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Project integration, interfaces & context
Project Integration
Series Article
by Alan Stretton

Series on project integration, interfaces and context management[1]
Article 1 of 3

Project Integration

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INTRODUCTION

This series of three articles is concerned with project integration. This first article is essentially an overview of what the literature has to say about project integration per se. The second article will discuss the management of project interfaces, which is strongly associated with project integration. The third article will discuss project contexts and their management, which are also strongly associated with both project integration and project interface management.

This article first confirms that project integration is regarded by many (if not most) project management writers and practitioners as <u>the</u> primary function of project management. However, in spite of its perceived importance, the project management literature does not have many materials which specifically focus on this topic.

Moreover, we find that the materials that do exist vary rather substantially – and sometimes very substantially – in their approaches and/or contents, and therefore do not provide good insights about the essential elements of project integration. However, as noted above, the literature has more material on the closely associated management of project interfaces, which may help throw further light on integration. This will be discussed in more detail in the second article of this series.

After noting that some of the above differing broad viewpoints on project integration may be due to the fact that project management knowledge is not context free, we look at materials on integration from Shenhar & Dvir 2007 that are indirectly linked to project contexts. Their NTCP model has a wide range of different integration approaches which are recommended as appropriate to four project 'dimensions', and component 'types', whose assignments are largely determined by contextual factors in the project's environment. The third article of this series will discuss the management of project contexts in more detail.

THE NATURE OF INTEGRATION

Integration is a word in common usage, and with a well understood meaning. *The New Shorter Oxford English Dictionary* defines integration as

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[1] Editor's note: This series of articles is by Alan Stretton, PhD (Hon), Life Fellow of AIPM (Australia), a pioneer in the field of professional project management and one of the most widely recognized voices in the practice of program and project management.   Long retired, Alan is still accepting some of the most challenging writing assignments; he is a frequent contributor to the *PM World Journal.* See his author profile at end of this article.

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The making up or composition of the whole by adding together or combining separate parts; combination into a whole.

Integration in an organisational context

The management role at large was long ago defined in an integrative context, as for example by Allen 1962 (albeit a little indirectly), as follows:

….we can define a manager as someone who is so placed organizationally that only he has the perspective, objectivity, and balance with respect to the sometimes conflicting needs of his subordinates.

At a more detailed level, Morris 1988 first approaches the broad subject of integration from a systems perspective. His initial concerns are with systems and sub system boundaries and interfaces, which he discusses quite extensively. He moves on to discuss degrees of differentiation between subsystems, followed by considerations of interdependencies between subsystems, from which he develops the following discussion on integration in a broad organisational context.

Integration becomes important when the degree of organisational interdependence becomes significant. Research has shown that tighter organisational integration is necessary when
- The goals and objectives of an enterprise bring a need for different groups to work closely together
- The environment is complex or changing rapidly
- The technology is uncertain or complex
- The enterprise is changing quickly
- The enterprise is organisationally complex

The amount of integration actually required at an interface depends on both the size of the differentiation across the interface and on how much "pulling together" the interfacing subsystems need.

Morris goes on to discuss integration in a project context, to which we will return shortly.

It will also be noted that Morris specifically associates integration with interfaces between subsystems. We will also be discussing this association further a little later.

Integration as the primary function of project management

It appears to be widely accepted that the project management role is primarily an integrative one. As Streun 2011 has expressed it,

In fact, a case can be made that integration is the capstone skill for excellent project managers – the skill that, more than any other, reflects the project management role.

Morris 2013:284 puts it this way:

Project management's core function is integration. Its focus is holism (integrating to achieve success at the overall system level). Its work is typically interdisciplinary. The

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project manager is 'the single point of integrative accountability' in achieving the outcome desired by the sponsor; and to the extent possible, other stakeholders.

Moreover, as Healy 1997:274-5 has pointed out, the intensity of integration required in the project context is markedly greater than in general management. In the following quotation, Healy is discussing the management of interfaces, which in this context is broadly equivalent to integration – as will be further discussed later.

