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Title: **Hard and soft projects: a framework for analysis**

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Abstract:

This paper provides clarification on the use of the terms 'hard' and 'soft' in the context of project and program management, by exploring what it means for a project to be hard or soft. This paper draws on the authors' practice based research into large organisational change programs in a variety of contexts, and the literature on project management, systems thinking and evaluation. A framework for exploring the hardness and softness of project process and outcomes is provided. It acts as an aid to structured discussion and informed decision making about the application of methods for managing projects and programs and the appropriate methods for evaluating their success. This framework is designed to aid in the transfer of lessons learned to practice by offering a common point of comparison between projects, and has potential for use as a predictive aid to resourcing. Its use is demonstrated in three cases.

Keywords: Hard and soft; Systems approach; Project analysis; Lessons learned

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1. Introduction

The terms 'hard' and 'soft' are commonly used in practice and within the literature on general and project management in a loose and ambiguous way, including reference to hard or soft projects [1]; programs [2]; approaches [3]; methodologies [4]; systems [5]; goals [6]; outcomes [7]; aspects [8]; criteria [9,10]; measures [11]; costs [12]; situations [13]; issues [14]; knowledge [15]; ideas [16]; logic [17]; values [18]; and, skills [19].

Examination of the International Journal of Project Management indicates that the terms 'hard' and 'soft' are entering the language of project management. A search for these terms in the full electronic text database of IJPM between 1988 and 2003 revealed over 25 separate articles making reference to the terms 'hard' or 'soft'. Articles which used the terms to indicate difficulty, texture or hardware and software were excluded from this count.

Many writers have recognised that identification and response to the differences between hard and soft aspects of projects can influence their success. McElroy [1, p. 329] notes that ''.. .we have not only to recognise the differences between soft and hard projects, but also develop approaches which will bring their respective success rates together''. Direct connection between the identification of project type and the ability to select appropriate management methods has also been linked to project success [20].

Supporting this link between project success and identification or hard and soft aspects, Wateridge [10] states that projects have often been perceived to have failed due to project managers not paying due attention to soft criteria. Yeo [3] states that product acceptance goes beyond technical quality, extending into soft criteria, while Williams [16] notes the value of soft ideas in project models.

Soft issues have been identified as the key success factors in projects [21] and as having a high impact [8]. However, defining hard and soft issues is not always clear. For Jafaari [8], soft issues include community perception, safety, environmental impacts, legal acceptability, political and social impacts. By including Thiry [22], this list can be extended to include benefits, stakeholders, value management, and communications. Hard issues and measures include time, cost and quality [9], the traditional measures used to establish project success.

Hard and soft issues require different management approaches and skill sets [2]. However, these skill sets need not be mutually exclusive and can be applied in a complimentary way [23]. Categorisation of a project early in the life cycle can ensure that team members understand the project and its context more completely, aiding in the transfer of lessons learned from previous projects.

2. Philosophical basis of the hard/soft dichotomy

Generally, objectivist, scientific approaches are hard, while subjectivist, social approaches are soft [19]. Hard methods are rooted in positivist and realist philosophies, emphasising the search for objective knowledge, while the soft approaches stem from interpretivist and constructivist schools of thought, emphasising the inter- subjective creation of knowledge [24].

The hard paradigm promotes an understanding of the world as an objective reality, to which all people have equal and unvarying access. Systems are mechanistic processes, with stable, or predictably varying, relation- ships between the relevant variables [25]. Systems are interpreted through functional analysis, the attempt to understand a system in terms of its purpose [26].

Examples of hard methods include Systems Engineering [27,28], Systems Analysis [29] and early Systems Dynamics [30]. These methods influenced the development of project management, which has inherited their hard assumptions about the world [31].

Interpretivism is central to the soft paradigm, drawing on ideas from phenomenology and hermeneutics [24]. Approaches based on interpretivism include critical theory, social constructivism [32], and Soft Systems Methodology (SSM) [33], an interpretivist approach that has already been applied in the context of project management, e.g. [34].

3. The hard and soft dimensions of project management

This paper presents a framework for the analysis of the hard and soft dimensions of projects. It is based on previous research, [35–37], use of the terms in project management practice and literature, and identified differences in the philosophical basis of the hard/soft dichotomy. The framework is a categorisation scheme for structuring discussion on influential aspects of projects, facilitating project evaluation and the transfer of lessons learned to practice. The framework also has a predictive application, aiding in resourcing, planning and guiding the use of management approaches.

