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Topic II: Planning and management of statistical projects

CHANGING MANAGEMENT PRACTICES

Invited paper

Submitted by Statistics Canada¹

I. INTRODUCTION

1. Over the last few years, studies in management science have focused on the processes by which organisations *learn* and mature. The *Software Engineering Laboratory* of Carnegie-Mellon University has developed a model and an assessment method for ranking organisations in terms of their maturity - the Capability Maturity Model (CMM). In this paper, the CMM is used to assess the current maturity of project management practices at Statistics Canada and to identify how we might move to the next stage.

2. A customisation of the CMM is used to indicate how tools play an integral part in introducing new practices to an organisation. It is suggested that an investment in tools and the supporting infrastructure will have a strong influence on the future ability of Statistics Canada to conduct projects.

3. The ready availability, commonality across the organisation and how easily these tools and supporting knowledge assets work together is key to their effectiveness. The paper explores the value of tools in increasing the effectiveness of knowledge workers, including project managers, by incorporating preferred practices and reference material.

4. To reach the next stage of maturity in project management, the paper concludes that Statistics Canada should develop a project manager community and discipline. It proposes that we should capitalise on the eagerness of knowledge workers to use tools

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and that we should employ this media (in conjunction with training) to spread common practices across this community.

II. CONTEXT

5. Information Technology is a key enabler in a statistical agency's intrinsic ability to respond effectively to program demands. However, to respond quickly requires more than technology; it requires a framework of common standards and practices across the agency so that the opportunities for reuse and integration are maximised.

6. This paper inspects the practices for managing development projects at Statistics Canada within a framework that is currently being promoted across the Canadian Federal Government, known as the *Enhanced Framework for Managing IT Projects*.

7. Four overall principles have been defined for the enhanced framework to set the broad parameters within which information technology projects are managed:

- *Projects are aligned with, and support, the business directions and priorities;*
- *Clear accountabilities are established;*
- *Project managers are developed in, and work within, a corporate discipline; and*
- *Project management decisions are based on risk management.*

8. The first two of these principles are well established at Statistics Canada as a direct result of long-term planning (LTP) and project cost accounting processes that have been entrenched in the management culture over a number of years. Funding is allocated to program managers during the planning process and they are responsible for the successful completion of development projects. Interdisciplinary teams, that may include subject matter, central systems and methodology resources, and operations staff, are employed to carry out the projects.

9. However, this decentralised approach to the management of projects has proved to be antithetical to the third principle, which promotes common practices and disciplines across projects. Instead, project managers have tended to be drawn from survey management or subject matter staff and consequently project management practices vary widely. To some extent, the use of central methodology and systems staffs as resources on these projects has mitigated the lack of common project practices. As well, Statistics Canada has evolved mechanisms to quickly redirect its work force to where it is needed through career assignment and development programs. These programs provide an opportunity to spread best practices.

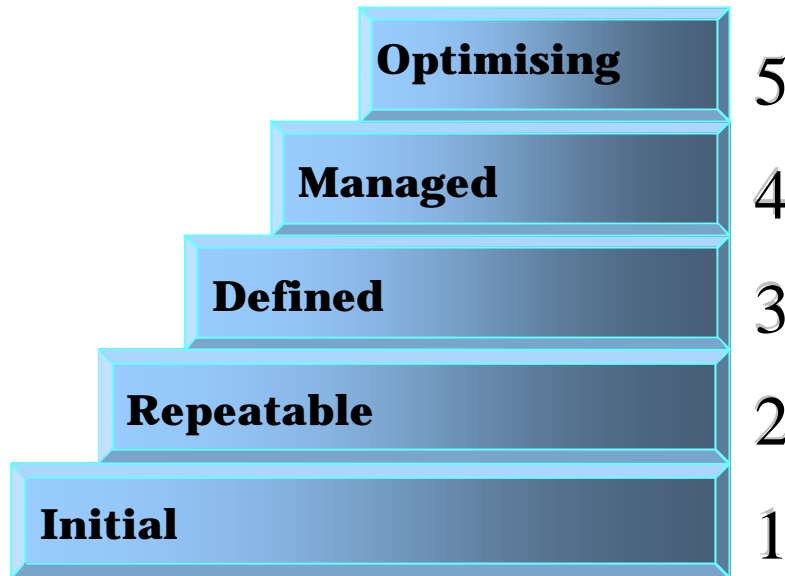
10. Statistics Canada has, from time to time, considered implementing a project manager discipline that could supply expert resources to projects. However, the advantage of having a manager that is more knowledgeable in the subject matter domain has usually won out. This choice can increase the risk of inadequate planning and control over the project but at Statistics Canada this risk is mitigated by:

- (a) Using inter-disciplinary teams where some aspects of project management are taken over by the methodologist or systems members of the team;
- (b) Keeping project size to a minimum by breaking up larger endeavours; and
- (c) Repeating project patterns that are proven and reusing components whenever possible.