> A difference between process and project management might be highlighted here. In process management, the interfaces also need to be identified and managed. However, as they are of a more permanent nature, there is opportunity to refine their management. In project management, the second chance does not exist to anything like the same extent……

The above highlights the key importance of integration in the project context, and the added difficulty of managing it effectively, by comparison with the general management context.

We now look at what some prominent contributors have had to say about project integration in a little more detail. We start with contributions which are presented in a context-free mode (hence the descriptor "at large" in the following heading).

SOME PERCEPTIONS/DESCRIPTORS OF PROJECT INTEGRATION AT LARGE

The PMBOK Guide (PMI 2013)

PMI describes project integration management at the head of its Chapter 4 thus:

> Project Integration Management includes the processes and activities needed to identify, define, combine, unify, and coordinate the various processes and project management activities with the Project Management Process Groups.

Project Integration Management is then discussed in more detail under the following headings:

- Develop project charter;
- Develop project management plan;
- Direct and manage project execution;
- Monitor and control project work;
- Perform integrated change control;
- Close project or phase.

In some ways, PMI's approach appears to imply that integration is essentially just good project management practice. It is also noted that this approach has a strong intra-project focus.

The APM Body of Knowledge (APM 2012)

APM's Section 3.1 on Integrative management defines the subject as follows.

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> ***Definition:*** The application of management processes that integrate some or all fundamental component of scope, schedule, cost, risk, quality and resources.

This definition also has an implication of integration being seen as essentially just good project management practice.

APM goes on to say that while the topics in its Section 3.1 do not directly address the above fundamental components of scope, schedule, cost, risk, quality and resources, they are integrative topics that bring together some or all of these components. The topics in Section 3.1 comprise:

- Business case;
- Control;
- Information management;
- Organisation;
- Planning;
- Stakeholder management.

Along with its "fundamental components", these topics are certainly components of normal project management practice. APM does not spell out why these particular topics have been nominated, whilst other writers nominate other topics as also being relevant.

However, their inclusion does seem to reinforce the above implication of integration being seen by APM as essentially just good project management practice.

Morris 1988

Following his discussions of integration in a broad organisational context, which were summarised above, Morris goes on to introduce integration in the project context as follows.

> In project terms, subsystems which are in continuous interaction require liaison in order to achieve the necessary integration, whereas those that just follow on from one another can follow plans and schedules.
>
> There is a range of devices which can be used to achieve liaison:
> - Liaison positions
> - Task forces
> - Special teams
> - Coordinators (or permanent integrators)
> - Full project management
> - Matrix organisations

After briefly discussing the first four bullet points, Morris has the following to say about the last two, starting with full project management.

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The full *project manager* role upgrades the authority and responsibility of the integration function to allow cross-functional coordination. The integrator – the project manager – now has authority to order groups directly to take certain actions or decisions.

Moving on to matrix organisations, Morris says:

Matrix structures provide for maximum information exchange, management coordination, and resource sharing. Matrices achieve this by having staff account simultaneously to both the integrating (project) managers and the functional managers whose work is being integrated. Both project managers and functional managers have authority and responsibility over the work, albeit there is a division of responsibility: the functional manager is responsible for the "what" and "by whom"; the project manager decides the "when" and "how much". ….

Matrix structures generate considerable conflict and suffer from constantly changing boundaries and interfaces.

In both of the last two liaison situations the project manager is the integrator. Morris does not give us a summary descriptor of actual processes involved in project integration, but focuses quite extensively on managing project interfaces, which evidently he sees as a primary component of project integration. We will return to project interface management shortly.

Stuckenbruck 1988

Stuckenbruck describes project integration as follows:

Project integration can then be described as the process of ensuring that all elements of the project – its tasks, subsystems, components, parts, organizational units, and people – fit together as in integrated whole which functions according to plan.