Seven dimensions have been identified as encapsulating the key issues in the analysis of hard and soft aspects of projects, forming the basis of the framework. The seven dimensions are:

(1) Goal/objective clarity: How clearly defined the project goals and objectives are;

(2) Goal/objective tangibility: How tangible the project goals and objectives are;

(3) Success measures: The kinds of measures used to judge project success;

(4) Project permeability: How subject the project is to risk outside project control;

(5) Number of solution options: The project approach to exploring and refining the goals;

(6) Degree of participation and practitioner role: The roles that team members take in managing the project;

(7) Stakeholder expectations: What influential stakeholders consider to be a valid application of project management.

The relationships between these dimensions in a project context are represented in Fig. 1.

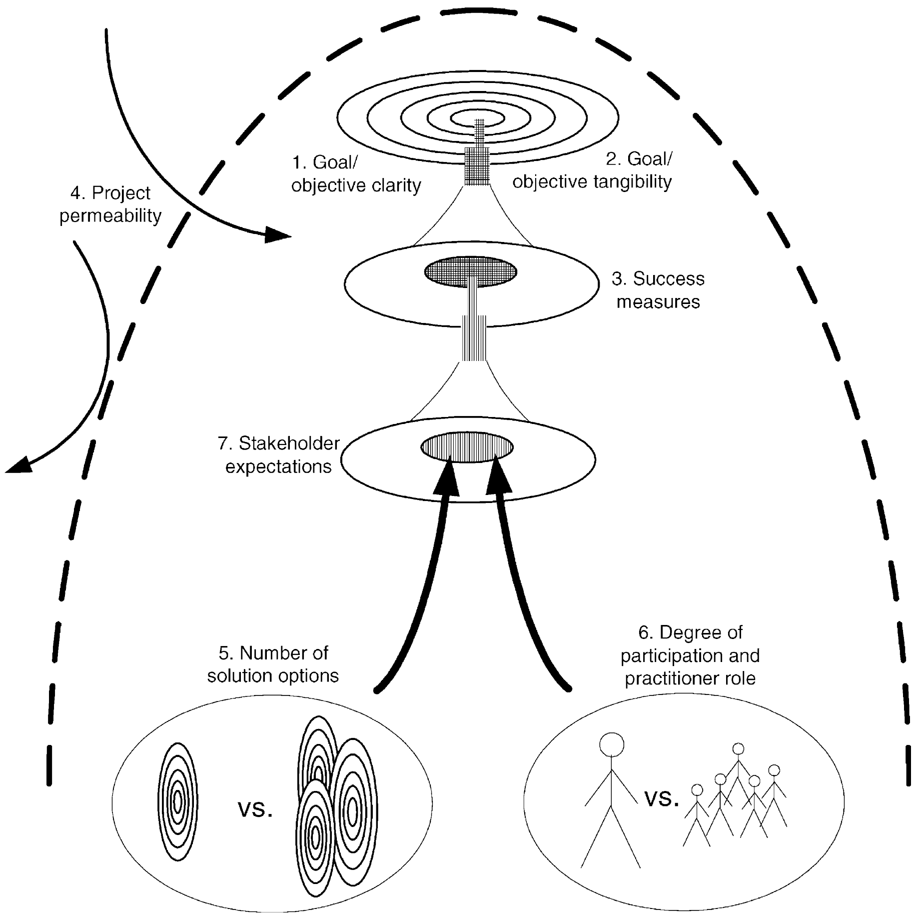

Fig. 1. The interaction of the seven dimensions of hard and soft.

4. Goal/objective clarity

Not all projects start as clearly defined as might be desired. Either the specifications given to the project manager may be too nebulous to avoid ambiguity in interpretation, or, when the objective seems unambiguous, how to reach it may not be apparent. Soft projects differ from hard projects in that the goals and objectives of soft projects are typically not clearly defined at the outset [1].

Projects can be classified according to the degree of definition of their goals and methods [38]. Engineering projects are typically highly defined, while research and organisational change projects are often ill-defined. This categorisation of projects aligns with the hard/soft di- vide in the systems literature. It ''is often stated that 'hard' systems thinking is appropriate in well-defined technical problems and that 'soft' systems thinking is more appropriate in fuzzy ill-defined situations involving human beings and cultural considerations'' [33, p. A17].

Hard methods work with the assumption that goals are previously clearly defined and don't need to be further examined [39]. Hard methods address how to most efficiently reach the defined goals. For example, Systems Engineering ''is a 'how-oriented' activity; it answers the question How can this need be met? What the need is has already been defined'' [40, p. 17].