11. These standard solutions have proven to be effective most of the time because we have a record of (mostly) successful projects. However, the practices are not sufficiently robust to handle large projects, or ones that present significantly new challenges.

III. ORGANISATIONAL MATURITY

12. No matter what level of success an organisation achieves, there is always room for improvement. Statistics Canada is entering a period where we expect there to be a relatively greater number of new projects, an increased requirement for integration across subject-matter lines, and therefore a need to take on larger and more complex developments. Consequently we need to assess the maturity of our methods and determine if changes are required to meet these challenges. The *Capability Maturity Model (CMM)* developed at Carnegie-Mellon provides a means make such an assessment.



Capability Maturity Model

13. The CMM identifies five stages of a maturing organization with respect to project management practices. Informally, and in brief, these are as follows:

- *Initial* The baseline is referred to as the *initial* stage. Projects in these organisations succeed by personal heroics and hard work. Or, put another way, projects are unreasonably dependent on a few key individuals. These projects are characterised by a high risk of failure or cost/time overruns. Management is by crisis and intervention. Processes and practices are invented (or reinvented) as they happen.
- *Repeatable* At the next stage of maturity there is improved planning and the emergence of a project methodology. By sharing practices among individuals and learning from experience the organisation reaches a stage where performance is repeatable. Having done something once, it can be done again. The corollary is that a new challenge, with significant differences to past practice, will likely fail or will be ineffective. Most organisations, including Statistics Canada, are at this stage today.
- *Defined* At the third stage we reach a plateau that few organisations go beyond. Here processes are well defined. Standards can be defined for deliverables, for performance and for interactions between players within a project. Different disciplines have their own standards and common templates and tools promote the sharing of practices. At this stage it becomes feasible to introduce metrics and to manage on a quantitative basis. The focus at this level is by organisation. The *quality movement*

and the ISO 9000 series of standards are targeted at this stage. Companies advertising that they are certified as ISO 9001 compliant means they have defined and documented their processes.

- *Managed* At level 4 the project management practices become common across the whole organisation and part of the culture of governance. This is characterised by a project management discipline with the associated training and human resource development programs. Metrics, used in common across projects, provide the benefit of a quantified, longitudinal database of experience. (Not just in peoples' heads, but a recorded history.) Performance is predictive and estimates are realistic and based on experience. The focus of this stage is corporate governance and management oriented.
- *Optimising* The final level in the model is referred to as the *optimizing level*. This implies that the feedback mechanisms become so integrated into the culture that the goal of continuous learning is achieved. Not only can processes be continually improved based on quantitative methods but management can see where investments can have the greatest impact and return.

14. Based on this model, Statistics Canada is a level 2 organisation. It is successful at projects that repeat a previous pattern but has some gaps with respect to defined processes and metrics.

15. However, there are some positive aspects of Statistics Canada's practices that are not highlighted by this model, but which enhance our ability to execute projects. The first of these is our corporate planning and financing mechanism, which effectively manages the duality of *project accounting* and *organisational budgeting*. Under this regime, all activity is accounted for within a project structure, while resources are supplied (and budgeted) from the line organisation. That is, projects consume resources supplied by organisational units.

16. The second beneficial approach has perhaps evolved as a direct result of the first; a common understanding that there is an *infrastructure capacity* embedded within the organisation. The definition of *infrastructure* in this context is quite broad; it is any capability that is used or shared by multiple programs or projects. It may apply to common practices and tools, corporate services or resources provided to projects, or the technical infrastructure providing common communication and computing capacity.

