

FRAMEWORK FOR USING A3S TO DEVELOP SHARED UNDERSTANDING ON PROJECTS

Arjun P. Gupta,¹ Iris D. Tommelein² and Katherine Blume³

ABSTRACT

Various forms of Integrated Project Delivery (IPD) have recently started displacing design-build as the project delivery approach of choice for a number of players in the construction industry. In an IPD setting, the combination of all disciplines working together and concurrently provides for a continuous exchange of ideas and information, leading to more informed decision making than would be possible otherwise. A report format called the A3 has gained prominence in projects managed in IPD settings to facilitate such exchanges and develop a shared understanding among collaborators. Especially in dynamic projects, A3s help in quickly educating new participants on the nature and status of the project. A3s also have the additional advantages of helping people on other projects learn what has already been thought through and providing direct points of contact for further information on the subject presented by them.

In this paper, we report on what A3s are. We describe a framework for A3 development and their effective use on projects, based on the A3 process developed in the co-opetition phase of the California Prison Receivership (CPR) project. We draw on reflections from leaders on that project to highlight questions that other projects might face and suggest means to increase the likelihood of successful implementation of the A3 process.

KEY WORDS

A3s, integrated form of agreement, Integrated Project Delivery, IPD, Plan-Do-Check-Act, PDCA, knowledge management, collaboration

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INTRODUCTION

Integrated Project Delivery (IPD) is a project delivery approach that integrates people, systems, business structures and practices in a process that collaboratively harnesses the talents and insights of all participants to reduce waste and optimize efficiency through all phases of design, fabrication, and construction (AIA 2009). Even before the AIA formulated IPD, lean practitioners successfully developed and used integrated agreements on their projects (e.g., Lichtig 2006, Matthews and Howell 2005). The combination of all disciplines working together and concurrently provides for a continuous exchange of ideas and information between the design and preconstruction teams. This exchange during the design phase allows the team to generate customer value, innovate, and avoid waste, while making decisions with full knowledge of their impact on cost, schedule, and other critical factors.

‘IPD is supported with the use of relational contracts—one agreement that is signed by the owner, architect, and contractor. Already common in the U.K. and Australia, these joint agreements are gaining momentum in the U.S. construction industry. Trade contractors can also be parties to the contract, which is sometimes called an integrated form of agreement. Such contracts call for the formation of an IPD team that shares decision making, pools contingencies, and provides incentives for team performance. This creates an environment where all team members share risks and rewards based on reaching targets. Having the right contractual framework in place is important to the IPD approach, but the project team must be armed with innovative tools in order to achieve success’ (Carbasho 2008). An A3 is such a tool.

A3s are meant to support the initiation, development, sharing, and documentation of ideas and information in this organizational setting. They are particularly well-suited to address the needs of disciplines working together and concurrently on IPD projects but may be used to support other projects in that way as well. However, for A3s to achieve their intended objectives, namely to promote collaboration, information sharing and innovation, their development and use need to be properly managed. As an answer to the challenge of managing something that very few professionals in the construction industry are already aware of⁴, we present a framework consisting of eight essential steps and eight different individuals/groups whom we call “actors.” We identify all the actors who need to be involved at each step for the framework to function as intended. Next, from the experience of the A3 process on one IPD project, we present questions that projects need to address in light of this framework. We end with additional recommendations on how to effectively implement an A3 process in a project setting.

WHAT ARE A3S?

An A3 is an orderly document that aids thinking. A3 reports are so named because they fit on one side of an A3 size paper (roughly an 11”x17” sheet). Before discussing

⁴ A3s are being used on projects other than the IPD project referenced here. E.g., Parrish et al. (2009) present their use on the Cathedral Hill Hospital project in San Francisco, California, a project co-author Blume also is engaged in. However, we are not aware of other scholarly publications describing A3 used in construction or we would have cited them.

their use in the construction industry, it is important to point out the purpose for which they are used by their developer, Toyota.

