

# Agile / Scrum Methodological Implementation in Capital Projects

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## Executive Summary

The Saint Louis Axe facility is an innovation project focused on multiplying the uses for beer byproducts. The project itself is currently located in the Front-End Planning (FEP) Phase, Funding Stage of the AB InBev Capital Project Process. The team has found success using Scrum as a Process (SaaP) throughout the design phase. Based on team-members experience with the traditional construction methodology in the FEP phase, the team has seen the greatest benefits in communication, interdependence, accountability, and results:

**Communication** – SaaP encourages participation of all team members regardless of position or place in hierarchy. Scrum team members felt that no matter their position outside the team, the equality of the individual contributors precipitated candid dialogue and honest discussion amongst all participants. Anecdotal observation indicates a high level of attendance at meetings and certainty on the current priorities of the team.

**Interdependence** – By increasing the visibility of tasks and priorities on the scrum team, team members were able to more easily see where they could contribute to the work of their team members. As a result, collaboration between different process areas was more streamlined and efficient, decreasing the amount of time it took to complete tasks, scope gap, and thus increasing value of the deliverable being provided. When examining the different number of ‘Champion[s]’ (the individual person or entity assigned responsibility for a task), there were (43) unique champions for (413) product backlog tasks over the course all sprints, indicating significant mixing of ad hoc teams, high levels of cooperation, and dependence on other team members.

**Accountability** – Status updates occur daily through the morning scrum; as such, there is distinct pressure on each champion to continue to drive progress or state the impediments that are hindering the champions’ ability to complete a given task. Also, because the methodology requires the team members to consistently present their work in an open forum to the entire team, it increases pressure to deliver a sound product or progress by the end of the sprint.

- Tasks were more likely to be accomplished inside of a single sprint when assigned 13 story points or less
- A group of individuals collectively assigned as a champion for a given task increased the probability that a given task would be accomplished inside of one sprint

**Results** – All scrum team members were firm in their belief that their scrum team is producing more favorable results than traditional methods of design and construction management. Though it is difficult to judge independently, scrum team members believe that their work is of higher quality and completed more quickly due to the factors above. This is backed up by the data; while the team was given an additional six months to complete elements of facility design, they have reduced the total project budget by 15% without significant changes to scope (as of 4 September 2020) on a project that exceeds \$50 million in total project value.

Based on the author’s experience as a member of the team and the universal opinion of the STL Axe scrum team (multiple members of whom have multiple decades of capital project management experience at AB InBev or subsidiary business units), the author **recommends the continued use of the scrum / agile methodology** in this project and into the execution phase. Additionally, the author **recommends that the methodological use of scrum agile be piloted and examined for adoption** by additional business units and zones inside of AB InBev **as the methodology used in capital construction projects**.

## Introduction

Large scale capital projects face three primary constraints, commonly known as the project management triangle: project duration, project quality, and project budget. In 2019, an AB InBev subsidiary made the decision to implement agile / scrum methodology into its capital project construction process to improve upon all three elements of the project management triangle.

For the purposes of this paper, the author conducted multiple interviews with different members of the Saint Louis Axe (STL Axe) Scrum team, reviewing their observances and recommendations, and analyzing changes to the business case as a result of the scrum team decision-making.

The scrum team is a multi-disciplinary team composed of FTEs from different areas of the AB InBev umbrella as well as contractors. All contractors had at one point in their careers worked for AB InBev or Anheuser Busch. More information regarding the scrum team composition can be found in Annex A. The team was trained on the agile mindset and scrum framework in collaboration with an AB InBev internal Scrum Trainer (ST) and Scrum, Inc., the creators of the scrum framework.

## Background

The STL Axe Scrum team has just begun the project funding phase in the AB InBev Capital Project Process. This document will be an overview of the use of scrum / agile methodology in the Front-End Planning phase of the Capital Project Process. This project was selected as a pilot for the use of scrum in capital project planning, development and construction. As of the publishing date of this white paper, the scrum team plans to continue to use scrum / agile methodology into the execution phase of the STL Axe project.

