightly different viewpoint to the other two agile teams because of their seniority and role within the organization, thereby providing different viewpoints on iteration objectives, critical decisions and PM success. The third team (Case 3) focuses on both fixing bugs in the corporate action processing software that tracks the life of corporate actions, from data scrubbing to allocation, and on client regression.

4. Findings

The first aim of this study is to investigate how agile teams’ iteration objectives relate to the golden triangle of PM success factors. The findings show that iteration objectives focus on Functionality, Schedule, Quality and Team Satisfaction, but not on budget. In addition, the second aim is to examine the critical decisions that relate to the golden triangle of PM success factors. There are four categories of such decisions: Quality, Dividing Work, Iteration Amendments and Team Satisfaction. These findings are presented in more detail in this section.

4.1. RQ1: What are agile teams’ iteration objectives and how do they relate to the project management success factors in the golden triangle?

Based on the data collected across all three cases, agile teams discuss four categories of iteration objectives: Functionality, Schedule, Quality and Team Satisfaction (see Table 2). Each of these four categories includes sub-categories within that iteration objective. Two of these objectives map directly to two aspects of the golden triangle of PM success factors, namely schedule (time) and quality, and budget is not discussed at the iteration objective level.

4.1.1. Functionality

The first iteration objective, Functionality, refers to completing the tasks decided for completion during that iteration. This includes the development, testing and documenting of functionality. In
support of developing iteration functionality, within the iteration, the “number one priority is to get the functionality done” (D, Case 1), or at least the part of the functionality the team committed to complete for that iteration. The “general objective” is to do what the agile team planned (SM, Case 1).

Often, the teams would ask, “Is your code complete?” as they were simply trying to “hit a date and get some code going” and then think about what to do after that (HE, Case 2). And in order for team members to complete their work, everyone must be up to speed on what everyone is doing, otherwise “the whole team can fall apart once their time comes to actually do their piece of work” (BA, Case 3).

The second sub-category in Functionality is to test what has been developed. Regarding the code developed in that iteration, the agile team also wants to “get that done functionality QA’d”, or tested, (D, Case 1). The QA work “makes sure that everything we did was complete” (QA, Case 1). Once code is complete in an iteration, the agile team wants it tested immediately, to “QA the work that’s been done... because it’s not ideal if they are finding bugs later that would interrupt the next planned iteration” (HE, Case 2). It was noted that reviewing the test cases helps development stay on track in an iteration because “if the tests are created based on specification... it’s a safety net that QA can actually find out if it’s correct or not” (BA, Case 3).

The third sub-category in Functionality discussed is documentation, referring to multiple types of documentation for what the team did. For example, all user stories need to have a “tech spec, the technical document... they do up front on their understanding of the pieces of code they’re going to hit and whatever database changes are required. It’s not a working document, so this is what it was [they knew] at that point in time, and it might change” (PO, Case 1). Additionally, documentation refers to “writing up what you’ve done on the wiki” (D, Case 1) to track what you’ve developed. However, this only happens when the piece of functionality is completed, which may take multiple iterations. Therefore, documentation only happens in an iteration when the functionality is ready to be documented.

4.1.2. Schedule

When talking about completing the functionality for the iteration, the next most discussed iteration objective is completing tasks on time by adhering to their Schedule. Two sub-categories here include planning the work and finishing the work on time. Planning is quintessential for completing tasks: when “our planning wasn’t so good, we weren’t able to deliver when we said we could” (QA, Case 3). But teams can find it difficult to plan appropriately as one SM stated, “It’s something that I find harder as Scrum Master is to show other people the dates that we say we are planning for and working [towards]” (Case 1). Team members note that it is crucial to “meet those [plans] on time” (SM, Case 1) and to “get it [planned functionality] delivered on time” (HPD, Case 2). When something is late, it becomes critical path for completion, meaning the task is “flagged because we’ve been working on it... and we’re still working on it... so we brought on another resource [because] that [task] was supposed to be done” (PO, Case 1). In fact, from the client’s perspective, it is imperative to “deliver the release on time” (QA, Case 3). But even though the team doesn’t discuss budget factors in their iteration objectives, they still bring on a resource which does affect the overall budget.

