Organizationally Informed Method Composition: An Empirically Validated Methodology

Magdy K. Serour, InContext Solutions Pty Ltd - mserour@incontext.com.au
Houman Younessi, Rensselaer Polytechnic Institute, Hartford, CT, USA - youneh@rpi.edu
Darryl Winder, InContext Solutions Pty Ltd - dwinder@incontext.com.au

Abstract

It is increasingly evident that there is no one approach or methodology to software development that suits all types of software projects - even at the organizational level. While modern software methodologies offer advice on the development phases of software, they do not usually offer any guidance in terms of how we can effectively select or tailor an approach that is a good fit from an organizational perspective. The need for an approach – a methodology – that does provide reliable guidance in how to tailor a software development method so that it fits the organization's culture, capabilities, maturity and norms is therefore evident.

In this paper, we present our on-going empirical work (using Action Research) aimed to engineer an organizational methodology through the adoption of a method engineering approach and the deployment of a methodological framework. Subsequently, this engineered methodology would be tailored and used by different teams within the organization in order to design and construct different development methods to suit their individual projects. The organization under study is going through a transitioning process to change their current work culture as their adopted method is no longer viable due to their sudden business growth and consequently, the rapid increase of their IT personnel.

1. Introduction

With the growing complexity of today's business environment and the dynamic nature of software requirements, IT organizations are facing ever increasing pressure to respond to and fulfill business needs rapidly and more efficiently than before. As a result, IT personnel and development teams are desperately looking for new approaches to software development as the old approaches simply do not efficiently scale up to the complexity, dynamicity and size of modern systems.

The adoption of a new approach to software development and accordingly, the deployment of an appropriate methodology becomes a major challenge to software professionals due to the lack of support and guidance on how a development team can choose and deploy a proper method for the project at hand. What makes this situation even worse is that software projects are expected to be very different, in domain, scope, size and type, and selecting one single method or process for all these different projects seems impractical and unattainable [1-5].

This paper reports on an empirical study that has been carried out on an IT organization in Sydney, Australia aimed at providing them with support and guidance on how they might design and construct their own methodology, at the organizational meta-level, that will be used by different teams to create different methods at the project level.

In this paper, we first discuss the importance and the critical role of deploying the right method for the right project. Then we present the underpinning theory of our research and the main objectives that we aim to achieve. This is followed by a presentation of our proposal on how to adopt a situational method engineering approach with the use of a well-defined methodological framework in order to engineer an organizational methodology that can be effectively used by development teams to create different methods for their various projects. Our proposal is based on seminal theoretical research that was tested and validated through several industrial experiments (see [6-9]).

2. Process, Method and Methodology

To begin, we must dispel some confusion with terminology. The terms process, method and methodology are usually used inter-changeably and are often misrepresented and misused in literature and even in education and training courses. There seems to be no agreed-upon definitions in software community for these terms. In this paper, we argue that they are essentially different and they have a completely distinctive meaning therefore, in the next section, we state our definitions of these three important terms, *at least for the purpose of this research*, that will be used heavily throughout this paper to minimize any terminology confusion and also to gain more understanding.

2.1 Process

The Oxford English Dictionary defines "Process" as a series of actions, changes or functions bringing about a result. Also, as a series of operations performed in the making or treatment of a product. Whereas Wang and King [10] define process as a particular and continuous course of action or series of changes intended to achieve a result.

For the intent of this study and based on the above definitions, we may define the software "Process" here as a set of practices (parts of which sequential) that are functionally coherent and reusable for the organization, implementation and management of software. In other words, software development process provides the step-by-step activities that lead

from project initiation and requirement analysis to software construction and deployment.

2.2 Method

According to the Oxford English Dictionary, "Method" is a procedure, technique, or way of doing something especially in accordance with a definite and systematic plan. It is a means implies a manner in which a thing is done or in which it happens to accomplishing something (a product).

Dorfman and Thayer [11] argue that a method has two components: a process element and a work product-focussed element.

Accordingly, we define "Method" as a way of doing something, especially in a systematic way which in turn implies an orderly logical arrangement (usually in steps) supported by a definition of its various products. Hence, where process is all about the "know how", method is all about the "know how and know what".

