PRACTICE-BASED PERFORMANCE ASSESSMENT IN PUBLIC TRANSPORT PLANNING

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Abstract

In public transport, concern for social and environmental sustainability and value for money are driving practitioners' interest in performance assessment but scientific research is lagging behind. Performance assessment covers both measurement and evaluation of performance and is presented in this paper as part of a wider framework in which performing, assessing performance, and improvement are seen as three embedded related activities. We highlight a serious weakness of the two currently dominant approaches, *Balanced Scorecard* and *Tableaux de Bord (Dashboards)*, namely that they ignore actual practice; they compare actual outcomes to theoretical targets based on what should have been done according to the procedures rather than on what is actually done in practice. We propose an alternative paradigm of practice-based performance assessment and present tools to support practitioners in representing their practices and assessing their performance. The difficulty of formalizing the representation of practices is overcome using contextual graphs that link actions to specific situations in the context of an activity. Practices are viewed as alternative ways of carrying out the activity and appear as different paths in a contextual graph. Each graph corresponds to an activity and shows practices that have proven to be effective. Since each of the practices represents an effective way of doing the activity they may be legitimately compared. When a particular practice emerges from the assessment as a so-called best practice it may be de-contextualized and elevated to become a new procedure in the learning organization. Our approach allows a uniform representation of activities that does not depend on the level of analysis, and in this paper we will analyze public transport-planning practices at both the political/strategic level and at the tactical/operational level. We present findings from a case study in light rail route selection in Dublin that demonstrates the feasibility and utility of the contextual graph representation formalism in support of practice-based performance assessment in a complex public transport planning activity. We situate our findings in a wider ongoing research project that will compare performance assessment and organizational learning in light rail route selection in Dublin and Paris.

Keywords: Practice-based Performance Assessment, Contextual Graphs, Organizational Learning, Public Transport Planning, Light Rail, Route Selection.

INTRODUCTION

Transport infrastructure projects are characterized by their long duration. In such long-cycle projects, performance assessment of activities like transport planning and route selection, whose impact can only be measured on project completion, pose special problems. Bias due to anchoring on recent events is identified in the decision-making research literature as a problem in such situations [1]. The fact that experienced people may leave the organization before their experience is formalized in lessons learned is another. Keeping track of the

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situations in which decisions are made and the links between the different levels of decision poses a third problem. Light rail public transport systems, because they are enmeshed in the very fabric of a city, are both technically and socially complex systems that are especially prone to problems like these.

In this paper, we propose a practice-based paradigm for performance assessment in transport planning. We build on our previous view of how actual practice can be represented in contextual graphs [2] and show here how practices can be evaluated directly in the context of the activity. In this way performance is evaluated in terms of what is actually done rather than in terms of what should have been done according to the procedures. Previously we have shown how the contextual graph representation formalism keeps track of the reasoning about the situation [3]; here we go on to show how to use the contextual graph to explain performance variances. When both actual practice and prescribed plan are represented in the same contextual graph, it makes explicit why actual practice deviated from the prescribed plan and so supports assessment of performance that takes account of the evolving situation in an analogous way to flexible budgeting where the initial budget is restated at the value it would have had if the actual conditions prevailed at the time of the construction of the budget.

The rest of the paper is organized as follows: we present the current approaches to performance assessment and show their weakness in being procedure-based, then we present our practice-based approach and show how it overcomes the weakness of the currently dominant approaches, then we present results from ongoing research in performance assessment of light rail route selection in Dublin that demonstrate the feasibility and utility of our approach and finally we indicate some perspectives for future research.