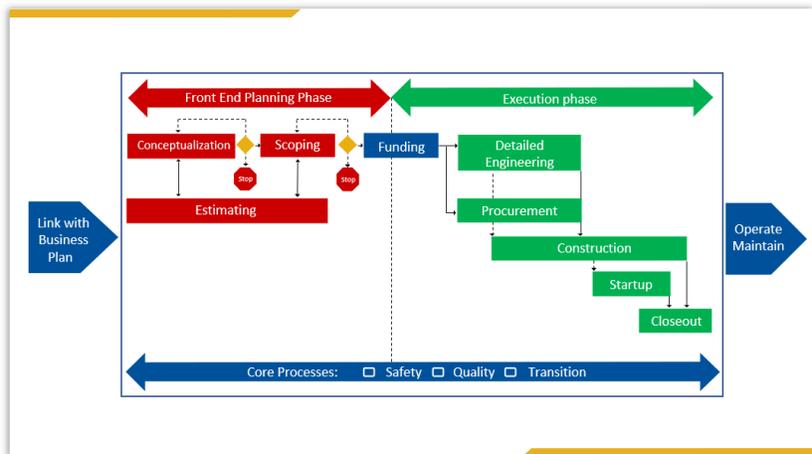


Figure 1: AB InBev Capital Project Process

## Scrum as a Process (SaaP) In Capital Projects: Advantages and Opportunities for Improvement

When using SaaP, the scrum team was universally positive in its reviews of the methodology. After interviews with the team, the benefits of SaaP can be grouped into four major areas: communication, interdependence, accountability, and results.

Communication

*“[A]s a result of the methodology, it’s **very** difficult to **not know** what’s going on with the team.”*

*-STL Axe Scrum Team Member*

Every colleague interviewed expressed their view that use of scrum has positively impacted communication relative to other projects on which they have been assigned. The cadence of daily stand-ups with all team members clearly and concisely conveys the priorities of the team and individuals for the day and for the duration of the sprint. SaaP encourages participation of all team members regardless of position or place in hierarchy, and scrum team members felt that no matter their position outside the team, the equality of the individual contributors precipitated candid dialogue and honest discussion amongst all participants.

As an example, the continued, daily display and review of the sprint backlog, which holds the scrum team tasks and priorities for the duration of the sprint, clearly announced to anyone who viewed it the level of importance and the status of a given task.

*Opportunities for improving Communication:*

Frequently left off the agenda for the STL Axe Scrum Team was a specified Sprint Retrospective event, the final of the three scrum artifacts. Scrum teams must take time to reflect on not only the product that was created / honed by the end of the sprint, but the process that was used to create the product.

**Communication: what the Data says**

While there was no measurement for validating the amount of communication, **results** seem to indicate that the statements above are proved out in practice. Through cursory observation, those assigned to the Scrum Team on a full-time basis attend more than 90% of the morning scrum meetings, while attendance at high-level scrum artifact meetings (Product Backlog and Product Review) are nearly perfect.

Interdependence

*“Scrum methodology enables very high levels of collaboration and coordination between team members.”*

*-STL Axe Product Owner*

An additional benefit of SaaP was the increased amount of interdependence between team members in the accomplishment of their tasks, resulting in an overall increase in quality of product delivered. By increasing the visibility of tasks and priorities, team members were able to more easily see where they could contribute to the work

**Interdependence: what the Data says**

Analysis of the sprint backlog items from sprints 11-20 indicates interdependence is high. When examining the different number of “Champion[s]” (the individual person or entity assigned responsibility for a task), there were (43) unique champions for (413) product backlog tasks over the course all sprints.

What is a unique champion? A given individual or grouping of scrum team members form the ‘champion’ for a given task. For example, ‘Tayo’, ‘Marcus + Ranjani’, and ‘Aimee + Kat + Shawnda’ are examples of ‘unique champions’.

of their team members. As a result, the opinion of the scrum team was that collaboration between different process areas was more streamlined and efficient, decreasing the amount of time it took to complete tasks, scope gap, and thus increasing value of the deliverable being provided.

As an example, the process design for protein refinement of brewers’ saved grain (BSG) has never been attempted at this level of industrial production. Further complicating matters, the process is required to fit inside of an existing building that was constructed more than 100 years

ago. Through close collaboration between civil and process engineering, the scrum team was able to optimize a process design for protein refinement that takes advantage of existing building layouts and new construction areas.