USE OF A3S IN TOYOTA

At Toyota, A3 reports record Plan-Do-Check-Act (PDCA) cycles (Liker 2003, Liker and Meier 2006, Morgan and Liker 2006, Jimmerson 2007, Shook 2008, Sobek 2008a, 2008b, Sobek and Jimmerson 2008, Sobek and Smalley 2008). They serve as a knowledge management tool at all levels in the company. PDCA is a methodology for continuous improvement, first advanced by Shewart (1939, 1980) and Deming (1986) that has long been a basic element of the Toyota Total Quality Management movement. A3s are used, e.g., as problem-solving tools to explore and record opportunities for improvement. The Plan stage establishes the objectives and processes necessary to deliver results in accordance with the expected output. The Do stage involves implementation of the new process. Changes from the implementation of the new process are then measured in the Check stage and results compared against the expected results to ascertain any differences. Finally, the differences are analyzed in the Act stage to determine their cause and if the results deviate from expectations, the scope to which PDCA is applied is refined until improvement is realized.

An A3 report is meant to draw the author and collaborators into conversation in order to develop a deeper, shared understanding of the problem or opportunity they have, and give insight into how to address the issue. It is meant to facilitate cohesion and alignment within the organization as to the best course of action. For this purpose, it is imperative that the format of the A3 report encourages critical thinking. The flow of the report is from top to bottom on the left side and then top to bottom on the right side, as shown in Figure 1. Authors write the report in sections, each clearly labelled and arranged in a logical flow.

ADAPTATION ON CONSTRUCTION PROJECTS

On many projects, especially large-scale construction projects in an integrated agreement or IPD setting, information constantly and cyclically needs to change hands across disciplines and teams, up and down hierarchies, and back and forth in time. The team studying a particular issue needs to communicate with other teams potentially affected by their findings, and incorporate their inputs and concerns into the solution. The team needs to communicate with the eventual users of the information to see if their concerns and needs are properly addressed, and with managers to determine whether any broader issues have been compromised or not addressed. In addition, the team needs to analyze past solutions and their results as well as future possibilities that might affect the outcome (Sobek and Smalley 2008). Taking all this into consideration produces innovative and useful recommendations. A3s allow for this extensive communication to take place quickly and effectively, and create transparency in the decision making process.

A3 reports are brief, by design. They are meant to present a synthesis of the learning acquired in the course of researching an issue, along with recommended action. Graphical representations of the issue or proposal can eliminate a thousand words and the associated explanation time and energy. In many cases creating the visualization aids in the synthesis and distillation process (Sobek and Smalley 2008). Seasoned A3 users have reported that they consider good A3s to be ones that they can

grasp in around one minute. Such quick-use tools can be invaluable, especially in large project settings.

Also important in projects is the maintenance of a systems viewpoint. The A3 process helps keep the authors mindful of how the course of action furthers the project's goals, needs and priorities and how it fits into the larger picture and affects other parts of the project. In this way, a solution that solves a problem in one part of the program but creates one in another is avoided. Similarly, a solution that promotes one project goal at the expense of another is unlikely to survive through the process (Sobek and Smalley 2008).