4.1.3. Quality

The third iteration objective refers to Quality. Although the sub-categories for this objective are not mentioned as often as those for Functionality or Schedule, if they are aggregated together, Quality would be the most discussed iteration objective. As the HPD states, “I’d prefer to see something done right and delivered late than something done incorrectly and delivered on time” (Case 2). The first sub-category is to ensure the product works before it’s released to the client because “what we actually develop is the end result. That’s what the client will see, so we need to make sure that that’s always on track, doing that demo that tests [our development] functionality” (BA, Case 3). Thus, the agile teams view one of the most important tasks as “to ensure everything is working before it goes out the door. This would be the most important task for the sprint” (QA, Case 1).

The second and third sub-categories, fixing bugs and addressing client issues, each had equal numbers of agile team members discussing them. Fixing bugs is critical because defects must be addressed so “we can meet iteration commitments” (HE, Case 2). What happens in development continues, but then a bug arises so development stops because the developer has to address the bug since it is blocking new development by keeping it from working, and “they are constantly held up on this” (HE, Case 2). Regarding client issues, team members ensure they address client issues immediately because “the issues that they’ve [clients] raised are... the first thing they’d check” (QA, Case 1) and “there’s no point delivering something that everybody is very happy with if it doesn’t meet what the actual objective was [for the client]” (HPD, Case 2).

The fourth and fifth sub-categories, review others’ code and ensure client satisfaction, each have equal numbers of agile team members discussing them. Reviewing others’ code means that “someone [the BA or SM] should sign off on or... say yes, that’s working as the spec” (D, Case 1). Team members should also “provide assistance to other team members with their work so that I code review some of theirs so that they can commit it... so that QA can test it” (D, Case 1). Ensuring client satisfaction simply refers to “making sure the customer’s satisfied with the product” (SM, Case 1). In other words, the “highest priority is the client [satisfaction] being number one” (SM, Case 3).

4.1.4. Team satisfaction

The final iteration objective discussed is Team Satisfaction and ensuring it on the team. According to the HPD, team satisfaction is evidenced if the team “took full ownership of the implementation and everyone who worked on it was proud of what they did, are still happy to say that they worked on that project, understood what had to be done and were left alone to do it” (Case 2). ASD helps drive this objective because ASD fosters “constant communication” (QA, Case 3). Further, one developer also commented his team’s satisfaction is ensured because the Retrospective meetings help set the objectives in the planning of the next iteration because using agile “gets you more information quicker... the Retrospective meetings definitely help at the very end, where you go through kind of what went wrong because if any issue came up in the iteration, your team leader would be better able to handle it in the future sprint to make it not impact you either at all or as much” (D, Case 1).

4.2. RQ2: How do agile teams’ critical decisions relate to the project management success factors in the golden triangle?

In addition to identifying the categories of iteration objectives to see how they relate to the golden triangle of PM success factors, the agile teams’ critical decisions were also examined in relation to the golden triangle of PM success factors. Based on the data, there are four categories of such decisions: Quality, Dividing Work, Iteration Amendments and Team Satisfaction.

4.2.1. Quality

Interestingly, the largest category for this research question was Quality. Agile team members talked about making decisions based
on Quality in order to have PM success. For example, the HE would have decided not to work on functionality until regression testing was completed via test cases: “I would’ve refused to start work on it until I could stand over the quality” (Case 2). What actually happened in this situation was they worked on functionality even though the client hadn’t provided test cases for how the functionality should work. Quality also refers to doing work that adds value for the client and avoiding non-value add work. In the past, the agile teams made decisions with the client that led to “an awful lot of work that we hate, that wasn’t adding any value…because we haven’t wired it all together” (HE, Case 2) with the client.

4.2.2. Dividing work
Dividing Work is the second decision that affects PM success. This refers to how work is divided across team members on each agile team. For example, “rather than divide work into technical component stories, keep the overall epic as being this nice end-to-end piece. Break it down into stories with the one product on or over it…so it goes to one team with one product owner, and they break it down across the smaller components. [...] rather than three different product owners” (HE, Case 2). And to ensure that team members can do the work, “deliberately ask them do they understand it and can they estimate it, or do they have any issues with it” (HPD, Case 2). This avoids people nodding along to do work that they don’t understand.