CURRENT APPROACHES: BALANCED SCORECARD and TABLEAUX DE BORD

The Balanced Scorecard and the Tableaux de Bord (literally, dashboards) are the two main approaches to performance assessment currently in use both in the public and private sectors. From different starting points, pragmatic American business culture and rational French engineering culture [4], they share the same goals of reactivity, selectivity and coherence and may be seen as complementary [5]. They can be seen to converge over time, in fact the Balanced scorecard is translated in French as "tableau de bord stratégique" and the French term for dashboard is often left un-translated in English. The Balanced Scorecard was introduced by Kaplan and Norton [6] in the 1990s and has become dominant in the English-speaking world [7]. The approach extends the traditional financial assessment of organizational performance and balances it with three complementary perspectives: the organization as viewed by the customer, as viewed from an operations perspective, and as seen from a learning and growth viewpoint. It is a top-down functional articulation of objectives and corresponding measures, targets, and initiatives starting with the mission and strategy of the organization. Financial, customer (sales and marketing), internal process (operations management), and sustainability (human resources, research and development) objectives support and are linked to strategic objectives in a hierarchical fashion; measures are indicators of performance, the scales used (e.g. return on investment, customer satisfaction, throughput time, and employee training); targets are the levels aspired to for each key performance indicator (KPI); and initiatives are the plans put in place to reach the target. Its top-down nature makes it what we call procedure-based because it compares outcomes to targets that represent expectations of what would have been if the procedures were strictly applied. There is little research evidence to support the effectiveness of the balanced scorecard [8].

Tableaux de bord are constructed in a four-step process. They also start with objectives but not from a predetermined list of perspectives; rather whoever is developing the dashboard selects the dimensions of the problem that seem relevant to them, the gaps. Next, questions about causality are asked to establish the so-called action variables. Third, actions are selected that will impact the action variables. Finally indicators are chosen to reflect performance. This approach suffers from the same weakness as the balanced scorecard, namely being procedure-based; and the authors know of no research evidence to support the methods effectiveness. Given the situation with the two dominant methods there is clearly a case for a new paradigm. One reason for the paucity of conclusive research is the lack of conceptual clarity and a coherent framework [9].

A common view of performance, as the economy with which resources are converted into inputs, the efficiency with which inputs are transformed into outputs, and the effectiveness with which outputs are transformed into desired outcomes is illustrated in Figure 1. In order to concentrate on some essential questions, we exclude goal-conflict and resource-conflict from consideration. We take policy as given, in the form of desired outcomes, and resources as given in the form of the necessary inputs for the prescribed procedures. That leaves us with two questions, the efficiency with which inputs are converted into outputs, and the effectiveness with which the outputs correspond to the outcomes. See Figure 1.
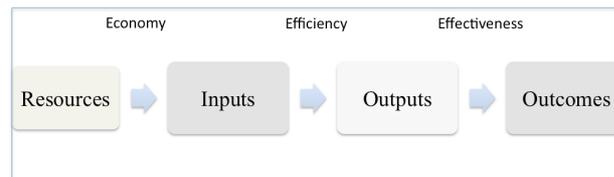

Fig. 1. Three aspects of performance

Effectiveness so viewed poses a problem; stated theatrically, "the effectiveness of the performance will depend on the effectiveness of the play and the effectiveness with which it is played" [10]. In our language, the play corresponds to the procedure that the organization intends to adopt, the playing to the actual business practice. The prerequisite for meaningful evaluation of effectiveness is a representation of actual practice in the context of the planned activity. We take up this challenge in the next section.