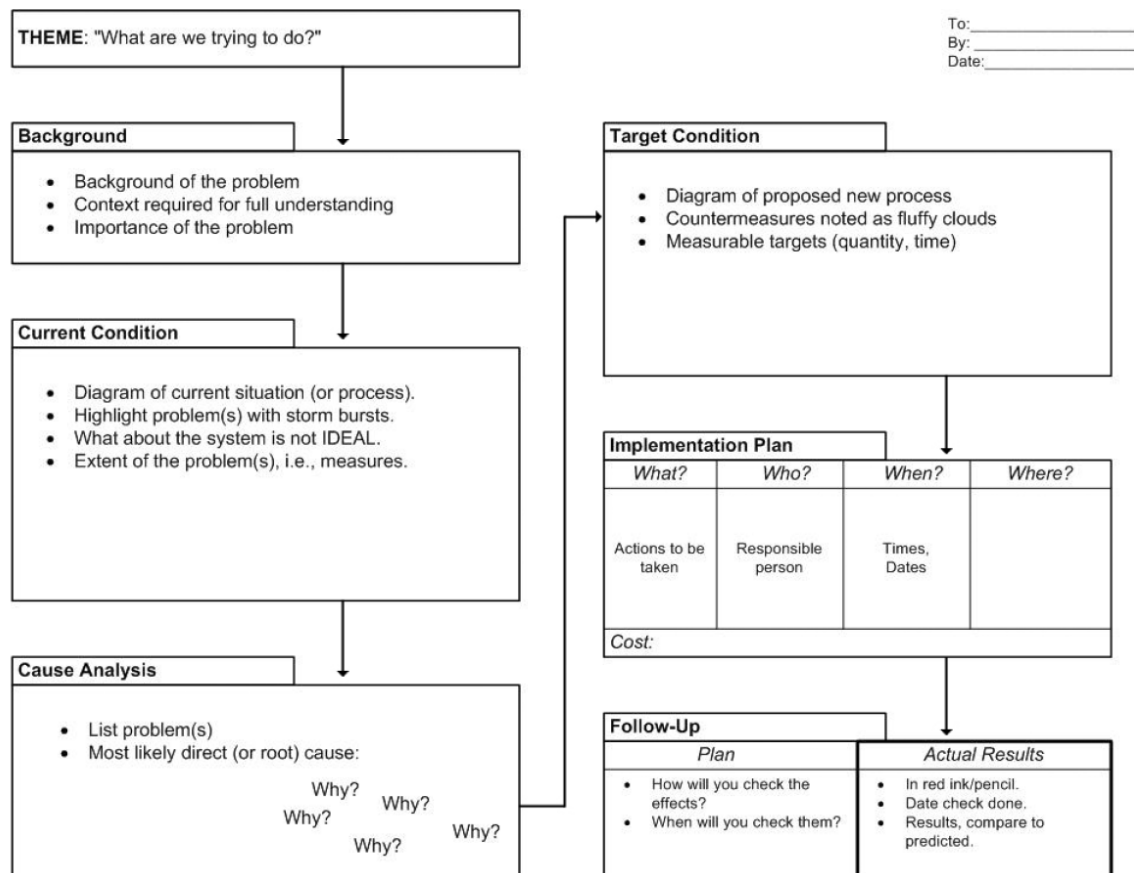


Figure 1: Flow of a typical problem solving A3 report
(<http://www.coe.montana.edu/IE/faculty/sobek/A3/report.htm> visited 03/21/09)

A3 PROCESS FOR A PROJECT SETTING

We present an improvised version of the A3 process employed in the co-opetition stage of the California Prison Receivership (CPR 2009), a project delivered in an IPD setting, after considering its advantages and limitations (the process actually followed on this project evolved rapidly as project participants first familiarized themselves with A3s and various models then emerged despite efforts at standardization). We offer our presentation as a basis for others to adapt and improve upon as learning continues in the use of A3s on projects.

ROLES OF ACTORS IN THE A3 PROCESS

First, we lay out the roles of key individuals/groups involved in the process.

- i. **Champion** – The person who identifies an A3 topic and stewards it through the A3 process.
- ii. **Customer** – A person or group of people who would either use the information or make a decision in light of the information presented in an A3.
- iii. **Collaborator(s)** – One or (more likely) several people interested in the A3 topic and capable of making valuable inputs to the topic under study.
- iv. **Leadership** – Senior leaders on the project. Their involvement legitimizes the A3 and ensures that every proposal is made in accordance with the overall goals of the project.
- v. **Editorial Board** – A group of people who display mastery over the A3 process, the editorial board's responsibility is to implement quality control. This board also interacts with the leadership in all matters regarding the A3 process.
- vi. **A3 Mentors** – Since few are expected to have prior experience developing A3s, a group consisting of professionals experienced in their use in different project settings is highly recommended to be available on each project. Their role is to train project participants, help them create A3s and find collaborators and customers, and help tailor the A3 process to the specific project's needs.
- vii. **Log Keeper** – Though A3s are live documents, they need to be stored once they reach a certain level of development so that they can be easily located. The log keeper functions as the go-to person for this purpose. The keeper maintains an updated and well arranged list of A3s (the A3 log) at all times. The log keeper also helps champions find collaborators based on previous A3 contributions.
- viii. **Other Groups** – They represent all those not directly involved in the A3 process. These groups provide valuable insights and suggestions to people directly involved in the A3 process at different stages.

STEPS IN THE A3 DEVELOPMENT PROCESS

Second, we present the steps in the proposed A3 framework along with the actors and their involvement each stage, as illustrated in Figure 2.

Step 1 – Topic: Any project participant who thinks that a topic is important enough to be thoroughly studied, resolved, and shared can champion its cause.

Step 2 – Approval: The champion runs his/her topic through the editorial board who, in consultation with the A3 mentors, decide whether or not the topic is indeed one of substantial importance. The board along with the mentors might alter the scope of the proposed topic, tailor it to the needs of the project in any way, or decide that the topic is not worth spending resources on. They can also refer the champion to any related A3s already developed. This step is essential to institute quality control.