This assumption can be seen in the field of project management. ''The project management profession tends to assume the existence of a pre-established business plan, in which the objectives and constraints are clearly identified'', with emphasis on the ''delivery of a solution to a predetermined problem'' [41, p. 42].

In contrast, soft methods acknowledge any goal ambiguity, focusing on learning, exploration and problem definition. This ''reduces the chances of incorrect identification of the problem'' [42, p. 15]. The emphasis then becomes one of negotiation, debate and accommodation.

5. Goal/objective tangibility

A project's hardness and softness can also be examined in terms of goal tangibility. Indeed, McElroy [1, p. 326] bases his definition of soft projects around goal tangibility: the ''... term soft project is used to describe any complex task which aims to achieve an intangible result.''

A strong link exists between the degree of definition of goals and their tangibility. Tangible goals, such as in engineering or construction, can often be defined in clear measurable terms. By contrast, projects with intangible goals, e.g. organisational change projects, are often more difficult to define, having to rely on subjective interpretation and judgement.

However, the link between goal tangibility and clarity does not always exist. For instance, a learning program might proceed with clearly defined goals and methods, while producing nothing that can be physically measured. Similarly, construction projects can start with ambiguous specifications, requiring soft methods to in- crease goal clarity, before construction can commence. For this reason, goal clarity and goal tangibility should be separately analysed in order to develop an under- standing of the hardness or softness of a project.

6. Success measures

Typically, it is easier to measure the success of hard projects than soft projects [1, p. 327]. Project specific critical success factors and key performance indicators can impact on project processes and outcomes, as performance is often guided by how success is measured, influencing project processes and outcomes. Measures come in two forms: quantitative; or, qualitative. Quantitative data and measures are associated with the hard paradigm [16], while qualitative data and measures are linked to the soft paradigm [8,43].

Examples of quantitative measures and monitoring techniques common to project management include Earned Value Management, e.g. [44], PERT and Gantt charts. Quantitative data is useful for simplifying complex situations. Performance measurement, a quantitative technique, can be used to translate ''subjective judgments into precise metrics which companies can then record and analyze'' [45, p. 39].

Qualitative data and analysis can provide a rich in- depth understanding of a situation [46]. Analysis of qualitative data involves letting the significant factors arise from the data, as opposed to applying a framework for analysis before data is collected. This can be appropriate when the project team wishes to explore the root causes of project success or failure, avoiding the influence of preconceptions.

It is often assumed that hard methods of data col- lection measure objective reality, while softer methods rely on subjective interpretation. This is implicit in the use of terms such as 'hard data' and 'soft evidence', e.g. [47]. However quantitative measurement can not analyse all aspects of reality, as ''quantity does not capture issues of meaning, attitude, or morale'' [48, p. 22]. Furthermore, in complex situations the measurement of a few isolated variables may not provide an adequate description of the outcomes being assessed [49,50].

In addition, ''Quantitative methods are no more synonymous with objectivity than qualitative methods are synonymous with subjectivity'' [46, p. 55], as despite the ability to incorporate the perceptions of large numbers of people or appeal to pre-established scales, quantitative evaluation inevitably involves subjective choice. The difference between the two approaches to data collection is in their ''relative degrees of calculated manipulation'' [46, p. 43].

7. Project permeability

Project permeability refers to the degree to which a project goals, processes and outcomes are affected by influences outside project control. This section draws on a pivotal study examining links between "changing boundaries and permeable interfaces" [51] in project management. In examining project permeability, it is necessary to differentiate between four concepts: scope; boundary size; boundary fixity; and, boundary permeability.

The PMBOK® Guide defines scope as the "sum of products and services to be provided as a project'' [52, p. 208]. The scope of a project determines what is and is not to be included as deliverables of the project, defining product and service boundaries. However, product and service boundaries are different from the boundary of the project as a whole.

When the project is thought of as a system with external and internal influences, the line between influences that are inside and outside the control of project personnel will determine the project boundary. Boundary size relates to the project size, such as number of personnel or organisational divisions involved in the project. Boundary fixity relates how the boundary changes during the project, as influenced by changing goals and scope.

Boundary permeability relates to the number of project influences inside and outside project control. A project with many influences outside project control, that can not be isolated from its environment, has a permeable boundary. A project that is only affected by influences within project control and can be effectively isolated from its environment has an impermeable boundary. This concept is similar to that of open and closed systems [53].