2.3 Methodology

The Oxford English Dictionary defines the term "methodology" as a set or systems of methods, principles and rules for regulating a given discipline. Whereas The American Heritage Dictionary defines it as a body of practices, procedures, and rules used by those who work in a discipline such as art and science. From a different perspective, Avison and Fitzgerald [12] define a methodology as a collection of many components.

Accordingly, we may classify the term "Methodology" as the study of methods through the theoretical analysis of a set of working methods appropriate to a field of study or to the body of methods and principles particular to a branch of knowledge. In the context and the purpose of this study, we then define a methodology even further as a set of coherent method fragments or components that have been carefully selected, evaluated and put together in order to fulfill the needs of a particular IT organization in terms of software development.

3. The Necessity of Employing a Practical Software Methodology

Nowadays, software systems are substantially growing larger and increasingly more complex and account for an increasing percentage of total computer system cost. So, the quality aspects (a.k.a. the non-functional requirements) of software systems such as reliability, security and maintainability have attracted the attention of business users and software developers alike [13].

Recent studies have shown that these aspects become major concerns and communal fundamentals due to the vital role of software systems in business and also in our daily lives [14]. As such, developing software systems with high quality that must be accepted by the majority of users is not an option anymore but rather it becomes a firm precondition to accept and make use of these systems. As a result, software teams are continually looking for new technology and approaches to improve their way of developing modern software systems and to satisfy business needs.

The role of software methods in development and more importantly in maintenance and update stages where changes are more arduous and costly becomes vital and more important than ever before. Fitzgerald [15] emphasize the critical role of software methods by asserting that while there are very many influences on the success or failure of software development projects, two factors of high importance are the people involved and the methodological approach they use. On the other hand, Botezatu and Botezatu [16] highlight and validate the advantages of employing suitable software methods. They show that the adoption and diffusion of an appropriate software development methodology provides significant improvements in software quality, on time delivery, control of development costs and user satisfaction.

4. Different Methods for Different Projects

As part of our work, we strongly argue that different problems and/or chances for improvement initiate different projects that imply following different, *appropriate and adequate*, methods for successful and satisfactory results.

Practices from real life projects have helped to validate the assertion that software projects are different and it is seldom that we find two projects exactly alike or even similar. Software projects vary greatly in objectives, domain, size, scope, complexity, and criticality. Additionally, there are other factors that strongly contribute to the uniqueness and distinctiveness of software projects including human culture, environmental changes, organizational culture and technological aspects. As a result, it is increasingly being recognized that it is hard or nearly impossible to find or construct one single process or method that can be optimally used for multiple projects. For example, very large projects require more planning, management and control than small projects which in contrast, may better utilize a lightweight process. Intensive, critical and real time projects need more safety, quality assurance, reviews and accurate and extensive testing than other projects. On-line Web applications require a different process to ordinary systems [17, 18]. Brand new systems require a different process to software re-engineering projects. Soft systems (ill-defined) require a different method to well-defined systems. A single project will require a different process to a whole suite of projects (programme) and so forth.

In addition, Hackathorn and Karimi [19] found that no one methodology addresses all required issues. Constantine and Lockwood [1] and Glass [20]

confirm that in the context of software development, there is no one size that possibly fits all and a single methodology cannot work for the whole spectrum of different projects.

5. The Challenge of Choosing an Appropriate Methodology

Contemporary software engineering processes/methodologies have gone beyond the discussion of theory only and have reached a stage where they are "products" in their own right. Henderson-Sellers and Serour [21] assert that in the past years, there have been a plethora of methods from which one might choose. Therefore, the task of choosing an appropriate and practical methodology for an IT organization – and over an array of different projects of various size and context - forms a serious challenge to project managers and IT development teams [22]. This challenge is due to many reasons including:

a) As we stated above, there is no one type methodology that could possibly be used to manage different software projects even at the organizational level.

b) Most of the contemporary methodologies have been designed as "one solution for all projects" that organizations can adopt, the way they are, and then adapt their work culture to suit these methods. In other words, the contemporary methods do not offer a great deal of guidance on how an organization may customize and/or tailor a method to best fit their software development environment. Cockburn [23] declares that each organization must develop its own way of working as opposed to adapting to an existing way.

c) The task of constructing a new method, using a process framework, is considered to be difficult, time-consuming and requires an insightful level of explicit knowledge. Henderson-Sellers [24] declare that in order to utilize a process framework, one needs to have a deep level of knowledge pertaining to different disciplines including method engineering, software construction and the use of process frameworks.