At this beginning of the A3's development process, the A3 is to be logged and tracked. Otherwise, members of the project team could be working on something related and the rest of the team would not know it. In a large team setting people could be working at cross purposes or even on the same thing and not know it.

Step 3 – Search: To further ensure that the outcome of the A3 will be directly useful to the project, the champion is required to have a customer to his/her A3. To gain a broader perspective on the topic, he/she is also required to look for collaborators.

Step 4 – Development: The development step is the most collaborative step in the whole A3 process, where the champion leads the processes of collecting all relevant information from different sources, consulting with the customer periodically, and presenting the information in a clear and concise manner on an A3 sheet.

Step 5 – Sharing: The champion and collaborators reach out to other groups who might find the A3 useful or who might have useful inputs to contribute. This step is essential since it leads to shared understanding. It increases the visibility of the A3, forces the champion and collaborators to seek additional opinions inside and across disciplines, and prevents duplication of work.

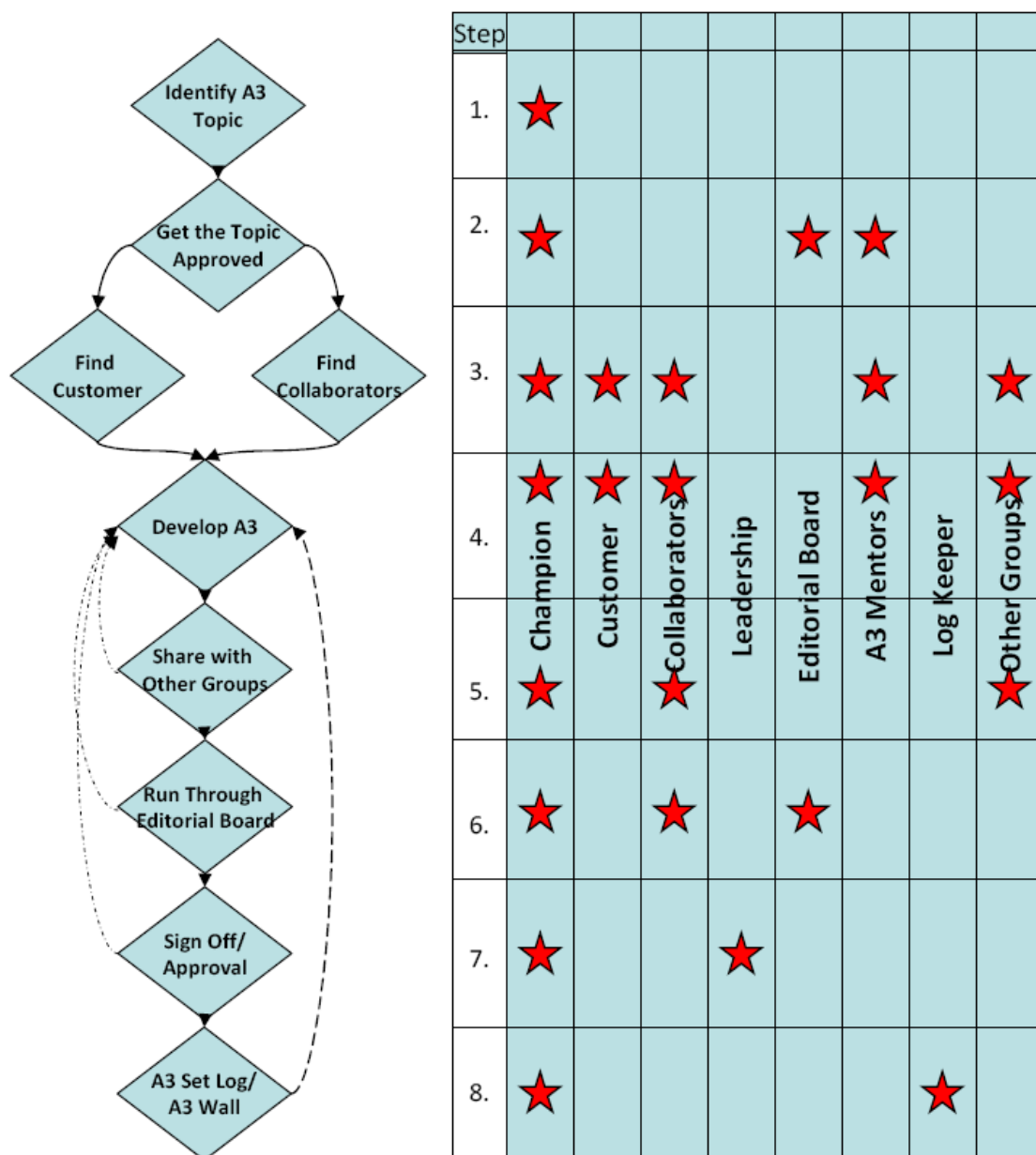


Figure 2: Proposed A3 framework

Step 6 – Quality Control: Once the champion and collaborators have harnessed all available expertise in their project setting (and beyond, if appropriate), and are satisfied with their accomplishments as reflected in the A3, they run it through the editorial board as a final stage of quality control. The A3 may again be returned to the development stage if the board sees any scope for improvement.

Step 7 – Sign off/Approval: Before releasing the A3 for implementation on the project, the leadership takes a final look at it to make sure that all steps in the process have been followed and that contents of the A3 support the overall goals of the project.

Step 8 – A3 Set Log/Wall: Once an A3 is official, it needs to be quickly shared and made easily accessible to all project participants. The A3 log and the A3 wall promise to be effective sharing mechanisms. The log is essentially a well-organized repository of all the A3s that are produced during the project and their status. It can be maintained electronically and/or physically. This provides a systematic way of storing information and making it easily retrievable. The A3 wall is a common physical space in the work place with high visibility. This decreases the likelihood of A3s going unnoticed and prompts on-the-spot discussions.

While these eight steps provide a loose framework for implementing A3 development and use, it is extremely important to realize that the A3 process is never complete. A3s are meant to embrace the lean ideal of continued learning and be frequently revisited and updated as more information becomes available.

IMPORTANT QUESTIONS TO CONSIDER

Based on our experience in the CPR co-opetition, we have identified some important questions that a project team needs to answer in order for the process to function smoothly:

1. What incentive does a champion have to identify an issue and give it his/her best effort carrying it through?