17. Things that are part of the infrastructure can be reused; they add to our innate capacity to respond to new challenges:

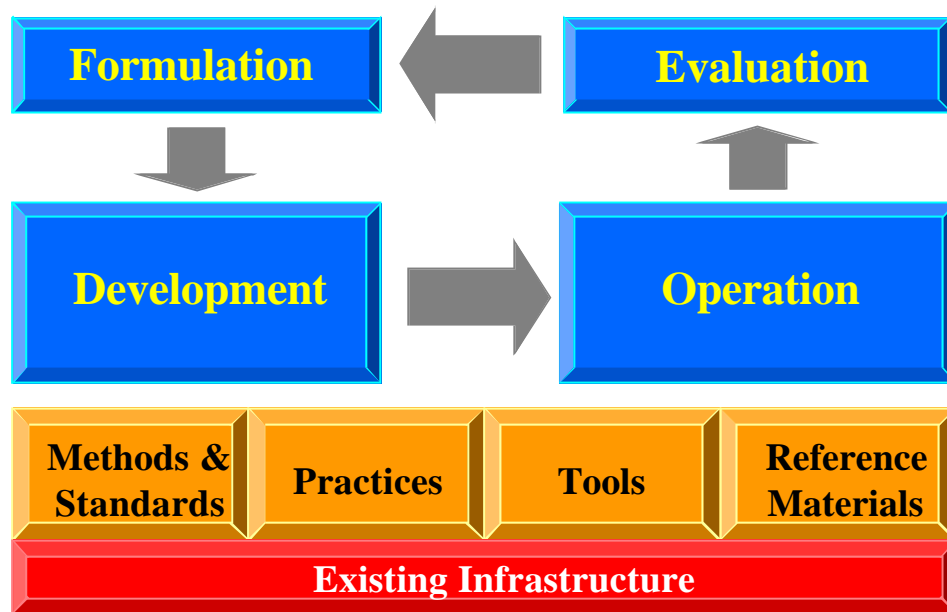
- Methods and standards are encouraged by central service providers; as common approaches are adopted they reduce the time to formulate and develop our response to new situations;
- Generalised components and common tools make our knowledge workers more productive by reducing the need for retraining from project to project;
- A common technology infrastructure, developed and managed independently from projects, enhances communication and integration possibilities among projects; and
- Common reference databases in the form of repositories and registers means that common development and operational support can reuse existing knowledge and data.

18. Statistics Canada has a mature legacy in each of these areas and recognises the value of investing in infrastructure as a means of achieving efficiencies beyond the

confines of a single project. Some of these common elements are fully cost-recovered from projects through usage rates; others are directly funded at the corporate level.

IV. FUTURE PRACTICES

19. The CMM used in the previous section to assess our level of maturity also suggests ways to improve by looking at the higher levels: *defined* and *managed*. The traditional ways of achieving these levels is to document processes as best practices and ensure these are widely used in the agency. To manage this, metrics must be developed and used as a quantitative means to evaluate and improve on past practices.



Organisational Capabilities

20. There appears to be a barrier within the culture of the organisation to metrics. Although we are quite focused on results as seen by our external clients, the variation in project methods and a reluctance to explicitly compare project performance, work against a consistent set of measures. The central service areas (systems and methodology) provide human resources and bill projects for their services in person-days. This is a measure of *input* resources rather than a measure of output or results. What we require next is consistent *size* and *complexity* measures for the systems developed. This measure of output would allow comparison of one project to another and a basis for assessing the relative effectiveness of project processes and development practices.

21. The diagram above depicts organisational capabilities for program and service areas. It is a model of our program cycle. This model proposes four basic continuing and interdependent activities for any statistical project, supported by the infrastructure. Everything we do falls into one or other of these boxes.

22. *Formulation* includes the planning and research activities that define new projects. This includes the intellectual component of selecting a methodology and system architecture, then defining the development approach. It is an interdisciplinary activity.

23. *Development* means delivering the system and operating procedures, including training the client and performing a trial. This activity should be performed using *project management* methods and *software engineering* principles.

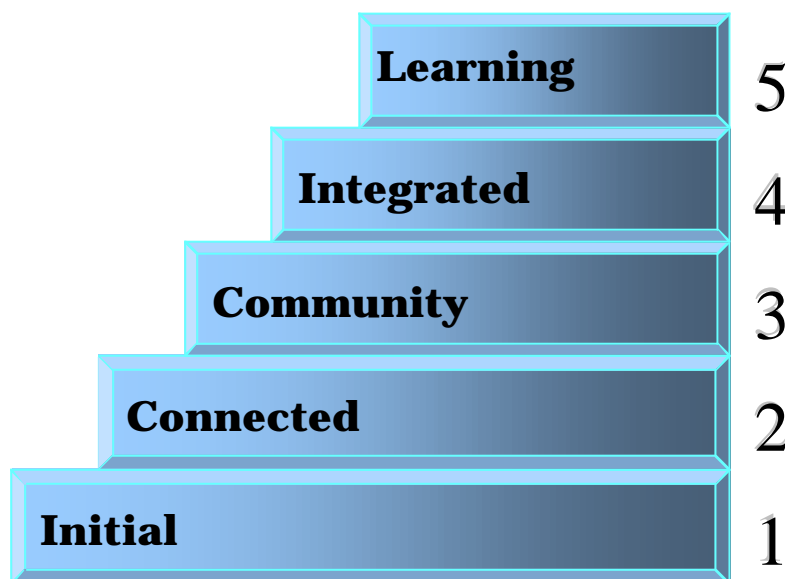
24. *Operation* is most often the responsibility of client areas at Statistics Canada, but some common activities such as *data collection and capture* and *dissemination* are provided by dedicated service areas. Similarly, key information services such as *geography* and *business register* operations are separate organisations. These services can be considered part of the infrastructure because they are common to many programs.