*Opportunities for improving interdependence:* The number of unique champions indicates a high degree of cooperation and mutual support within the Scrum Team as different sub-teams form to handle certain tasks. However, there may be additional productivity gains by grouping selected teams together more frequently and decreasing the amount of unique owner combinations. The rate of accomplishment for tasks differs depending on the grouped individuals; find the sub-teams that are most productive and group them together.

## Accountability

*“Scrum provides right amount of ownership behind tasks; allows for accountability, but the right kind of accountability.”*

*-An STL Axe Scrum Master*

A universal theme among all team members was that SaaP dramatically increases accountability of the team collectively and the individual team members. Within the sprint backlog, deliverables and tasks are explicitly assigned to each team member – known as the ‘champion’ for the given task. As each champion is required to brief the status of their assigned task daily, there is distinct pressure on each champion to continue to drive progress, or state clearly and openly to the scrum team the impediments that are hindering their ability to complete a given task. Also, the methodology requires the team members to consistently present their work in an open forum to the entire team; in the opinion of the STL Axe Scrum Team, this increased pressure to deliver a sound product or progress by the end of the sprint.

Another feature of the methodology creates the time-boxed nature of the sprint; the sprint duration (selected by the scrum team) presents an omnipresent deadline before which all tasks should be completed. Following the conclusion of this deadline, the product review meeting forces a re-examination of all tasks assigned at the beginning of the sprint. This meeting includes the Scrum Team members, but also includes key external stakeholders to provide input on the product progression by each member of the team. To the team members, this was a much more effective mechanism than traditional capital project reporting (which has various staff members engaging in traditional ‘progress update’ briefs from one layer of bureaucracy to another) for delivering updates, as the product review meeting takes on a much more free-form and engaging discussion than a one-way presentation to layers of management.

*Note:* The original sprint duration selected by the scrum team was two weeks; this was eventually adjusted to a three-week duration.

As an example, accountability flows organically throughout all parts of the STL Axe scrum team. When a team member announces that there is an impediment to the completion of their work, it forces the scrum master and the product owner to work together to remove the impediment, lest they block the advancement of the teams’ overall product or deliverable.

## Accountability: what the Data says

When looking for measurements, the author used task completion by sprint as a proxy for accountability. After analyzing the dataset, there is a 30% probability that a given sprint backlog item was present in more than one sprint. When the amount of story points assigned to a sprint backlog item was 13 points or less, the average probability of the sprint backlog item being present in more than one sprint drops to 22%. When the sprint product backlog item was greater than 13 points, the average probability that an item was present in more than one sprint increases by 63% to 36%.

When comparing individuals vs. groups, additional patterns emerge. The probability of an individual champion having a sprint backlog item being present in more than one sprint is 36%. However, when a group champion is assigned a task, the probability of the task occurring in more than one sprint drops by 31% to 25%.

Interestingly, when a group is assigned as a champion to a given sprint backlog item versus an individual, the probability of a task being completed increases. Rather than accountability decreasing when more individuals are assigned as champions, the probability that a task will get done inside of one sprint rises when a group is assigned as a task champion.

*Opportunities for improving accountability:* Any sprint product backlog item that has a story point value of greater than 13 should be further broken down into different tasks to minimize the chance of carryover into another sprint. Identify the teams or team members who may need help breaking down their tasks based on their probability of their tasks appearing in more than one sprint.

## Results

*“You really need to check your ego at the door; there is no room for hierarchy. You have to be willing to improve and admit when you are wrong.”*

*- STL Axe Scrum Team Member*

All scrum team members were firm in their belief that their scrum team is producing more favorable results than traditional methods of design and construction measurement. Though it is difficult to judge independently, scrum team members believe that their work is of higher quality and completed more quickly due to the factors above. Process flow diagrams (PFDs), Piping & Instrumentation Diagrams (P&IDs), and product bid specifications are – by their judgement – more superior in their content and are being created and issued more quickly when compared to traditional methods. Additionally, the scrum team has been able to reduce the costs of the project from

### Results: what the Data says

Through the delay in project funding and the SaaP approach, the STL Chopper Team was able to make significant reductions to the total project budget. With a maximum estimate in excess of \$50 million in total project value, over the six-month delay the scrum team was able to reduce the total project value by 15%, with no significant changes in project scope.