6 Empirical Study with Action Research

The organization under study has joined our research team to take part in an ongoing research project in the area of method engineering and the newly agile development approach. The study organization has agreed to provide an empirical environment and to assist our research team to advance and validate our research hypotheses and at the same time to assist them to design and construct a new methodology for their software development using the Action Research (AR) methodology.

Action research is a research methodology originally used in education research and more recently in information systems research [25]. Using action research, the researcher proposes a hypothesis and then tests it in an industrial setting, acting as both external observer and internal team member. AR was chosen by our team since AR offers the ability of the researcher(s) to contribute both to the practical concerns of people in their immediate problematic situation and to the goals of social science by joint collaboration within a mutually acceptable ethical framework [26-32]. The action research methodology focuses on the collaboration between researchers who are aiming to test and/or prove their theory and practitioners who are aiming to solve their immediate problem(s) and/or enhance their current work culture [25]. In other words, AR has the dual aims of providing a mechanism for practical problem solving (Action) and for testing and enhancing theory (Research). Elden and Chisholm [33] argue that the dual interest of AR provides a win-win scenario for both researcher and participants and plays an effective role in solving practical problems by increasing the understanding of a given social situation through the direct involvement of the researcher in an organizational change that can also positively affect future decisions and actions based on better understanding of the problem(s) at hand [29, 25]. As a result, action research, as an effective qualitative research method, has been widely adopted and utilized for studies in many different disciplines.

6.1 The Existing Culture of the Study Organization

Our study organization[1] for this project is a large IT Services organization with regional headquarters in Sydney engaged in multiple simultaneous projects for a wide range of clients. In order to study their existing work culture as an obligatory step towards a successful change, we have conducted a several meetings with the executive and project management and also with various members from different development teams.

Following our initial investigation, it was evident that the study organization was in a desperate need for a new development approach after their unsuccessful attempt of scaling up their existing process to manage and support their sudden increase in both, the size of their projects and the their IT personnel. So, the main priority was given to the task of developing a new scalable organizational methodology that must be characterized by agile features including flexibility, maneuverability with fast and frequent deliveries.

6.2 Our Proposed Theory

Based on our literature study and initial investigation on the study organization, we argue that in order for IT organizations to enhance and advance their process of software engineering, they need to examine their existing work culture and then

[1] For confidentiality concerns, neither the organization's name nor the names of the people involved will be revealed.

adopt and diffuse new approaches that best suit their development environment. In the context of this research, we assert that IT organizations ought to adopt and employ a practical and appropriate organizational methodology. This methodology should embody a process as well as a notation for representing products and it should provide a standard, yet flexible framework for developing software systems that blends engineering rigor with engineering creativity. Such a methodology that can be customized and/or tailored at project level to ensure a consistent, reproducible approach can then be applied to a suite of projects. We view the practical methodology as a street directory, as a contrast to a recipe book, providing the traveler with a road map and a good guide, for each individual journey, to gaining satisfactory outcomes and reaching the final destination successfully. Using an appropriate and suitable method to the project at hand permits successes to be repeated and most importantly, failures to be avoided.

6.3 The Proposed Solution for the Study Organization,

Hence, in this study, we propose the following solution to validate our theory and also as an attempt to assist the study organization to improve their existing work environment:

- The adoption of a method engineering approach and the utilization of a well-established and metamodel-based process/method framework in order to engineer an organizational ***'type'*** methodology that best suit the organizational development environment by meeting the requirements of the organizational suite of projects.

- Subsequently, project managers and/or development teams within the organization will be able to create method instances of their engineered methodology type for different projects using the concepts and guidance of their adopted method engineering approach.

- Furthermore, the IT organization may apply possible improvement to their methodology type through their practices and learning with the support of their selected process/method framework. Accordingly, this applied improvement and organizational learning will positively reflect on every instantiated method.

Figure 1 illustrates and exemplifies the above proposal

In Object Oriented terms, we express our proposed organizational methodology as a '***type***' while a method is an instantiation of that methodology type for a particular project. Thus, we describe our proposed methodology and refer to it as an organizational methodology type.