25. *Evaluation* has not always been seen as a formal step in the cycle, but is essential to quality assessment and learning how to improve the process. Because of the lack of quantitative measures of project performance this is a weakness at Statistics Canada.

26. The infrastructure shown in the lower part of the diagram provides a variety of technical and expert services, though *project management* is not currently one of them. If we are to further improve our project management skills we shall need to develop these competencies and treat project management as a *discipline* with an associated training and development program.

27. Even without a formal project management discipline the infrastructure components exert a significant influence over how projects are conducted through the application of common methods and standards, development methods and tools. In fact, the use of common tools may be the most effective method of promulgating common practices as explored in the next section.

V. COMMON PRACTICES AND TOOLS



A Maturity Model for Tools

28. In a largely decentralised project environment like Statistics Canada, the methods and processes used are strongly influenced by how software tools are used. The modified maturity model presented above illustrates the progression of using tools in a strategic way to enhance the capabilities of knowledge workers.

VI. STAGES

Initial Stage

29. Knowledge workers of all disciplines are the foundation of Statistics Canada’s ability to respond to new requirements, and key to their productive capacity is the use of tools. At the initial stage of organisational development, tools are acquired

in an ad-hoc fashion with a focus on individual productivity; they make experts more productive and allow non-experts to participate in areas that were previously unavailable to them.

30. The market provides a very wide choice of personal tools, with almost every manual task having its electronic counterpart. Choices are made on the basis of *ease of use* and *ease of learning* as well as other, less tangible, characteristics. The *initial* stage is long past in most organisations and is more representative of home computer use. Stage 1 tools are used to produce a paper product, and to do this more efficiently, and with greater quality, than could be achieved manually. Tools in this class are just technologies that amplify our personal skills.

31. Examples of Stage 1 tools are:

- Word processors
- Spreadsheet processors
- Business graphics
- Process and data modelling tools (application level)

Connected Stage

32. The second stage, already well established at Statistics Canada, is when tools become connected by a common communications infrastructure. It is at this stage that tools begin to become part of the culture of the organisation because they are used to *exchange* information.

33. With a focus on communication there is added value in having *common* tools to ensure that information exchange is reliable and content accurately reflects the original. The shift from personal preference to a common approach can be long in some organisations but the marginal differences between competing products are usually less important than the value of shared information.

34. This is also a period where the professional appearance or *style* of output becomes a driving force. This is partly an aspect of the focus on communication but also an expression of personal motivation towards professional quality. Tools can be personalised using templates and style-sheets so that there is a consistency from document to document. Interestingly, this attention to style helps the shift to common tools because the integrity of stylistic enhancements is often lost in moving content between products.

35. Tools also become more *connected* with each other at this stage and we see the emergence of product *suites* rather than stand-alone tools. This has been particularly true in the *office automation* market but also occurs in more specialised markets such as database and development tools. Integrated suites of tools generally improve *ease of use* but at the expense of *portability* of information to other families of products. It is an open question whether standards will emerge to counter the negative aspects of proprietary data interchange formats.

36. Statistics Canada is currently moving towards common tools in the mainstream of office automation and system management, where communication is the predominant driving force. For specialised tools, particularly in the areas of system development, metadata management, database design and data analysis there is much more divergence.

37. It is on these expert tools that the remainder of this discussion is focused. The audiences for these tools are our professional knowledge workers and the

potential for improved communication, aided by their tools, is strategic to the Agency's capabilities.

38. Examples of Stage 2 tools are:

- Electronic mail
- Scheduling and calendar management
- Web publishing and browsing
- System management

Community Stage

39. The third stage of maturity is the establishment of *communities* of tool users. The focus is on the management of the environment and the support services that complement the use of tools.