While it is evident that the six-month delay assisted in the reduction of required CAPEX for successful project completion, the Scrum Team members are confident that the reduction would not have been achieved without the use of scrum as the team operational methodology. The team was able to quickly cycle through high-and-medium risk scope areas, swarm the potential problems, and deduct the resulting savings from the total project value. Additionally, the removal of risk from these areas allowed for second and third order effects that resulted in both CAPEX and OPEX savings (i.e., the rightsizing of the spray dryer resulted in a smaller dryer building footprint [capex reduction], which then resulted in reduced energy use for cooling the building [OPEX reduction]).

By choosing to implement this process early in the Front-End Planning phase, the team maximized the impact that the methodology was able to have on the process, which also dramatically impacted results.

Note:

It is important to annotate that through the Bridge to 2021 capex replan, initiated by the company in March of 2020 to safeguard the company’s liquidity position, the project was delayed by approximately six months following the preliminary funding round of greater than \$1M USD in January of 2020.

*Opportunities for improving results:* as the project moves from the funding phase into the execution phase, the amount of people involved in the STL project is going to expand

dramatically. The scrum team currently consists of ten people who are involved in the day-to-day planning for this project. This will eventually turn into a cast of hundreds as the project moves into the execution phase. The team should begin planning for this and must do so if it hopes to continue to use the methodology throughout the duration of the project. Potential areas of focus for planning:

Software – The current tool used to oversee the day-to-day tasks and stories of the project is based in Microsoft Excel. While it has proved useful for task tracking and project burndown oversight, Excel is limited in its ability to expand further. If the team hopes to continue to produce results with the same speed and quality, the team should

begin the transition of a software designed for scrum / agile methodology, such as Azure DevOps. This will allow multiple scrum teams to begin working on the same project backlog, provide easier tracking on completion of tasks and stories, and streamlined management of project milestones and timelines.

Training – The team should look at implementing scrum-at-scale training for all team members who will be permanently involved in the execution phase of the project. Current training for the team is specifically for the running of a scrum team only. Further training through internal consultation in collaboration with Scrum, Inc. on how to integrate the activities of multiple scrum teams into a cohesive unit with a unified direction will be necessary to ensure the future financial success of the project.

Personnel – Based on feedback from individual team members, the position of scrum master is time consuming and takes away from the ability of a team member to focus exclusively on the task at hand. By its' nature, project execution is more complex than project design, and thus the team should consider hiring professional scrum masters to run the scrum teams during the execution phase of the project. This will provide benefits to results in two ways; it gives back time to the scrum team members to focus on project specific tasks, and brings in personnel who have more experience and knowledge on the methodology of scrum to focus on optimizing routines and who can work with multiple teams to manage scrum-at-scale.

## Conclusion

*"We were **insane** for not adopting [agile] method[s] earlier; this can absolutely run on a brewery job"*

*-STL Axe Scrum Master, +20 years AB Engineering Experience*

After a qualitative and quantitative analysis on the use of SaaP, it is apparent that scrum / agile methodology holds benefits over existing project management methodology used at AB InBev. The four areas of greatest benefit are in the areas of communication, interdependence, accountability, and results. Communication is greatly impacted through daily scrum meetings, where daily and sprint priorities are re-emphasized and made known to all attendees. There is a very visible, elevated amount of interdependence in task accomplishment as multiple scrum team members will group together to work through problems. In the opinion of the STL Axe Scrum Team, accountability of team members to each other and to external stakeholders is the paramount trait; task accomplishment is maximized because the nature of SaaP increases visibility and responsibility for given tasks. Finally, the results of this team are undeniable: through detailed work, the team was able to reduce the total project value of the STL Axe facility by 15%.

Based on the author's experience as a member of the team and the universal opinion of the STL Axe scrum team (multiple members of whom have multiple decades of capital project management experience at AB InBev or subsidiary business units), the author recommends the continued use of the scrum / agile methodology in this project and into the execution phase. Additionally, the author recommends that the methodological use of scrum agile be piloted and examined for adoption by additional business units and zones inside of AB InBev as the methodology used in capital construction projects.