Projects of short duration in stable environments and well developed fields might be seen as isolated from their environment, with an impermeable boundary, being unchanging in response to environmental changes. In this case, hard methods which concentrate on the management of identified issues, and optimising the quality and delivery of objectives would su?ce for boundary considerations.

However, in many research projects, organisational change projects, bureaucratic projects, or where project teams have limited experience with the native culture, determination of a clear boundary between what will and will not affect the project is more problematic [54]. Soft methods would be useful, focusing on learning and exploration, allowing deliverables to be tailored to the local environment and emergent knowledge concerning risks and benefits exploited. When permeability is high it will be beneficial to include a wide variety of stakeholders to gain insight from multiple perspectives on the situation [24].

8. Number of solution options

Project hardness or softness is also typified by the focus of the methods used to manage the work. Hard methods focus on efficient delivery, while soft methods focus on debate and exploration of alternative options. The hard paradigm defines solutions which are culturally desirable and technically feasible, while the soft paradigm focuses on cultural feasibility and technical desirability [40].

In some cases, project managers are not included in the goal setting process, and objectives and/or solutions are handed down without room for discussion, or influential stakeholders personally push for the implementation of one particular solution, foreclosing debate on alternatives. Here, hard methods are most appropriate, focusing on the optimisation of the predetermined solution, without undue examination of its intrinsic value or alternatives.

Where the opportunity for questioning the assumptions about goals occurs, it can be profitable to explore alternatives and seek innovative solutions using soft methods. The soft paradigm emphasises learning, de- bate, participation, exploration and questioning of basic assumptions about the situation, making ‘‘no pretence to identifying an objective ‘one best way’: rather, it is proposed that the ‘best way’ emerges from inter-subjective, rational argumentation’’ [24, p. 196].

9. Degree of participation and practitioner role

Hard methods tend to be non-participative [53]. Team members are seen as experts in their individual fields with clearly defined roles, where everyone clearly understands the boundaries between the tasks that they and others have to complete, often defined in terms of a work breakdown structure.

An expert, non-participative approach may encourage faster project completion, but it increases the risk of ignoring potential innovation and contribution by stakeholders. Furthermore, assumption of expert status has been found to align with a reduction in learning and lower amenability to change [55].

Within the soft paradigm, if ‘‘the intervener can be regarded as an expert at all, his or her expertise is in facilitation’’ [24, p. 195]. The soft paradigm involves a participative, collaborative, facilitative approach where many views are sought on many issues and people are encouraged to cross professional boundaries [56].

A participative approach can be more time consuming [57,58], but is suited to situations where it is necessary to negotiate between multiple perspectives or where participant ownership is necessary to the delivery of project objectives. For example, a business change project, may require negotiation, cooperation and development of a sense of ownership across various business units.

10. Stakeholder expectations

A greater degree of interaction between stakeholders is required in soft projects, than in hard projects, which instead place emphasis on clear logical relationships between project elements 1, p. 327]. Management and client expectations can significantly affect which aspects of a project are valued, which in turn influences project delivery processes, if project team members are managing to these expectations.

Awareness of differences in stakeholder expectations can be vital to project success. Different groups, i.e. senior management and project personnel, are likely to view projects differently [59], having different backgrounds, concerns and languages [60], or differences in views on project process, management style and project management competencies [61].

The management style associated with the hard paradigm sees people within a system as essentially inter- changeable. People are assumed to act in predictable ways, with their actions being determined by their environment [39], while the organisation as a whole is viewed as a machine that can be engineered [31]. This results in a management style based on command and control.

The management style associated with the soft paradigm has culture, meaning and value as central concerns. Organisations are understood as cultural systems, and the emphasis is on the people who will take the action to improve the situation, and ultimately judge the success of any intervention [42]. People are understood to be part of complex cultures, with individual expectations, desires, values, roles and norms of action [33].

11. The hard and soft dimensions framework

These seven dimensions of hardness and softness can be used as a framework to structure discussion and distil and transfer project learning. By involving stakeholders in discussion, di?erent perspectives and meanings can be revealed and negotiated. The framework can also be used to determine the kinds of methods that will be most useful, in relation to project context, governance, deliverables and resourcing, and can be used as a framework for categorisation. These seven dimensions of hardness and softness in project and program management have been reduced to seven dichotomies (See Fig. 2).