A PRACTICE-BASED APPROACH TO PERFORMANCE ASSESSMENT

A practice is a contextualization of a prescribed procedure in a specific situation and can be represented using the contextual graph formalism. We build on previous work by one of the authors on the difference between practices and procedures that highlights the advantages of practice modelling over task (procedure) modelling [11]. Representing practices involves two levels of abstraction; the parameters (contextual elements) of the generic situation are first identified (these are relatively stable over time), then the particular situation is specified dynamically i.e. the contextual elements take on specific values as the activity unfolds [12]. Figure 2 shows the elements of the framework we use to represent practices in contextual graphs.
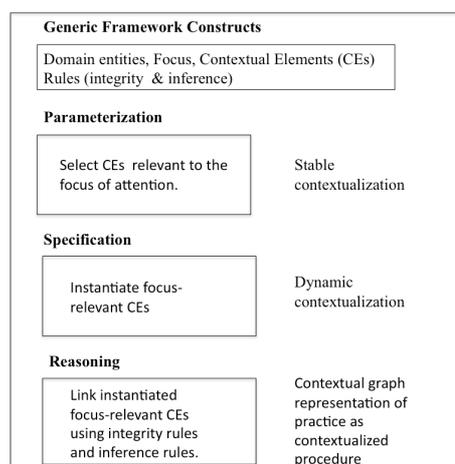

Fig. 2. A framework for representing practices using contextual graphs

A contextual graph (CxG) can be used to represent the different ways of carrying out a generic task. Each of these ways (practices) corresponds to a path through the graph that links actions in a way that depends on the value of contextual elements that characterize the

specific situation. The specific values of the contextual elements on a path explain the reasoning behind the practice. Once a practice is represented in the context of its activity, the question of efficiency is reduced to comparing the practice to other practices that effectively carry out the same activity using some measure (indicator) of efficiency, like journey time. The question of assessing effectiveness of a given practice is reduced to asking if we had chosen the right objectives for the practice. To do so we must consider the objective-setting (strategic) activity like any other (operational) activity and represent its practices.

To understand and explain the performance involved in any practice we need to distinguish between the contextualization of objectives (effectiveness) and the contextualization of ways and means (efficiency) as shown in Figure 3.

Figure 3. Performance assessment maturity model [3]

All activities have these two dimensions corresponding to the effectiveness and efficiency dimensions of performance (cf. supra). In the next section we present our research results on the feasibility and utility of using contextual graphs for practice-based performance assessment for the objective setting and route selection activities of the organization studied.

RESULTS: PRACTICE-BASED PERFORMANCE ASSESSMENT IN LIGHT RAIL
In this section, we present results from a field study with a public transport infrastructure procurement organization. The process under investigation is light rail route selection, a key process according to the chief executive officer of the organization. The decisions concerning route selection involve both top management and the transport-planning department. Interviews with management of the organization involved in route selection confirmed our hypothesis that organizations generally have difficulty in formalizing their practical experience in a way that effectively transfers experience from one project to another. Our ideas on modelling practice were met with interest on the part of management. We followed this up with an on-site route selection workshop including top management and the transport-planning department. During the hands-on workshop participants were able to produce a contextual graph representing the route selection practices followed in two important light rail projects. The project managers found the results useful in highlighting differences between their practices. The head of the transport-planning department expressed interest in using contextual graphs on other projects.

The graphical output of the workshop is presented in simplified form in Figure 4 below as a contextual graph of the route selection process as a whole as practiced for the line L. Figure 4 is a relatively high-level representation of the route selection process that is quite generic corresponding almost to a project network but it still contains important contextual information relating to technology used, the existence of prior work, and the complexity of the topology. Of course each of the activities illustrated in Figure 4 may be represented as a graph in its own right showing practices for each activity (and so on recursively).
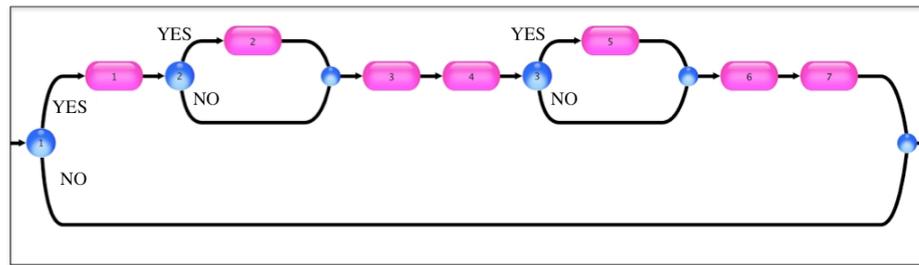
Fig. 4 A contextual graph for route selection - the case of line L

The contextual elements and activities corresponding to Figure 4 are shown in Table 1. (For simplicity, the case of alternative technologies is not illustrated in Figure 4.)