Based on some strong recommendations from our research team, *delivered from our findings of other research projects*, the study organization has agreed to adopt the Situational Method Engineering approach and the OPEN Process Framework (OPF) [34] to achieve the objectives of this project. In brief, the following Sections introduce these two adopted approaches.

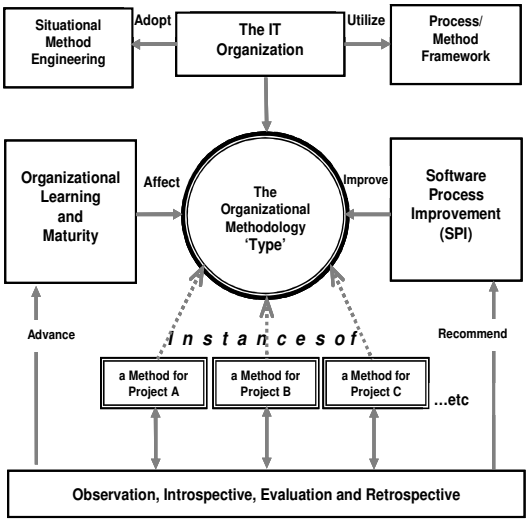

Figure 1: The organizational methodology type

6.4 Situational Method Engineering Approach, Introduction

Situational Method Engineering (SME) is a rational approach to the construction of methods/methodologies from method fragments (a.k.a. method chunks or process components) typically stored in a repository, sometimes known as a methodbase [35, 36]. SME is defined as the creation of a method/methodology specifically tuned to the situation of the project at hand or to best suit an organizational culture i.e. one that meets the requirements of a particular project or the requirements of an organizational suite of projects [37]. One group of researchers [38-41] define Method Engineering as an approach in which a methodology or a method is conceived not as a single intertwined and interdependent entity but as a set of disparate fragments. Method engineering offers the adoption of a mindset of 'do it yourself' or 'create your own' instead of the adoption of a pre-designed and more often biased single method.

6.5 The OPEN Process Framework, Introduction

The Open Process Framework (OPF) is a powerful and rich process framework and not a process or a method per se that can be used or even customized for implementation. The OPF has a large repository of process components, based on a well researched metamodel layer, from which a process engineer can select the appropriate components to construct a specific process for a specific domain and environment [42, 34]. So, the OPF provides an architectural framework, which is evident in its

process metamodel that can then be tailored by the user to create a usable software engineering process [34]. Thus, The OPF architecture gives IT organizations a great deal of flexibility and tailorability to engineer their own method that best suits their development environment.

Figure 2 shows the mechanism of constructing a method/process using the methodbase of the OPEN Process Framework [24].

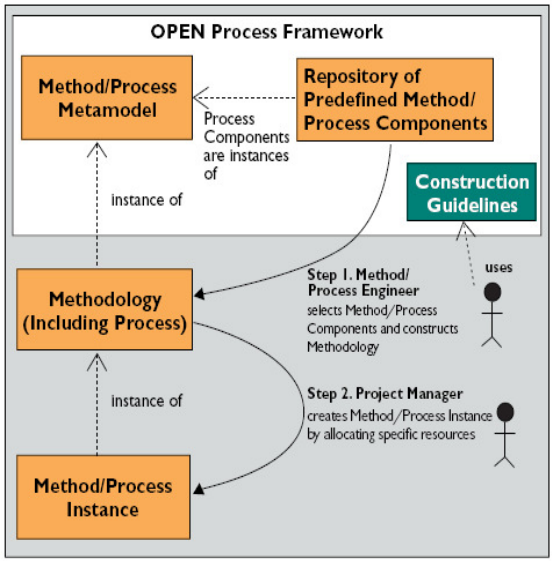

Figure 2: The OPEN the mechanism of constructing a method/process

Based on specific endeavor requirements, appropriate components are selected from the repository, and are then configured using stages and process components; thus adding sequencing, timing and life cycle information. This procedure constructs a project-specific process directly; or it may construct an organizational methodology first, and then a project-specific method [24]. After the project method has been determined, the project manager then instantiates the organizational methodology with actual people, deadlines with real dates and so on.

6.6 The Engineered Methodology Type for the Study Organization

Following our plan, we have completed the first task of our proposed solution by designing and constructing the organizational methodology **type** for the study organization. This methodology is constructed with the intention of taking away the burdensome of constructing an organizational methodology type by only the development teams and/or project mangers. Henderson-Sellers [24] declares that to be able to utilize the OPF you need to have a deep level of knowledge pertaining to different disciplines including method engineering and the use of process frameworks.

