COLLABORATION DRIVES SUCCESSFUL SYSTEMS INTEGRATION

This article explores practical methods for creating effective collaboration toward rail program delivery.

July 2, 2020

Due to the highly complex nature of modern railway megaprojects, it is impossible that any team or organization has all the required skills and knowledge to deliver a successful outcome on its own. As is true for any major project, collaboration is critical.

One of the main goals of systems integration (SI) is to enable effective technical collaboration by building it into the management framework of a megaproject/program. From this perspective, collaboration can be defined two ways:

1. Right Resources at the Right Time – Getting the right mix of niche technical expertise and deep domain knowledge, with the team efficiently deployed against the program to assure the outcome

2. Driving Collaborative Behaviours – Supporting all team members to work in an aligned way toward the collective delivery of the program

Enabling collaboration across a megaproject organization is a critical skill for SI team leadership. If the focus on collaboration and communication is not there, no amount of tools, techniques, people or process will fill the void. With teams and people at its core, WSP's SI:D^3 framework provides practical methods for collaborative SI.

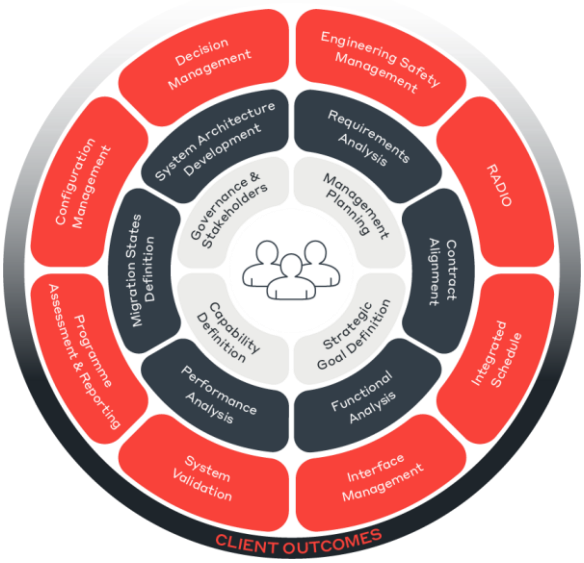

Figure 1 – Systems Integration through the SI:D^3 approach provides program leaders with practical methods for undertaking collaborative systems integration.

Collaboration and communication are central to WSP's SI:D^3 framework, which brings together the best knowledge from people, teams and the organization. Considering each organization's unique culture and stakeholder objectives, the SI:D^3 approach facilitates effective multidisciplinary thinking and interaction for shared understanding and coordinated action toward delivery of the expected outcomes.

Creating an Environment for Effective Collaboration

The leader of the SI team plays a key role in creating the ideal environment for effective collaboration by undertaking the following activities:

— Locating and securing the required competence and technical expertise

- Undertaking team-building exercises to develop a shared understanding of the goals
- Creating clarity around roles and responsibilities
- Planning the work as far ahead as possible
- Providing the tools and platforms necessary for collaboration (such as online workspaces)
- Monitoring and holding the team accountable for the delivery of SI work on a regular basis
- Taking time to recognize success and learn from failure

Collective Competence of a Team Eclipses Its Size

High levels of competence are a prerequisite for effective collaboration. A competent team is one that has both the technical expertise and the confidence to self-organize, solve problems and address risk with rigour. This competence also supports a reduction in the amount of checking, reviewing and authorizing required—leading to enhanced program productivity. Where competence levels are low, integration becomes very difficult, as there is a tendency to fill competency gaps with more team members and suppliers offering specific technical expertise. The larger the team becomes, the more difficult it is to integrate everyone's knowledge and experience. Rather than reaping the benefits of enhanced collaboration, additional team members can result in cost and timescale challenges.

Establishing Shared Understanding

Engaging stakeholders in the SI process from the outset lays the foundation for structured collaboration across the lifecycle of the megaproject. To bring about a successful outcome, the SI team must make its approach:

a) Relevant – by articulating how it will help stakeholders achieve their objectives

b) Accessible – using a commonly understood vocabulary to aid discussion and collaboration, and agreeing on a small number of simple key artefacts (diagrams, dashboards etc.)

Successful and sustainable collaboration relies on shared understanding not just of the end goals but also the methods, tools and terminology being used to drive the SI effort. Early on, the SI team will propose formal methods—such as lifecycle models, requirement sets, interface matrices and migration plans—to underpin program delivery. While these are the right tools for the job and do not require explanation to SI experts, they can appear obtuse to the uninitiated, and may be unfamiliar to the client/sponsor. Formal SI methods can be seen as abstract and esoteric—this is kryptonite for collaboration.

To gain stakeholder buy in, it is not necessary to give an in-depth description of each SI method being proposed, only to provide simple, straightforward answers to the following key questions:

- What is this method?
- Why are we doing this? What value does it bring us? What risk does it mitigate?
- Who needs to interact with this? When and how should each person, or team, do so?

Collaboration at Every Stage

The nature of technical collaboration changes as the program moves through the lifecycle. At the front-end, the key SI steps are to establish the technical feasibility and requirements of the megaproject. Here, collaboration is required to effectively negotiate trade-offs between the engineering solutions that will deliver the output operational capabilities and meet the needs of stakeholders, the costs and the program impacts (e.g societal and environmental).

At the design stage, collaboration is supported by design tools and/or a common design environment that enables various engineering teams and organizations to work toward a collective design solution. These tools aid interface management processes, such as the establishment of interface responsibilities, which dictate how subsystems (e.g. power, track, train, communications and control) interact with each other, both within and across contract boundaries.