Stuckenbruck lists the critical acts of integration [in a matrix management context] as

(a) those which are essentially just good project management practice and which must extend over the entire life of the project

(b) specific one-time actions which must be taken by some members of management (usually the project manager or a member of top management) to ensure that the project is integrated. The most important of these actions are as follows:
1. Getting started on the right foot
2.   Planning for project integration
3.   Developing an integrated Work Breakdown Structure, schedule, and budget
4. Developing integrated project control
5. Managing conflict
6. Removing roadblocks
7. Setting priorities
8. Facilitating project transfer
9. Establishing communication links

It seems to me that the first four items, and perhaps also the last, are primarily concerned with establishing bases for good project governance and management

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(including, of course, integration), whilst the remaining items are primarily concerned with particular types of on-going management integration activities in the implementation phases of the project. Stuckenbruck does not spell out why these particular items have been nominated, whilst other writers nominate different topics as also being relevant.

Finally, we note that Stuckenbruck 1988 directly links project integration with the management of interfaces as follows:

> Project managers carry out their function of project integration primarily by carefully managing all of the many diverse interfaces within their projects.

Discussion

This major section on perceptions/descriptors of project integration has been concerned with contributions from the literature which are presented in a context-free mode. There are some direct and indirect implications in most of them that integration is essentially just good project management practice.

However, we have also seen that different contributors have identified quite different groups of processes that they see as particularly significant for effective project integration. This is a worry, because it does not help us much in providing insights about the essential elements of project integration.

Two lines for further investigation appear to emerge from the above. The first derives from the fact that two of the four authors above have specifically linked project integration with project interfaces and their management. The second derives from the context-free nature of the materials presented so far. We will look at each in turn.

LINKING PROJECT INTEGRATION WITH PROJECT INTERFACES

We have noted that both Morris 1988 and Stuckenbruck 1988 closely associate project integration with managing project interfaces. But they are not alone.

Struen 2011 also links the two very directly:

> Need for integration of project processes is evident when interfaces must be established for the processes to interact.

However, Dinsmore 1990:116 introduces another perspective with regards to interface management and its relationship with project management at large.

> …..the sometimes-held notion that project management is synonymous with interfacing is incorrect; interface management addresses only boundary issues, or those that are "floating" between defined areas of responsibility. But a project's problems are not necessarily concentrated at the boundaries. …..

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What does appear to be shared by the above authors, and by many others, is a recognition that project interface management is, at the very least, an important component of project integration (and thence, of project management).

This suggests that an examination of what the literature says about project interfaces and their management should help in providing insights into the essential elements of project integration.

There are modest amounts of materials in the literature on project interfaces and their management, but they are substantially fragmented, and vary considerably in their perceptions of the nature of project interfaces, and what are regarded as the important ones. It is quite a substantial task to try and pull this all together, so I have elected to tackle this topic in a separate article, which will be the second of this series.

We now turn to the second line of investigation outlined above, which moves on from the context-free nature of the materials presented so far, to take a preliminary look at integration in some more specific project contexts.

LINKING INTEGRATION (INDIRECTLY) TO PROJECT CONTEXTS

Introduction

Perhaps it is not all that surprising that different contributors have identified quite different groups of processes that they see as particularly significant for effective project integration. As Morris 2013:103 has noted, project management knowledge is not context free. It would appear that, although they have tried to be context free, each contributor may well have had some type of generalised context in mind when choosing his/her significant integration processes – and hence the differences.

This led me to look for materials on integration that are specifically linked to project contexts. I found one such group of materials which might qualify, albeit somewhat indirectly, namely the well known NTCP model of Shenhar & Dvir 2007.

However, before discussing this, we need a clear understanding of what we mean by a project's context. I propose to adopt the following definition of 'context' from *The Macquarie Concise Dictionary*, which appears to reflect normal usage.

> **Context** 2. the circumstances or facts that surround a particular situation, event, etc.

We now look at the basics of the NTCP model.

Four 'dimensions' and many 'types' in the NTCP model of Shenhar & Dvir 2007

Shenhar & Dvir's NTCP model covers what they describe as four broad 'dimensions' of a project, which they call Novelty, Technology, Complexity, and Pace. They define each of these dimensions as follows:

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- **Novelty.** This … represents the uncertainty of the project's goal, the uncertainty in the market, or both. It measures how new the project's product is to customers, users, or to the market in general, and thus how clear and well defined the initial product requirements are. Novelty includes three types: derivative, platform, and breakthrough.