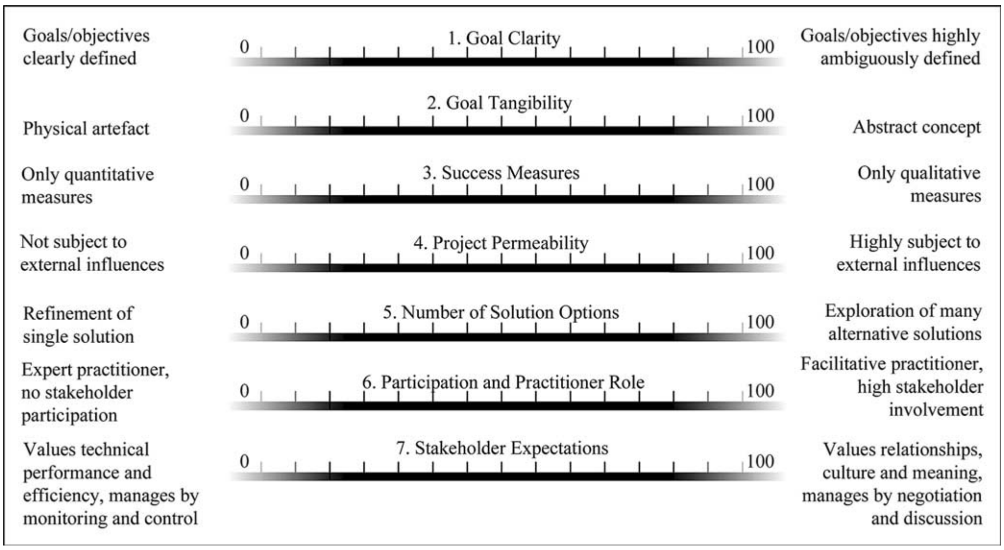

Fig. 2. Depiction of the hard and soft dimensions framework.

This framework has been used to translate participants' experience and understanding of projects into a number; an interpretation of the project type, in terms of hard and soft characteristics. Using a numerical scale to represent subjective interpretations of hardness and softness provides a framework for discussion through an easily communicated and shared representation.

Each of the seven dimensions were estimated as being between 0 and 100 (see Fig. 3). On this scale, 0 represents ultimately hard and 100 represents ultimately soft. These values were chosen due to the graphical implications of the charts produced: soft results implying broad analysis; hard results implying tight focus. A scale of 0–100 was found to give sufficient scope for participants to reflect their perception of the complexity inherent in reality. A smaller scale, e.g. 1–5, was not considered sufficient to capture this complexity.

12. Application examples

The use of this framework is demonstrated in three cases. Positioning on each of the dichotomies was developed in discussion with a representative of each project or program.

12.1. Case 1

The first case is a procurement project managed by an Australian public sector organisation which regularly manages complex procurement and capital works projects, focusing on reconciling the needs of ''multi-headed'' clients, total asset management, ecological sustainability, legislative constraints, and satisfying both policy and client objectives.

This framework was used to structure discussion focusing on how the interviewee saw the project at the time of the interview. Considerable changes had already occurred within the project. Significant heritage issues were being well handled, but stakeholder issues continued to cause problems. Through discussion it became clear that the goals were clearly defined from the perspective of the project manager, but problems had arisen in the communication of goals between major stakeholders, perhaps due to differences in the perceived tangibility of the goals. For instance, although the project involved physical redevelopment of a site (tangible), many success criteria related to intangible goals.

While discussing project permeability, it was found that factors outside the control of the project team could significantly influence the project's success. For instance, at the start of the project, problems arose due to the competence of a significant contractor. As time passed, the project continued to remain highly subject to a range of outside influences.

In this project, participation, measures and stakeholder expectations are linked. The organisation has procedures in place to monitor soft influences, gathering feedback on communication, claims and issue resolution, but the client for this project was resistant to them. Problems interfacing with the client developed throughout the project, to the point where it was necessary to introduce a new team member, whose approach met client expectations and was thus more credible in the client's eyes. The emphasis in measurement changed to mirror the client's harder perceptions, allowing the project team to have more influence over the client.