## *Annex A: Saint Louis Axe Scrum Team Composition*

Product Owner: "Aimee"

Background: 20+ Years employed at Anheuser Busch; former General Manager of Saint Louis Brewery

Scrum Master: "Shawnda"

Background: 9+ Years employed at Anheuser Busch; process engineering and product management, focus in brewhouse and brewhouse maintenance

Scrum Master: "Kat"

Background: 4+ employed at Anheuser Busch; Process management, focus on brewery operations

Scrum Master / Team Member: "Marcus"

Background: 20+ Years employed at Anheuser Busch; capital projects execution focus, Brewery Resident Engineer at multiple breweries

Team Member / STL Project Manager: "Akshay"

Background: 30+ Years employed at Anheuser Busch and AB InBev; capital and construction management execution focus, former zone CAPEX Director

Team Member: "Noah"

Background: 9+ Years employed at Anheuser Busch, operations and maintenance background / subject matter expert

Team Member: "Owen"

Background: 13+ Years' experience; Chemical and Environmental Engineer

Team Member: "Ranjani"

Background: 5+ Years employed at Anheuser Busch; GMT, brewing background, current NAZ procurement manager

Team Member: "Silas"

Background: 1+ Year employed at AB InBev; GMBA, 8+ years as a former military engineer, project management background

Key Stakeholder: "Tayo"

Background: 30+ Years employed at Anheuser Busch and AB InBev; VP Innovation, capital projects and construction management background, former Global Director of Engineering & Capex and BU President

## Annex B: Interpreted Data for Interdependence

### Summary

Description: The tables below outline the number of tasks assigned to a group of scrum team members or individuals from sprints 11-20. It is important to note that there were dozens of combinations of scrum team members over the course of all sprints analyzed; individuals were assigned a number and the assigned number is shown below, instead of names. There were 30 different groups over the course of the analyzed sprints and 13 individuals; total number of tasks over all sprints was 413.

Table 1a – Tasks by Champion (Group)		Table 1b – Tasks by Champion (Individual)	
Row Labels	Count of Task	Row Labels	Count of Task
<b>Group Champion</b>	<b>244</b>	<b>Individual Champion</b>	<b>169</b>
1, 11	2	1	13
1, 5	1	2	3
1, 7	1	3	5
11, 9	1	4	15
2, 13	1	5	43
2, 9, 14	1	6	7
3, 13	2	7	18
3, 4, 8	136	8	1
3, 4, 8, 5	23	9	6
3, 5	4	10	7
3, 7	1	11	4
4, 3, 8, 10	2	12	7
4, 3, 8, 11	1	13	40
4, 3, 8, 12	3		
4, 3, 8, 13	11		
4, 3, 8, 13, 6	1		
4, 3, 8, 14	2		
4, 3, 8, 5, 10	2		
4, 3, 8, 6	3		
4, 3, 8, 6, 7	2		
4, 3, 8, 9	1		
4, 6, 13	21		
5, 10	7		
5, 13	1		
5, 6	3		
5, 7	2		
6, 1, 13	1		
6, 13	6		
7, 11	1		
7, 5, 13	1		

### Annex C: Interpreted Data for Accountability

Description: The table below outlines the amount of duplicate and unique tasks with an assigned story point value from sprints 11-20. It is important to note that there were dozens of combinations of scrum team members over the course of all sprints analyzed; individuals were assigned a number and the assigned number is shown below, instead of names.

Duplicate Task: The number of tasks assigned to a given story point value that appeared in more than one sprint

Unique Task: The number of tasks assigned to a given story point value that appeared in only one sprint

Sprint Backlog Item Assigned Story Point Value	Table 2 – Task Carryover by Point Value		
	Duplicate Task	Unique Task	Grand Total Task
1		1	1
2		3	3
3	7	9	16
4	2	2	4
5	2	24	26
6	2	13	15
7	7	21	28
8	14	51	65
9	2	16	18
10	2	12	14
11	13	21	34
12	8	18	26
13	15	34	49
14	8	9	17
15	7	6	13
16	15	8	23
17	2	8	10
18		7	7
19	2	5	7
20	6	4	10
21	2	12	14
22	2	3	5
23	2	1	3
24		1	1
25	2	1	3
28		1	1
<b>Grand Total</b>	<b>122</b>	<b>291</b>	<b>413</b>

Description: The tables below outline the amount of duplicate and unique tasks assigned to a group of scrum team members or individuals from sprints 11-20. It is important to note that there were dozens of combinations of scrum team members over the course of all sprints analyzed; individuals were assigned a number and the assigned number is shown below, instead of names.