- **Technology.** This … represents the project's level of technological uncertainty. It is determined by how much new technology is required. Technology includes four types: low-tech, medium-tech, high-tech, and super-high-tech.

- **Complexity.** This … measures the complexity of the product, the task, and the project organisation. Complexity includes three types: assembly, system, and array (or system of systems).

- **Pace.** This … represents the urgency of the project – namely, how much time there is to complete the job. Pace includes four types: regular, fast/competitive, time-critical, and blitz.

Morris 2013:241 has the following to say about these dimensions.

> Shenhar & Dvir's contingency determinants – ntcp – are furthermore only characteristics of the project. Unlike the original contingency theory they say nothing about the characteristics of the environment the project finds itself in.

In other words, Morris is saying that Shenhar & Dvir's four 'dimensions' have nothing to say about the project's context. However, if we look at things in reverse order (and with different purposes to Morris'), the following situation emerges.

Linking 'dimensions' and project contexts

It is most difficult to see how any of the NTCP 'dimensions' and 'component' types could be determined/ assigned without a very clear understanding of the context(s) of the project. Indeed, if you view the 'dimensions' only as internal characteristics of a project, then you are tacitly assuming that the project only exists within and for itself – which, of course, is does not. Hence I regard Shenhar & Dvir's 'dimensions' as a significant part of the linkage between the individual project and its context(s).

Linking integration with project 'dimensions' and component 'types'

Shenhar & Dvir 2007 align the various 'types' (or levels) of each 'dimension' with the (then) knowledge areas of the PMBOK Guide (PMI 2004), one of which is integration. The following four tables show the authors' recommended approaches to integration in the many combinations of 'dimensions', and dimension 'types'.

Novelty (How new is your product in the market?)

As we move from the *derivative* type, through *platform* to *breakthrough*, the recommended approaches to integration change as shown in Table 1-1.

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LEVEL OF PROJECT NOVELTY			
PMBOK Guide Knowledge Area	**DERIVATIVE (Extensions/ improvements of existing products)**	**PLATFORM (New generations of existing products)**	**BREAKTHROUGH (New-to-the-world products)**
Integration	• Simple integration based on previous experience; • Focus on derivative added value and on quick transfer to operation and sales	• Extensive cross-functional and customer involvement; • Focus on integration of new elements and new capabilities in the new generation; • Extensive testing during integration	• Integration focused on core functions to prove product concept validity; • Incorporate customer feedback through fast prototyping and beta sales; • Integrate organisational functions to create market awareness

Table 1-1: Derived from Shenhar & Dvir 2007, Appendix 4, Table 1 – Product novelty and PMBOK knowledge areas

Technology (Technological uncertainty)

There are four types of technological uncertainty, with recommended approaches to integration for the different types summarised as follows.

LEVEL OF TECHNOLOGICAL UNCERTAINTY				
PMBOK Guide Knowledge Area	**LOW-TECH (Mainly existing technologies)**	**MEDIUM-TECH (Mainly existing, but a new technology added)**	**HIGH-TECH (Mostly new technologies, but some existing)**	**SUPER-HIGH-TECH (New technologies not existing at project start)**
Integration	• Simple integration based on previous experience; • Quick transfer to operations and sales	• Focus on integration of elements new to the company; • Involve customers in new areas to ensure meeting their requirements	• Extensive cross-functional and customer involvement; • Extensive testing during integration; • Integrate organisational functions to create market awareness	• Integration focused on core functions to prove system concept validity; • Extensive effort in integration of newly developed technologies; • Integrate users feedback based on fast prototyping

Table 1-2: Derived from Shenhar & Dvir 2007, Appendix 5B, Table 4 – Technological uncertainty and the PMBOK knowledge areas

Project complexity (The complexity of your project – system scope)

There are three types of project complexity, and corresponding differences in approaches to integration in relation to each of them, as follows.