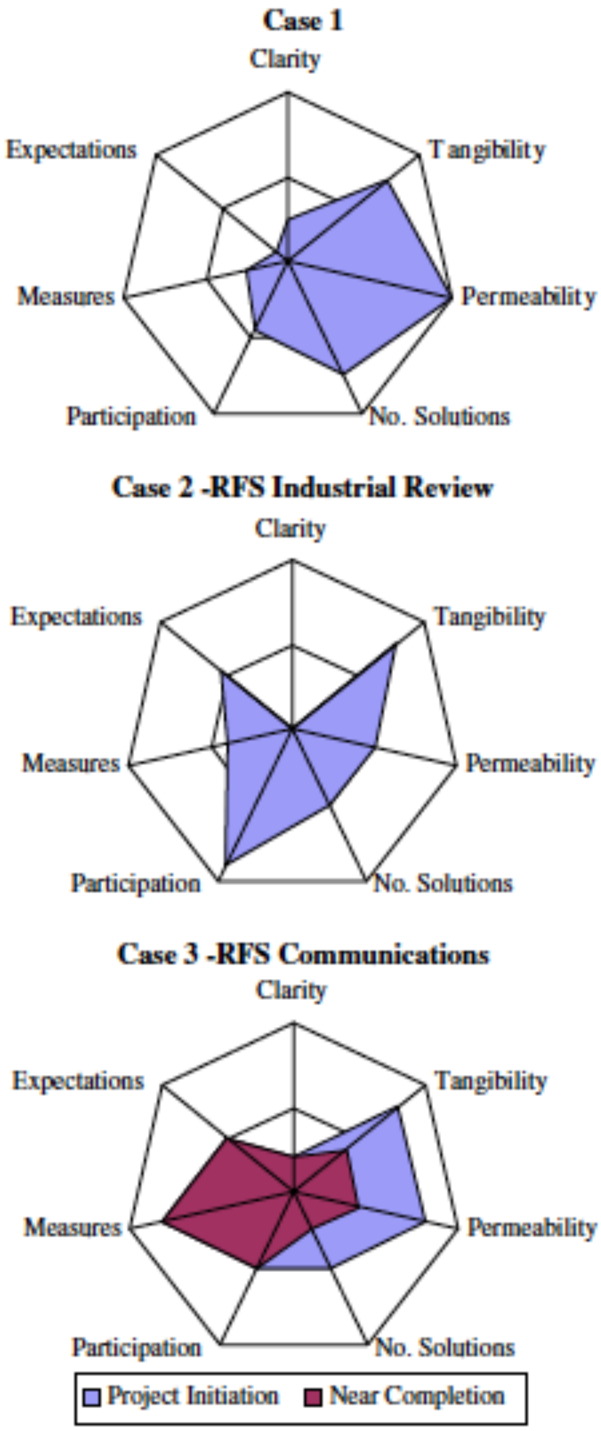

Fig. 3. Application of the hard and soft dimensions framework

12.2. Case 2

This and the following case study refer to an organisational change program that was undertaken by the Rural Fire Service, in NSW Australia, in association with the University of Technology, Sydney [36]. Two examples from the same change program were chosen to demonstrate the possible variation between hardness and softness within a single organisation. The change program comprised eight separate but interconnected programs.

This framework was used to structure discussion, analyse and capture learning about the hard and soft qualities involved in the Industrial Review program. The graph was created from the perspective of a program facilitator, discussing conditions at the start of the program.

In this case, management were very clear about the program goals, with relevant constraints and specific goals clearly defined, even though goals were predominantly intangible. Although the final goal, a signed agreement, was tangible, all the issues involved in reaching that point involved negotiation and stake- holder management. Measures that were used to judge success were considered to be slightly more hard than soft, focusing on the cost implications.

The program was considered to be moderately subject to the influence of outside parties, due to the influence of industrial negotiation. While the goals remained firm throughout the program, many options were explored for reaching these goals, and thus was evaluated as mid- way between hard and soft.

The approach taken was highly participative, focusing on use of the expertise of the program participants, instead of relying exclusively on the program manager's expertise. During the course of discussion it became clear that there was a split between management and team expectations: management having harder values while team members were focussed on soft issues.

12.3. Case 3

This case, focusing on the Communications Change Management program is provided to show a different use of the analysis framework. Here, the framework was used to examine differences between the hard and soft dimensions of the program at the start and near the end of the program, demonstrating a change in the way the program was managed.

In this case, the goal clarity, level of participation, the measures used to judge success and the management expectations remained the same throughout the life of the project. However, as time progressed, the approach to reaching the goal changed. Initially, an exploratory approach was used, pursuing different solution options, while as the program progressed and a satisfactorily appropriate solution appeared, the emphasis changed from exploring options to refining, then delivering, a single solution.

As the program progressed, it became clearer how the goals were to be reached, the boundary of the program became more defined, and the program permeability reduced in response to a developed understanding of risk management issues. As a method for achieving the goals was settled upon, the perception of the tangibility of the deliverables changed from the management of abstract communication processes, to the delivery of tangible communication packages.