Project participants from the CPR project report that their desire to have a good professional reputation and their own motivation leads them to champion high-quality A3s. However, it was observed that if the downstream steps of the process were ineffective, the motivation for championing A3s declined. The approval and use process of A3s appears to be vital. A3 champions are more likely to put in extra effort in their development if they know that the end product will be scrutinized by others on the project (usually more senior personnel) and will be of use. Management can send a mixed message when, on the one hand committing to development of A3s for decision making, but on the other hand making important decisions without A3s. An approval and vetting process also prevents the development of an unmanageable number of A3s by encouraging only the ones that are relevant.

2. How to make sure that the A3s are being shared and used?

In light of the answer to the first question, this question is particularly critical. In turn, this elevates the importance of the identification and involvement of a customer, since the customer is the primary user of the information presented in an A3. Ideally, during A3 development and sharing, the champions and collaborators reach out to many individuals and groups. Doing so advances many goals at once. It allows for collective learning and constant improvement as people share their A3s with their

peers without inhibitions. It prevents duplication of work, which was sometimes noted at the co-opetition with multiple people unknowingly working on the same topic. Finally, it promises to enhance the robustness of analyses on A3s since the opinions of people from different backgrounds is harnessed. Increased visibility would mean that anyone concerned with the subject would be mindful of the existence of the A3. The A3 wall and log continue to stimulate this process. Other innovative solutions suited to the particular project are encouraged.

3. How will new people be trained?

In large-scale projects, new participants are expected to arrive frequently. For the success of the A3 process, it is imperative that they are trained early on. It takes a considerable amount of time to learn a new way of conducting business, especially for those that have been used to a particular way of working for long periods of time. Constant mentoring and the creation of a learning environment are very important in this regard. We thus recommend the initiation of periodic training sessions by the A3 mentors. In this setting, entrants would be trained in the thinking that needs to go behind A3s by way of example from within the project. Through these sessions, A3 mentors would ease the newcomers into the A3 process and clarify all doubts and inhibitions. We feel that such a structured approach to training would help sustain the culture of rigorous analysis, collaboration, and continued learning that A3s would establish in the project. A starting point for training could be collective reading and discussing Shook's (2008) book on *Managing To Learn*.

4. Who can fill the role of a customer?

The answer would depend on the number and sizes of groups and sub-groups in the project. One might allow any individual to be the customer of an A3 on a small project, yet use a more constrained approach on a larger project. For example, it could be decided that only the leaders of groups could be the customers.