LEVEL OF PROJECT COMPLEXITY			
PMBOK Guide Knowledge Area	**ASSEMBLY (into a single unit performing a single function)**	**SYSTEM (interacting subsystems, jointly performing multiple functions)**	**ARRAY (large dispersed collection of systems to achieve a common purpose)**
Integration	• Simple integration • Quick transfer to operations and sales	• Extensive integration period to make sure the entire system is functioning as planned; • Cross-functional and customer involvement; • Gradual integration of subsystems; • Extensive testing during system integration	• Integration of subsystems by subcontractors; • Rare cases of full scale integration by main contractor

Table 1-3: Derived from Shenhar & Dvir 2007, Appendix 6B, Table 7 – Project complexity and PMBOK knowledge areas

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Project pace (How crucial is your time frame?)

There are four types of project pace, and of recommended approaches to integration therein.

	LEVEL OF PROJECT PACE			
PMBOK Guide Knowledge Area	REGULAR (Time not critical to project success)	FAST-COMPETITIVE (Common to industrial and profit-driven org's)	TIME-CRITICAL (Must be completed by a specific date)	BLITZ (Crisis projects to be solved as fast as possible)
Integration	• Gradual integration until final system is completed and tested	• Intensive integration and testing to ensure timely entry into the market	• Carefully planned periods of integration to ensure product preparedness on time	• Not time for integration in blitz projects

Table 1-4: Derived from Shenhar & Dvir 2007, Appendix 7, Table 8 – Project pace and the PMBOK knowledge areas

It is first noted that Shenhar & Dvir have introduced some types of integration not previously mentioned. One new concern, particularly with *novelty* and *technology*, is with integrating new elements and capabilities into existing ones. Another is with extensive customer involvement – i.e. interfacing with customers (which we will be further discussing in the second article of this series)
.
Another type of integration which emerges quite strongly from the above, notably with complexity – and which reflects Morris 2013:284 quoted earlier – is integration of systems and sub-systems, to ensure the entire system functions as planned.

Discussion

Most relevantly for our purposes, Shenhar & Dvir 2007 have recommended a wide range of different approaches to integration which they deem most appropriate for the various 'dimensions' and their component 'types' in the NTCP model. So, this is a significant contribution to project integration per se.

In turn, we have made the point that assigning the NTCP 'dimensions' and 'types' effectively necessitates a clear understanding of the project's context(s). Hence, I tend to think of integration and the NTCP model as a sort of half-way stage between integration and the management of project contexts per se.

SUMMARY

It was first established that there is wide-spread agreement that integration is a primary function of project management. We then looked at how four prominent author groups describe project integration in a very broad context-free mode.

On the one hand we found implications in three of them that integration is essentially just good project management practice. On the other hand we found little agreement about just what integration actually entails, or of what constitute its key processes.

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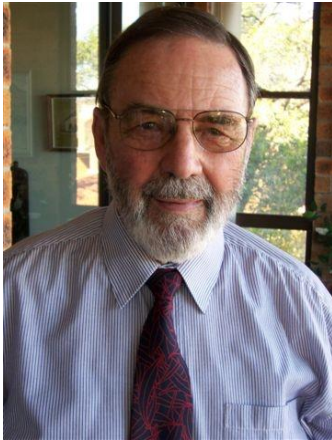Series Article   by Alan Stretton

However, it was also noted that several author groups have strongly associated project integration with the management of project interfaces, which should throw further light on the nature of project integration. Project interfaces will be discussed in more detail in the second article of the series.

After noting that some of the disagreements about project integration in a very broad context may be due to the fact that project management knowledge is not context free, we looked for materials on integration which relate with project contexts. We found a somewhat indirect link via 'dimensions' and component 'tasks' in Shenhar & Dvir's NTCP model, for which they recommend a wide range of varying approaches to integration. I regard this as a sort of half-way stage between integration and the management of project contexts per se. The latter will be discussed further in the third article of this series.

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