13. Conclusion

The framework for analysing project hardness and softness presented here has been developed by the authors in response to a perceived need for more informed use of the terms ‘hard’ and ‘soft’ in relation to project management. Results from previous research projects, literature review and application revealed that there is little value in a simplistic definition of ‘hard’ or ‘soft’ project management. However, it was found that the hardness and softness of projects could be analysed in terms of seven dimensions.

Practical application of the framework demonstrated that it provided a structure for analysis of influential aspects of project work and a focus around which les- sons learned can be identified and transferred. This framework provides a basis for comparison of projects, and more informed and responsive management approaches. A framework for analysing and discussing the hard and soft aspects of projects leads to enhanced recognition of their complexity and legitimises questioning the standard application of the more readily accepted hard approaches to project management.

This paper contributes to the informed and unambiguous use of the terms ‘hard’ and ‘soft’ in relation to projects, provides a tool for enhanced management, a framework for project categorisation and an aid to the transfer of lessons learned.

References

[1] McElroy W. Implementing strategic change through projects. Int J Project Manage 1996;14(6):32 5–9.

[2] Thiry M. For DAD: a programme management life-cycle process. Int J Project Manage 2004;22(3):245–52.

[3] Yeo KT. Critical failure factors in information system projects. Int J Project Manage 2002;20(3):241–6.

[4] Fernie S, Green S, Weller S, Newcombe R. Knowledge sharing: context, confusion and controversy. Int J Project Manage 2003;21(3):177–87.

[5] Crawford P, Bryce P. Project monitoring and evaluation: a method for enhancing the efficiency and effectiveness of aid project implementation. Int J Project Manage 2003;21(5):363–73.

[6] Kadefors A. Trust in project relationships – inside the black box. Int J Project Manage 2004;22(3):175–82.

[7] Li H, Cheng EWL, Love PED, Irani Z. Co-operative bench- marking: a tool for partnering excellence in construction. Int J Project Manage 2001;19(3):171–9.

[8] Jaafari A. Management of risks, uncertainties and opportunities on projects: time for a fundamental shift. Int J Project Manage

2001;19(2):89–101.

[9] Andersen ES, Dyrhaug QX, Jessen SA. Evaluation of Chinese projects and comparison with Norwegian projects. Int J Project Manage 2002;20(8):601–9.

[10] Wateridge J. The role of configuration management in the development and management of Information Systems/Technol- ogy (IS/IT) projects. Int J Project Manage 1999;17(4):237–41.

[11] Thiry M. How can the benefits of PM training programs be improved. Int J Project Manage 2004;22(1):13–8.

[12] Farrell L. Principal-agency risk in project finance. Int J Project

Manage 2003;21(8):547–61.

[13] Thiry M. Sensemaking in value management practice. Int J Project Manage 2001;19(2):71–7.

[14] Cheung S, Ng T, Wong S, Suen H. Behavioral aspects in construction partnering. Int J Project Manage 2003;21(5):333–43.

[15] Kasvi J, Vartiainen M, Hailikari M. Managing knowledge and knowledge competences in projects and project organisations. Int J Project Manage 2003;21(8):571–82.

[16] Williams MC. Rich pictures on the path towards systemic being. Syst Res Behav Sci 1999;16:369–73.

[17] Buckle P, Thomas J. Deconstructing project management: a gender analysis of project management guidelines. Int J Project Manage 2003;21(6):433–41.

[18] Andersen E, Jessen S. Project maturity in organisations. Int J Project Manage 2003;21(6):457–61.

[19] Martin A. A simulation engine for custom project management education. Int J Project Manage 2000;18(3):201–13.

[20] Shenhar AJ, Dvir D. Toward a typological theory of project management. Res Policy 1996;25:607–32.

[21] Williams T, Hillson D. Editorial – PMI Europe 2001. Int J Project Manage 2002;20(3):183–4.

[22] Thiry M. Combining value and project management into an effective programme management model. Int J Project Manage 2002;20(3):221–7.

[23] Yeo KT, Tiong RLK. Positive management of di?erences for risk reduction in BOT projects. Int J Project Manage 2000;18(4):257–65.

[24] Midgley G. Systemic intervention: philosophy, methodology, and practice. New York: Plenum; 2000.

[25] Wilson F. Flogging a dead horse: the implications of epistemological relativism within information systems methodological practice. Eur J Inf Syst 1999;8:161–9.

[26] Clarke S, Lehaney B. Information systems strategic planning: a model for implementation in changing organizations. Syst Res Behav Sci 1997;14:129–36.

[27] Hall ADA. Methodology for systems engineering. Princeton: Van Nostrand; 1962.