In the construction, testing and commissioning stages, a systems migration plan supports the collaborative delivery of the schedule across teams, contracts and stakeholders. This plan is a key SI tool using concept configuration states and integration milestones—i.e. higher risk points in the schedule where multiple contracts combine— to deliver a tangible system output, such as a timetable change. These milestones bind contract packages together and encourage collaboration to progressively work toward the commissioning of a completed and integrated railway.

Due to the high stakes and difficulty of delivering megaprojects, mistakes along the journey are inevitable. It is possible to learn a lot from these experiences as long as teams maintain a collaborative culture through the delivery lifecycle, to retain and share lessons—and refocus, as necessary, on the short-term objectives and long-term outcome. In this safe environment, individuals feel more inclined to own, discuss and address shortfalls.

Emerging vision for the Northern Powerhouse Rail network

Credit: Transport for the North

Putting SI into Action for Northern Powerhouse Rail

WSP worked hand-in-hand with our clients on the early SI effort for the CAD 60 billion (£36 billion) Northern Powerhouse Rail (NPR) megaproject in the North of England. The initial challenge was to engage the core stakeholder group (Transport for the North, Network Rail, Department for Transport, and the supply chain) in the formal systems engineering process of requirements development. The quality of the requirements outputs would depend entirely on their full, collaborative participation in the process. But how could we make this seemingly dry and abstract method—with its *shalls* and *shoulds*, its *hierarchy* and *traceability*—clear and engaging to a new audience?

1. **Relate the method to things they already care about.** On NPR, above all, the stakeholders care about achieving development consent. We explained that requirements are a way to capture overall goals and benefits, then trace and justify how the chosen solutions will achieve them. In other words, we said "doing requirements properly will automatically generate a large part of your case for consent." Now we had their attention.

2. **Use examples for everything.** We associated every mention of an abstract SI idea (e.g. a level of requirements; a physical interface) with examples the audience could relate to. For instance, the concept of a requirements hierarchy was illustrated by explaining that "Level 0 will include the NPR train frequencies and journey times between cities. Level 1 will include the lines of route chosen to achieve them. Level 2 will include the interventions needed along the lines of route." This immediately achieved shared understanding in the room as to what these terms meant.

3. **Avoid using terms that carry "baggage" for stakeholders.** Some terminology may hold pre-existing meaning for stakeholders. For example, a Client Requirements Document (CRD) is a standard deliverable within Network Rail. We therefore avoided using this term on NPR, to avoid any risk of confusion with the Network Rail process. Taking this approach resulted in a generic set of terms that had commonly agreed meaning across the NPR stakeholder group.

4. **Create a sustainable connection between the stakeholders and the science.** We created simple artefacts to summarize the shared understanding that had been reached. A picture on a page can be powerful—for example, NPR's full requirements model and timeline are shown in the diagram below. (Note how it ends with development consent being granted, tying the process back to the stakeholders' key motivator.)

The outputs produced at this stage should become focal points for collaboration. They provide the interface between the SI team and other parts of the organization. SI has every chance of success if, as has become the case on NPR, a point is reached where the wider stakeholder group is routinely communicating in a common language of Level 0/1/2 requirements, technical assumptions, interface agreements, etc.

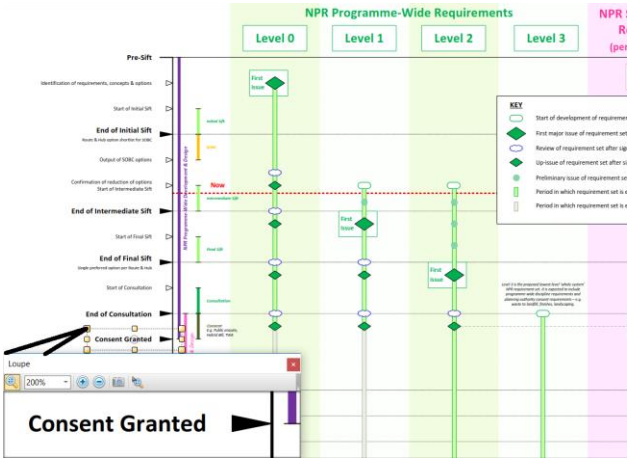

Figure 2: NPR requirements model against timeline – highlighting achievement of the client's ultimate goal

Robust and Informed Decision-Making

Ultimately, SI supports the delivery of megaprojects by enabling informed, justifiable and optimized decision-making. Decisions are based on the information available, and a highly functioning, collaborative SI process ensures this information will be as holistic, accurate, accessible and relevant to the project objectives as possible.

The few simple, agreed-upon SI artefacts that are established (see point 4 in the case study) should offer a one-stop shop to reach decisions. At a glance they provide:

- Clear understanding of how activities combine to achieve overall goals and benefits
- Clear identification of constraints, dependencies and risks to release of benefits
- Comprehensive understanding of impacts of change
- Rich, evidence-based reporting
- Assurance of delivery of outcomes

These SI artefacts should become part of the megaproject's day-to-day operation. Meetings at all levels of governance up to the highest decision-making forums and boards should use at least one artefact as a focal point, to serve both as a trusted source of information and a platform for updates and decisions. The artefacts are the gateway through which program data flows, between the wider team and the formal SI "engine room." They inform and give structure to collaborative decision-making and enable its outputs to be robustly captured and justified.

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Railway megaprojects are complex environments that require a high degree of collaboration for success. The focus of SI leaders should be to create an environment where collaboration is the norm throughout the lifecycle of the megaproject. Ongoing collaboration can be achieved using the principles, methods and tools of SI, implemented in a shared and comprehensive way such as through the WSP SI:D^3 framework.

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