4.2.3. Iteration amendments
The third decision category that impacts PM success is accepting Iteration Amendments after sign-off. This isn’t to say that the agile teams are not flexible and adaptable to change. What it refers to is adding additional work to the sprint, and instead agile teams should “push back on bugs that come in after the cut-off date” (SM, Case 1) and do them in a later sprint. Because when a user story is amended post-sign-off from the team, QA for example may still be “testing the current [initial] user story…unaware it has changed…and those bugs they are testing are actually fixed in the new version” (SM, Case 1) so they are doing unnecessary work.

Additionally, agile teams have to avoid Iteration Amendments that lead to work they should not be doing. For example, “you’ve got to make a decision, should this go into the core product set, or should it be something that’s delivered by an integration team” (HPD, Case 2). There are things that a core product should do, “what it should be doing in the first place” (HPD, Case 2), and then there are minor additional features that the integration team can do when they integrate the core product into the client’s system.

Likewise, they need to be careful of high priority clients driving Iteration Amendments because they “trump everything else…that makes it very hard to plan” (SM, Case 3). These clients affect the PM success because they create an external pressure from the “overload of work coming in” (HE, Case 2). By doing this, team members say, “I own it” and teams “want to get it out the door and get it right for the client” (HE, Case 2). These comments show agile teams accepting more responsibility and accountability, which is a positive in an agile environment. It’s also about senior management backing agile teams and understanding that they have “mixed abilities on your team...that a full regression for our client means that the whole team is going to do it…and we will stand by [the team] throughout it [the regression test cycle]” (HE, Case 2). Team Satisfaction would also improve if senior members decided to “find more time to spend with the junior members of the team so that we’re assured that when they say they’re somewhere, they’re actually there and not an entire iteration away” (SM, Case 1).

4.2.4. Team satisfaction
Finally, the agile teams report they should make decisions that lead to Team Satisfaction in order to achieve PM success. This includes “empowering teams to make a lot more decisions” (HE, Case 2). By doing this, team members say, “I own it” and teams “want to get it out the door and get it right for the client” (HE, Case 2). These comments show agile teams accepting more responsibility and accountability, which is a positive in an agile environment. It’s also about senior management backing agile teams and understanding that they have “mixed abilities on your team...that a full regression for our client means that the whole team is going to do it…and we will stand by [the team] throughout it [the regression test cycle]” (HE, Case 2). Team Satisfaction would also improve if senior members decided to “find more time to spend with the junior members of the team so that we’re assured that when they say they’re somewhere, they’re actually there and not an entire iteration away” (SM, Case 1).

5. Discussion
This study improves our understanding of how agile teams’ iteration objectives (RQ1) and critical decisions (RQ2) relate to the PM success factors in the golden triangle. For RQ1, the data shows agile teams discuss four categories of iteration objectives throughout their project: Functionality, Schedule, Quality and Team Satisfaction. Two of these objectives map directly to two aspects of the golden triangle: schedule and quality. There was no discussion of budget in the iteration objectives of the agile teams studied, although occasionally participants mentioned resource additions.

In this study, more interviewees discussed the sub-categories for Functionality and Schedule, and these are listed as the most discussed two categories of iteration objectives, with Quality as the third objective and Team Satisfaction as a fourth objective of iterations. Within Functionality, agile teams discussed the importance of developing, testing and documenting functionality within the iteration as a major iteration objective for without these, no product is released to the client. The documentation sub-category focused on teams tracking in some way the functionality they developed and tested. As agile teams use minimal documentation [47], some documentation is still necessary once functionality is complete in order to keep a record of what was done and why for use by future teams.

Related to these sub-categories, the Schedule objective is where participants focused on the objective of appropriately and effectively planning work and then completing that work on time within the iteration. Teams discussed the importance of sticking to the two week iteration plan, and introducing changes in the next iteration rather than disrupting the flow of the current iteration.

The Quality objective was broken into five sub-categories. Participants discussed the importance of ensuring the product works, fixing bugs and addressing client issues before releasing functionality to the client, and reviewing others’ code and ensuring client satisfaction as the sub-categories for achieving the Quality objective. This research listed Quality as the third most discussed objective as Table 1 shows fewer participants talking about each sub-category compared to their discussion of each sub-category for the Functionality and Schedule objectives. However, if all discussions of Quality in general are amalgamated, regardless of how many interviewees mentioned each sub-category, Quality would be the number one objective with the most references overall. While this does not provide statistical validity, it does show the frequency of the coded objective in an exploratory attempt to identify the iteration objectives. This fits with research where project managers have ranked quality as most important in the golden triangle, followed by schedule and budget respectively [26]. As there is often the struggle between higher quality versus needing more time and budget [4], it seems agile teams prefer to focus on quality for the sake of finishing iteration tasks on time as the HPD favors “something done right and delivered late than something done incorrectly and delivered on time” (Case 2).