Other challenges and questions surrounding A3s are bound to present themselves through the course of a project and we feel that the best solutions could only be discovered through experimentation and learning, considering the specific circumstances.

ADDITIONAL SUGGESTIONS

Upon consulting with managers, team leaders, lean coordinators and other project participants from the CPR co-opetition, we make the following additional suggestions for the implementation of A3s to avoid frequently encountered problems:

i. Start the process the right way

One way to start off well is with a presentation of a "true-north" A3 developed and explained by the project leaders. This sample A3 would provide guidance, depicting the thinking and analytical reasoning behind A3s. Demonstrations where A3s are taken through their whole life cycle would also be helpful in understanding the roles and responsibilities of the different parties involved in the creation and upkeep of A3s. These would drive home the point that A3s are not reports to be prepared in isolation.

ii. Develop a process early and be clear on updates if any are needed

Each project has unique needs and is carried out under unique circumstances and environments. Hence, we do not recommend the use of the framework discussed

above without due consideration given to the specific circumstances of the project. Instead, we feel that if project participants modify the A3 process themselves under the guidance of seasoned experts, it gives them a sense of ownership that goes a long way in maintaining their interest and enthusiasm. At the same time, we suggest that the A3 process is put into place relatively early on in the project and is adhered to in order to maintain consistency and synergy while avoiding confusion.

iii. Have regular check-ins regarding the A3s

With a regular check-in process the champions, mentors, and other key stakeholders can learn quickly the status of other people's work and ensure they are working in a complementary fashion.

CONCLUSION

In projects involving interdisciplinary teams, deeply-rooted analyses reflecting the opinions of all stakeholders, carefully examined, organized and spelled out on a single sheet of paper, promise to clarify complex issues while promoting collaboration and providing documentation of work. One possible framework to manage these A3s involves different actors at different stages and emphasizes the importance of the producer-customer relationship, sharing, and continued training and mentoring. While the suggested process sets the framework for the relationships and incentives necessary for A3s to be effective, it encourages project teams to take advantage of its flexibility by tailoring it to match the specific conditions prevailing on their projects.

The development and use of A3s on the CPR project has rapidly gone through several stages of evolution. While CPR participants continue to develop, use, learn, and experiment with them, the observations described in this paper stem from our involvement in several rounds of preparation and review of A3s using the A3 process in the early-project stages, and from interviews we conducted with project leaders, lean coordinators, and other stakeholders in all stages of the A3 process.

The framework presented herein builds on the strengths of the A3 process on the CPR project: it encourages critical thinking and promotes collaboration. It also adjusts for some of its weaknesses: inadequate sharing mechanisms, duplication of work, and limited training and mentoring. The discussion on questions that project teams will likely encounter further highlights the importance of incentives, adequate sharing mechanisms, the need for mentoring, and the need for adaption of the A3 process to prevailing conditions. The final discussion presents a strong start by leadership and adherence to an adapted process relatively early in the life of the project as additional suggestions to increase the likelihood of successful A3 implementation on projects.

The use of A3s is relatively new to the construction industry and the authors realize that the adoption of this knowledge management methodology could lead to frustration in the early stages. However, we feel that the process of developing A3s is a learned analytical skill that has great potential to improve efficiency and reduce waste in the construction industry.

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project participants at the Coopetition for their insightful remarks and honest opinions when interviewed from time to time.