Table 1. Contextual elements and activities illustrated in Figure 4

Contextual element	
CE1 (circles)	Light rail technology?
CE2	Prior work exploitable?
CE3	Complex topology?
Activity	
A 1 (ovals)	Select parameters
A 2	Exploit prior (2004) work
A 3	Generate spider's web
A 4	Sift 1 workshop
A 5	Sift 2 workshop
A 6	Consult public on route options
A 7	Appraise route options (multi-criteria framework)

An interesting and general problem mentioned by management of the organization at the route selection workshop was referred to as "early freezing". When a design decision is made at a higher (more general) level, the lower (more detailed) level often incorrectly assumes the higher-level decision is fixed in stone. This is a problem of misinterpretation of context. The solution is better context management, both in recording the reasons for a decision and making this information transparent between organization levels. This is exactly what the contextual graph does.

CONCLUSION AND FUTURE WORK

Basing performance assessment on practice is both feasible and useful. A framework for identifying and making context explicit is an essential part of a practice-based performance evaluation process. Our framework allows the addition of new elements as practices evolve over time. It can be used to represent and compare practices, to evaluate performance and to support experience sharing and organizational learning. Our approach is applicable to any organizational activity for which procedures have been formalized to deal with recurring situations. The research presented is part of an ongoing project comparing light rail route selection in two European capital cities.

REFERENCES

[1] Pomerol J.-C., and Adam F. (2008), Understanding Human Decision Making – A Fundamental Step Towards Effective Intelligent Decision Support, in G. Phillips-Wren., N. Ichalkaranje, & L. Jain (Eds.), *Intelligent Decision Making: An AI-Based Approach.* Berlin Heidelberg: Springer.

[2] Hegarty J., Brézillon P. and Adam F. (2011), Context-based Performance Evaluation in Planning. 7th International Workshop on Modeling and Reasoning in Context (MRC'11).

[3]   Hegarty J., Brézillon P. and Adam F. (2012), The Role of Attention in Fusing Situation and Activity, 16th International IFIP WG8.3 International Conference on Decision Support Systems (DSS2012).

[4]   Bourguignon A., Malleret V. and Norreklit H. (2001), Balanced Scorecard versus French tableau de bord: beyond dispute, a cultural and ideological perspective.

[5]   Mendoza, C., Delmond M.-H., Giraud F., and Löning H. (2002), *Tableaux de bords et balanced scorecards.* Paris, France: Groupe Revue Fiduciare.

[6]   Kaplan, R.S. and Norton D.P. (1992), The Balanced Scorecard - Measures that Drive Performance. Harvard Business Review, HBR Jan-Feb pp.71-79.

[7]   Neely, A.D., Gregory, M.J. and Platts, K.W. (2005/1995) "Performance Measurement System Design: A Literature Review and Research Agenda" reprinted in the International Journal of Operations and Production Management, 25, 12, 1228-1263.

[8]   Neely, A. (2008) Does the Balanced Scorecard Work: an empirical investigation, Research Paper 1/08 Centre for Business Performance, School of Management, Cranfield University.

[9]   Talbot C. (2010), Theories of Performance, Organizational and Service Improvement in the Public Domain. Oxford University Press.

[10] Simon H. (1947), *Administrative Behavior.* The Free Press, New York, NY.

[11] Brézillon P. (2007), Context modeling: Task model and practice model, *Proceedings of the 5th International and Interdisciplinary Conference on Modeling and Using Context, CONTEXT-07.*

[12] Brézillon, P. and Pomerol J.-C. (2010). Framing Decision Making at Two Levels. In A. Respicio et al. (Eds.) *Bridging the Socio-technical Gap in Decision Support Systems.*