Definitions:

GROUP: The different combinations of team members assigned as champions for a given amount of tasks

INDIVIDUAL: The team member assigned as a champion for a given amount of tasks

Duplicate Task: The number of tasks assigned to a group that appeared in more than one sprint

Unique Task: The number of tasks assigned to a group that appeared in only one sprint

Summary Tables:

Table 3a - Task Carryover Summary (#) shows the number of duplicate and unique tasks assigned to a group, and those assigned to individuals.

Interpretation example: in the table above, 61 out of 413 total tasks were assigned to a group and were duplicate tasks, or tasks that appeared in more than one sprint.

Sprint Backlog Item		Table 3a – Task Carryover Summary (#)		
Row Labels	Duplicate Task	Unique Task	Count of Task	
GROUP	61	183	244	
INDIVIDUAL	61	108	169	
Grand Total	122	291	413	

Table 3b - Task Carryover Summary (%) shows the percentage of duplicate and unique tasks assigned to a group, and those assigned to individuals.

Interpretation example: in the table above, 15% of total tasks were assigned to a group and were duplicate tasks, or tasks that appeared in more than one sprint.

Sprint Backlog Item		Table 3b - Task Carryover Summary (%)		
Row Labels	Duplicate Task	Unique Task	Percent of Task	
GROUP	15%	44%	59%	
INDIVIDUAL	15%	26%	41%	
Grand Total	30%	70%	100%	

Table 4a – Task Carryover by Champion (Groups) below shows the breakout of all groups and the duplicate and unique tasks assigned to the group. There were 30 different groups over the course of the analyzed sprints. Total number of tasks over all sprints was 413.

Sprint Backlog Item	Table 4a – Task Carryover by Champion (Groups)		
	Row Labels	Duplicate Task	Unique Task
<b>GROUP</b>	<b>61</b>	<b>183</b>	<b>244</b>
1, 11		2	2
1, 5		1	1
1, 7		1	1
11, 9	1		1
2, 13		1	1
2, 9, 14		1	1
3, 13		2	2
3, 4, 8	28	108	136
3, 4, 8, 5	9	14	23
3, 5	3	1	4
3, 7		1	1
4, 3, 8, 10	2		2
4, 3, 8, 11	1		1
4, 3, 8, 12		3	3
4, 3, 8, 13	2	9	11
4, 3, 8, 13, 6		1	1
4, 3, 8, 14	2		2
4, 3, 8, 5, 10		2	2
4, 3, 8, 6		3	3
4, 3, 8, 6, 7	2		2
4, 3, 8, 9		1	1
4, 6, 13	7	14	21
5, 10		7	7
5, 13		1	1
5, 6	2	1	3
5, 7		2	2
6, 1, 13		1	1
6, 13	2	4	6
7, 11		1	1
7, 5, 13		1	1

Table 4b – Task Carryover by Champion (Individual) below shows the breakout of all individuals and the duplicate and unique tasks assigned to the individual. There were 13 different individuals in the scrum team over the course of the analyzed sprints. Total number of tasks over all sprints was 413.

Sprint Backlog Item		Table 4b – Task Carryover by Champion (Individual)		
Row Labels	Duplicate Task	Unique Task	Grand Total Task	
<b>INDIVIDUAL</b>	<b>61</b>	<b>108</b>	<b>169</b>	
1	2	11	13	
2		3	3	
3	1	4	5	
4	4	11	15	
5	25	18	43	
6	2	5	7	
7	8	10	18	
8	1		1	
9		6	6	
10		7	7	
11	1	3	4	
12	6	1	7	
13	11	29	40	