The final iteration objective discussed was Team Satisfaction. Like client satisfaction, studies have found teams to be an additional factor of PM success beyond the golden triangle that should be assessed [23,37]. This objective is not included in the golden triangle of PM success factors, but seems to be a major objective for agile teams as this research found agile teams including Team Satisfaction as an objective and listing it as a critical
decision for PM success. For these types of teams, emphasis on team satisfaction as an iteration objective makes sense because agile teams are collaborative [47] and flexible [48] as they share knowledge and expertise [8,42]. These teams differ from SDLC teams in that agile teams rotate roles and share leadership across the team [48–50], thereby empowering team members [47]. Whereas the traditional golden triangle of PM success factors doesn’t include team satisfaction, it would seem a viable objective for agile teams given the nature of such teams and the findings of this research. The author recommends that agile teams consider this when creating iteration objectives. If agile team members are not satisfied, the agile process may be defunct and the team might not meet the iteration objectives. If agile team members are not satisfied, the agile process may be defunct and the team might not meet the other objectives of Functionality, Schedule and Quality.

The second aim of this study is to understand the agile teams’ critical decisions that relate to the golden triangle of PM success factors. The critical decisions are those that stretch a team member’s knowledge and skills [15,16] and are viewed as those decisions that agile teams would have made differently to ensure PM success. The data for this research question indicates four categories of such decisions: Quality, Dividing Work, Iteration Amendments and Team Satisfaction. Again, Quality was a factor of utmost importance, and these decisions relate to the iteration objective of Quality. Regarding decisions on Quality that agile teams made that relate to their PM success, agile teams believe in making decisions to do only value-add work rather than wasting time on non-value add functionality. Some participants felt they worked on tasks that were not important for the client or that the integration team would better focus on; therefore, they did not feel they contributed as much value to the client as they could have if they did not develop these tasks.

This critical decision of Quality relates to their objective of high Quality work because as discussed, participants stated that they’d rather deliver high quality work late than poor quality work on time. This has a serious ramification on Schedule for the sake of Quality in the golden triangle, which is a common dilemma PM teams face [4]. But it reinforces the importance of high quality as a PM success factor of the golden triangle as we see agile teams reflect this success factor in their iteration objectives and critical decisions. This makes sense and suggests that these agile teams are truly working according to agile principles by delivering high-quality products faster, thereby leading to more satisfied customers [12]. Interestingly, it was team members from Case 2, the senior roles, who discussed the critical decisions of Quality and Dividing Work.

Critical decisions for Dividing Work and Iteration Amendments refer to better ways of doing the iteration work. Ensuring the work is not necessarily divided up by technical competencies means that one team works on a specific functionality, learning all the technical competencies required rather than splitting the work across teams which creates scheduling and dependency issues. It also means that agile team members must discuss their capabilities and skills openly and honestly to accurately complete iteration work as their decision making is influenced by team member experience and resource availability [56]. These decisions relate to the Functionality iteration objective, as well as the decisions about Iteration Amendments in that teams should stick to deadlines for clients to assign iteration tasks, and include changes in the subsequent iteration as an iteration is only two weeks in duration. Agile teams should also avoid non-value add work being amended to their iteration plan as discussed above, while the third iteration objective of Iteration Amendments relates to the Schedule iteration objective discussed.

The fourth critical decision agile teams say affects their PM success is about Team Satisfaction. Team Satisfaction is also the fourth iteration objective discussed. However, when we examine the agile teams’ critical decisions, the participant responses were more numerous and specific about this critical decision compared to responses coded as the Team Satisfaction iteration objective. Team Satisfaction as a critical decision means that senior management must trust agile teams to make more decisions, allowing agile teams to own their functionality and implementation. This requires support from senior management, particularly for junior team members. It also requires their recognition of a variety of skill levels on an agile team and the opportunity for junior team members to learn and improve skills.