[28] Jenkins GM. The systems approach. J Syst Eng 1969;1(1):3–49. [29] Quade ES, Boucher WI. Systems Analysis and Policy Planning: Applications in Defence. New York: Elsevier; 1968.

[30] Forrester JW. Industrial Dynamics. Cambridge, MA: MIT Press; 1961.

[31] Yeo KT. Systems thinking and project management – time to reunite. Int J Project Manage 1993;11(2):111–7.

[32] Kazi MAF, Spurling LJ. Realist evaluation for evidence-based practice. In: European Evaluation Society 4th Annual Conference; 2000.

[33] Checkland P. Soft systems methodology: a 30-year retrospective. In: Checkland P, Scholes J, editors. Soft systems methodology in action. Chichester: Wiley; 1999. p. A1–A65.

[34] Yeo KT. Planning and learning in major infrastructure development: systems perspectives. Int J Project Manage 1995;13(5):287–93.

[35] Crawford L, Costello K. Towards a transferable methodology for managing strategic change by projects. IRNOP IV, Sydney; 2000.

[36] Costello K, Crawford L, Pollack J, Bentley L. Soft systems project management for organisational change. IRNOP V; 2002.

[37] Costello K, Crawford L, Bentley L, Pollack J. Connecting soft systems thinking with project management practice: an organizational change case study. In: Ragsdell G et al., editors. Systems theory and practice in the knowledge age. New York: Kluwer Academic/Plenum; 2002. p. 47–54.

[38] Turner JR, Cochrane RA. Goals-and-methods matrix: coping with projects with ill defined gaols and/or methods of achieving them. Int J Project Manage 1993;11(2):93–101.

[39] Lane DC. Should systems dynamics be described as a ‘hard’ or ‘deterministic’ systems approach? Syst Res Behav Sci 2000;17:3–22.

[40] Checkland P, Scholes J. Soft systems methodology in action. Chichester, UK: Wiley; 1990.

[41] Hobbs B, Miller R. The strategic front end of large infrastructure projects: a process of nesting governance. PMI Research Conference; 2002.

[42] Kirk D. Hard and soft systems: a common paradigm for operations management? Int J Contemp Hosp Manage 1995;7:13–6.

[43] Munro I. Man–machine systems: people and technology in OR. Syst Pract Action Res 1999;12:513–32.

[44] Flemming QW, Koppelman JM. Earned value project management. Upper Darby, PA: Project Management Institute; 1996.

[45] Leandri SJ. Measures that matter: how to fine-tune your performance measures. J Qual Participation 2001;24:39–41.

[46] Patton MQ. Qualitative evaluation and research methods. 2nd ed. London: Sage; 1990.

[47] Cooke-Davies T. The real success factors on projects. Int J Project Manage 2002;20(3):185–90.

[48] Pulley ML. Navigating the evaluation rapids. Train Dev 1994;48:19–24.

[49] Rose J, Haynes M. A soft systems approach to the evaluation of complex interventions in the public sector. J Appl Manage Stud 1999;8:199–216.

[50] Van der Meer F. Evaluation and the social construction of impacts. Evaluation 1999;5:387–406.

[51] Lee-Kelley L. Situational leadership: managing the virtual project team. J Manage Dev 2002;21(5/6):461–76.

[52] PMI. A guide to the project management body of knowledge. PA, USA: PMI; 2000.

[53] Jackson MC. Systems approaches to management. New York: Plenum; 2000.

[54] Li B, Berg D. Effects of cultural difference on technology transfer projects: an empirical study of Taiwanese manufacturing companies. Int J Project Manage 2001;19(5):287–93.

[55] Jarvis P. The practitioner-researcher. San Francisco: Jossey-Bass; 1999.

[56] Daniel DW. Hard problems in a soft world. Int J Project Manage 1990;8(2):79–83.

[57] Remenyi D, Sherwood-Smith M. Maximise information systems value by continuous participative evaluation. Logist Inf Manage 1999;12:14–31.

[58] Ormerod RJ. Putting soft OR methods to work: the case of the business improvement project at PowerGen. Eur J Oper Res 1999;118(1):1–29.

[59] Thomas J, Delisle C, Jugdev K. Selling project management to senior executives. PA, USA: PMI; 2002.

[60] Lai L. An integration of systems science methods and object- oriented analysis for determining organizational information requirements. Syst Res Behav Sci 2000;17:205–28.

[61] Crawford L. Senior management perceptions of project management competence. Proceedings, IRNOP IV, Sydney, 2002.