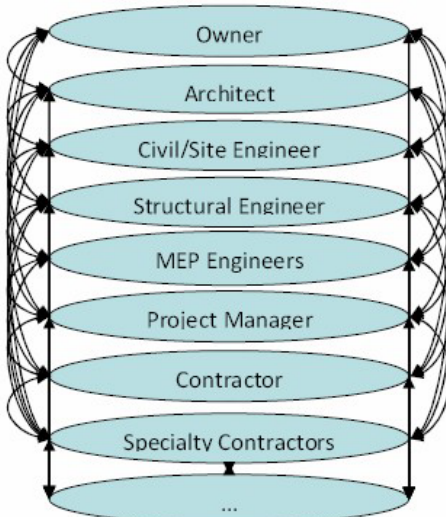
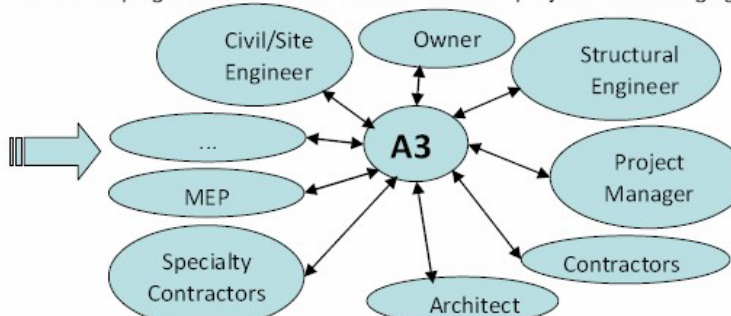
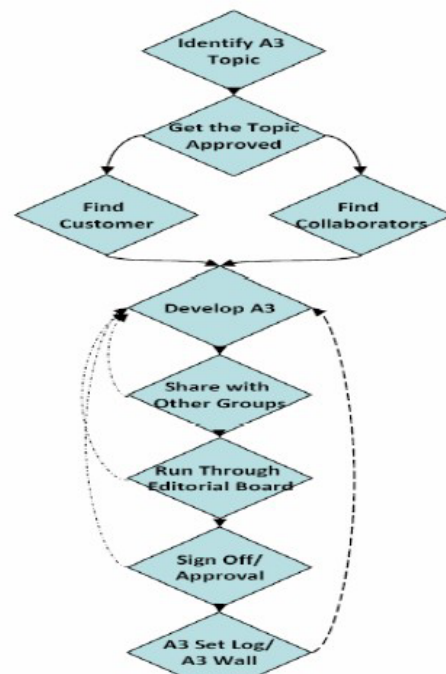
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APPENDIX:

EXAMPLE A3 PRESENTING “FRAMEWORK FOR USING A3s ON PROJECTS”

A3 Number	Title	Champion																																																																																	
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Collaborator(s)	Customer(s)	Date
Iris D. Tommelein, Katherine Blume	Project Teams	1-Apr-09
Explanation of Proposal		
<p>Diamonds in the flowchart represent activities or steps through which an A3 needs to pass. The table identifies eight different "actors" who engage in these steps and perform the work. Involvement of an actor in any given step is represented by a star, e.g., the second step involves the champion, the editorial board, and the A3 mentors. The champion is involved through the A3's lifecycle while the leadership is involved only in stage seven to provide control of quality and adherence to goals. A3s support the lean ideal of continued learning: they are frequently revisited and updated as more information becomes available.</p>		
Analysis		
<p>Questions from past use of A3s on projects:</p> <ol style="list-style-type: none"> 1. What is the champion's incentive for developing an A3? Their inherent motivation and professional reputation (if sharing works effectively). The level of effort will be higher if the work product is used. Therefore, the approval process and the customer are very important. 2. How to make sure A3s are being shared and used? The champion and collaborators reach out during the A3 development stage. The A3 wall: A common physical space in the work place with high visibility. This prompts on-the-spot discussions and decreases the likelihood of A3s going unnoticed. The A3 log: a well organized repository of all A3s produced during the project. 3. How are people going to learn about the A3 process and be trained to participate in it? Constant mentoring and the creation of a learning environment are very important in this regard. We recommend the initiation of periodic training sessions by the A3 mentors. The use of actual A3s from within the project for such training is encouraged. 4. Who can be a customer? The answer depends on the number and sizes of groups and sub-groups in the project. While it would make sense to allow any individual to be the customer of an A3 on small projects, a more constrained approach would make sense on a larger project. 		
Advantages		
<ol style="list-style-type: none"> 1. Allows for thorough analyses by including facts and opinions of all stakeholders. 2. Coaching and oversight by mentors, the editorial board, and leadership ensures quality work. 3. Streamlines communication and helps produce a shared understanding on projects. 4. Prevents duplication of work since project participants know what others are doing and can build on the A3 knowledge repository. 5. Produces an explicit record of work done on the project, which creates transparency in decision making and helps in later stages. 6. A3s can be leveraged on other projects. 		
Lessons from other Projects		
<p>Additional suggestions to avoid frequently-encountered problems:</p> <ol style="list-style-type: none"> 1. Start the right way: Establish a project-specific A3 framework as soon as the project starts. Have project leaders develop, explain, and present a "true-north" A3 (e.g., adapt this A3 if appropriate). 2. Develop a process early and be clear on updates if any are needed: Put the A3 process (tailored by project participants according to the specific project conditions) into place relatively early on in the project. Adhere to the process in order to maintain consistency and synergy and to avoid confusion. 		