40. Statistics Canada has made heavy investments in training its knowledge workers to build a common knowledge base and promote teamwork. We actively encourage the sharing of best practices and value experience and expertise equally. One of the mechanisms for broadening experience and spreading best practices has been rotational project assignment, particularly by our recruitment and development programs.

41. It is clear that job rotation mechanisms are most effective when skills are portable across assignments so that retraining is minimised and experience is easily transferable. The use of common tools within a particular discipline is a key element of this equation. The system development community at Statistics Canada is a good example of one that is widely dispersed and also very dependent on a wide range of tools to do their work. Data analysts, database administrators, methodologists and project managers are other examples.

42. The characteristics of tools that support a community approach are somewhat different than personal tools. Most importantly tools should match, or be tailored to match, the particular practices employed within the community. Alternatively, the practices can be moulded to align with a particular set of tools.

43. Many tools are customisable through the use of templates and programmable features so they can be the means to promulgate common methods within a community and another media for sharing best practices. Common tools, when combined with training and shared templates that encourage a common approach, improve productivity of the community as a whole rather than just the individual knowledge worker.

44. A second way that tools support teamwork is their ability to share work product through common libraries or repositories. Even the most basic of products can be powerful information managers when combined with an organised file system; when teams move from personal filing schemes to organised collections it is a sign that the third stage of maturity has been achieved.

45. More sophisticated tools provide project environments (so called Integrated Development Environments or IDEs) and may support change control features to manage the knowledge assets. Such features are often ignored unless they are strongly emphasised in training and actively promulgated by management as preferred practices. As the community for a particular set of tools grows, it becomes economic to establish expert support groups that promote effective practices and provide training tailored to those practices.

46. Examples of Stage 3 tools are:

- Conceptual system design tools (Enterprise level)
- Database management
- Project management
- Metadata management (Application level)
- Integrated Development Environments

Integrated Stage

47. For tool sets that are broadly applicable, or those that are critical to the functioning of the Agency, there will be a stage where an enterprise-wide approach is desirable. Some organisations have enforced such an approach at an earlier stage; Statistics Canada has allowed usage to evolve with the market and has considered an enterprise-wide approach only recently.

48. However, common usage is not the main objective of this fourth level of maturity; rather, it is the ability to share resources held in corporate repositories or registers and made available through the media of tools.

49. *Registers* are managed reference sites that *identify* some collection of things and information about them. They are fundamental to the operation of the Agency. For example, the e-mail tool might provide universal access to a register (directory) of employees. We also use this term for key operational references such as the *business register* and *address register*. We are developing *classification registers* that will provide universal access to standard definitions for data variables. Registers are necessarily enterprise-wide because they represent definitive sources.

50. *Repositories* are also shared reference sources that provide the means for storing *reusable* material. They may be thought of as libraries of experience rather than definitive knowledge and often emerge from the community efforts identified at stage 3. Repositories are the means by which corporate knowledge and history become incorporated into the tools and the tools become the primary communication media among experts.

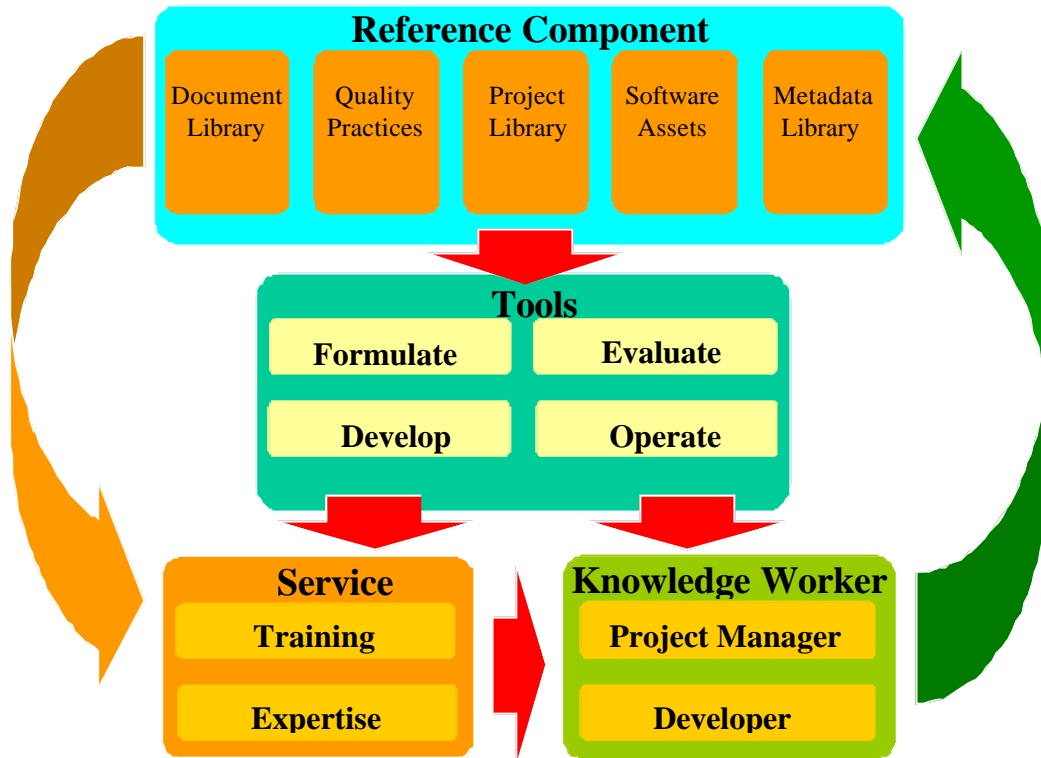
51. Examples of Stage 4 tools and services are:

- Enterprise concept registry
- Enterprise classification registry
- Business Register
- Farm Register
- Address Register
- Enterprise software registry
- Enterprise design repository

Learning Stage

52. The ultimate stage in the model is that tools, and the infrastructure that supports them, have the capacity to learn and to feed this knowledge back to the knowledge workers. To be a *learning* organisation is also a strategic goal; it means that the agency as a whole learns from its experiences, retains and builds that knowledge over time and incorporates the lessons learned into its future endeavours.

53. The learning cycle is shown in the diagram below. Enterprise knowledge is retained in the collection of repositories and registries that are actively fed by knowledge workers. This knowledge base also provides the source material for specialised support services. The most important of these services is *training*, which ensures that best practices learned in one area are universally applied.



The Knowledge Cycle

54. Intelligent tools play a key role in this learning environment. They are the media by which existing elements are reused and shared across the agency. The tools are an integral part of the cycle of knowledge workers documenting existing practice and making this experience available to colleagues throughout the professional community.

55. In such an environment the focus of the knowledge worker is on quality improvement because productivity is already optimised by the capability to reuse past experience.

VII. CONCLUSIONS

56. To reach the next stage of maturity in project management, Statistics Canada should develop a project manager community and discipline. However, simply introducing a central service to promote project management practices is unlikely to be successful. Instead, we should capitalise on the eagerness of knowledge workers to use tools and employ this media (in conjunction with training) to spread common practices across this community.

57. A "tools, not rules" approach is better suited to Statistics Canada because of its interdisciplinary and decentralised nature. As we have many smaller projects, rather than a few large projects, we expect a tools-oriented approach will achieve faster penetration. There is also a need for a centre of expertise or *Project Office* at the enterprise level to ensure that the agency learns from its collective experience. The Project Office supports the common tools and provides advice and training to promote the best project management practices. It also maintains a

repository of past project experience, integrated with the common tool so that this experience is available to whole community of project managers.

58. If the project manager community gains real value, in the sense of individual and team productivity, from the use of an integrated environment, then usage will spread and Statistics Canada as a whole will benefit.

59. We also noted earlier that Statistics Canada does not have a consistent set of metrics related to project performance. An integrated project management tool has the potential of filling this gap in a way that is unobtrusive. By providing a means for project managers to prepare realistic development estimates based on past experience, they would have the incentive to establish measures of size, risk and complexity for each development project.

60. The organisational placement of the Project Office is likely to be an issue at Statistics Canada, as well as its funding. Should it be funded as a strategic investment, or cost-recovered from the projects for the services it provides? On balance a direct investment and subsidisation appears to be the winning approach because this is essentially a management service and these have usually been centrally funded at Statistics Canada. Organisationally, a Project Office would be an excellent adjunct to Corporate Planning and Audit function because of its strong links with the Corporate Planning Committee (CPC). The CPC is Statistics Canada's senior governance body for project funding. This placement would also have the advantage of being outside any of the existing organisations that participate in projects.

61. This paper has explored the possible improvement of Statistics Canada's project management practices from the perspective of organisational maturity. Tools have been suggested as a means to introduce improved practices, as well as justifying the presence of a Project Office. At the time of writing, no concrete plans have been proposed to advance this suggestion at Statistics Canada.