In turn, such support from senior management allows the agile team to gain responsibility and accountability, which is what agile teams are all about. Agile teams are supposed to be empowered to make more decisions [47] and rely on the collective ability of the team to solve problems [57]. Prior research finds that agile teams can face ownership and implementation obstacles to making decisions [40]. This current research contributes to these findings by stating agile teams must make decisions in support of Team Satisfaction, which can combat against the ownership and implementation decision obstacles.

Finally, the teams were chosen to reflect a variety of experience, roles and project purpose. Two teams were distributed (Cases 1 and 3), but the HE of Case 2 stated that “all [agile] teams now have to have Indian and Irish representation on them, otherwise nobody has any visibility and there’s no cross communication” (HE, Case 2), indicating that even though his team was not distributed he still believed in the merits of distributed teams. There were no obvious differences in the findings based on the level of experience, roles, purpose or distribution across teams, thereby improving the generalizability of the findings across teams within this organization.

There was one exception: the first and second critical decisions of Quality and Dividing Work which were only discussed by members from Case 2 with senior roles. This could indicate their senior perspective of where critical decisions should focus on agile teams. These team members also have a more high level view of the agile teams because they are the Scrum of Scrum agile team with oversight across all agile teams. Thus, they can more clearly see where critical decisions are made on various teams. Perhaps our Cases 1 and 3 teams did not see Quality and Dividing Work as critical decisions on their teams, but Case 2 could see these as critical decisions across many other agile teams they oversee.

6. Limitations and future work

While this study contributes to our understanding of how iteration objectives and critical decisions relate to the PM success factors in the golden triangle on three agile teams, there are some limitations to the method employed. A limitation of the current research design is the single point in time in which the data was collected, which created a frame of reference for the study and reflected the perspective of participants during that time period [63]. As this was an exploratory study rather than a longitudinal study, no data was collected that looked at the final project outcomes of schedule, budget and quality at the end of the project. It could be useful to conduct a longitudinal study to measure final golden triangle outcomes and objectives of each iteration on agile teams to see the final results of the project. The objectives of this current work were simply to understand what aspects of the golden triangle are discussed as agile teams’ iteration objectives and critical decisions. As this is exploratory research, it would be beneficial to continue applying the concepts studied here to other agile teams at other organizations and using other agile methodologies besides an XP and Scrum hybrid. This would help expand the list of iteration objectives and critical decisions.

Additionally, interviews do have limitations. As recommended by Corbin and Strauss, the researchers attempted to address these
by following an interview protocol for each interview and observ-
ing each agile practice several times, capturing as much detail as possible during each observation and subsequently clarifying the meaning of certain events and behaviors to ensure that the researcher did not assign a particular (incorrect) meaning to an event [61]. Examining the concepts studied here with other agile teams would serve to validate the list of findings resulting from these three agile teams and generalize the results beyond these teams and this organization, as well as shed light onto additional iteration objectives and critical decisions that were not discussed by these three teams.

7. Conclusion

This research has contributed to the software development and project management literature by examining iteration objectives on agile teams and how they relate to the golden triangle of PM success factors to see whether these teams incorporate the golden triangle factors in their iteration objectives and whether they include additional objectives in their iterations. Two of the three factors in the golden triangle are specifically discussed as iteration objectives, namely Quality and Schedule. The two other categories of iteration objectives are Functionality and Team Satisfaction. Additionally, this research sheds light on the critical decisions agile teams could make differently to improve their PM success. Such decision categories include Quality, Dividing Work, Iteration Amendments and Team Satisfaction.

Furthermore, these findings have implications for practitioners as well as researchers. Practitioners can appreciate incorporating PM success factors into their iteration objectives to address the golden triangle of PM success factors throughout the project during the planning for each iteration when they set the objectives for that iteration. From these results, agile teams should discuss Functionality, Schedule, Quality and Team Satisfaction as objectives each iteration. And while budget wasn’t specifically discussed or listed as an objective, some agile teams bring on additional team members during iterations, so it is recommended that agile teams incorporate budget into their iteration objective discussion.

Finally, Quality plays a pivotal role not only in PM success, but in client satisfaction as well. Client satisfaction is a key driver for projects as their satisfaction allows the project to continue. These findings therefore provide important insight to the continuing effort to better assess PM success, particularly for agile teams.

References

[13] J.R. Turner, Editorial: project management: a profession based on knowledge and this organization, as well as shed light onto additional iteration objectives and critical decisions that were not discussed by these three teams.

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References