Figure 3 illustrates the main structure of this methodology.

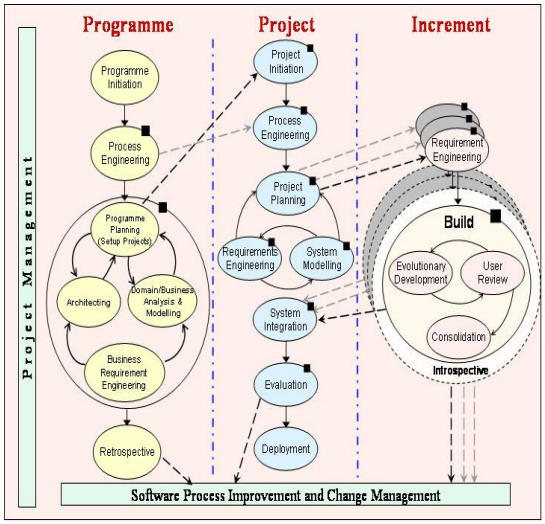

Figure 3: The Organizational Type Methodology

7. The Advantages of the Proposed Solution

As shown in Figure 3, the proposed methodology is designed and constructed as a specific selection of method fragments that would best suit and fulfill the requirements of the study organization. Project managers and development teams - using the principles and guidance of the adopted situational method engineering approach - will be able to configure and assemble a particular method to suit a specific project. In other words, the organizational methodology can be instantiated and/or tailored to manage a programme of projects. Moreover, the instantiated methods (the instances) can be configured as formal (heavyweight) methods or as agile (lightweight) methods or even a method that falls between these two extremes to best fit the situation at hand.

Another substantial benefit of using the above organizational methodology type is that every instantiated method, using that type, for a specific project will embody a process that describes the particular development activities and techniques to be performed and applied on that project as well as the overall framework that describes what tasks are, how they are carried out and how they are organized. Such a method that provides development teams with the capabilities of producing a range of software products for their particular business domain.

Also, as shown in Figure 3, the organizational methodology supports the incremental, iterative and parallel software development approach. The solid line arrows on the diagram represent the iterative aspect between various activities (i.e. revisit or redo work units for improvement). The lane on the right hand side of Figure 3, marked "increment", represents the incremental aspect by allowing the development team to decompose the entire system to a number of manageable and independent parts such as use cases, classes, components and sub-systems

that can be developed independently and/or possibly in parallel.

8. Conclusion

This paper attempts to present study of how an organization might select a software development methodology at a meta-level of the organization. This is a research underpinned approach using the action research methodology. The software development approach has been informed by cultural as well as technical norms, needs, imperatives and limitations to adapt a technical framework using this higher level methodology to compose a development life-cycle that is suited to the environment of the organization, the technical and method requirements of the development team and the specifics of the individual projects.

As such, we advocate that we should roll our own meta-method, but only using well-recognized and tried and true components and to do so based on a standard framework that fits the requirements of the organization. The highly successful action research study conducted has validated the framework proposed.

9. References

[1] Constantine, L.L., and Lockwood, L.A.D., 1994, “One Size Does Not Fit All: Fitting Practices to People”, Reprinted from American Programmer, Vol. 7, No. 12, pp.30-38

[2] Cockburn, A., 2000, Selecting a project’s methodology, IEEE Software 17(4): 64-71.

[3] Jurke, A., One Size Does Not Fit All, Retrieved May 15, 2006, from: http://www.wherescape.com/whitepapers/one_size_does_not_fit_all.pdf

[4] Stonebraker, M. and Çetintemel, U, 2005, "One Size Fits All": An Idea Whose Time Has Come and Gone, Proceedings of the 21st International Conference on Data Engineering (ICDE'05) - Volume 00, pp. 2-11.

[5] Ambler, S., One Size Fits None, Dr.Dobb’s Portal, Retrieved September 15, 2006, from: http://www.ddj.com/dept/architect/184415291

[6] Serour, M.K. and Henderson-Sellers, B., 2004C, “Introducing agility: a case study of situational method engineering using the OPEN Process Framework”, Proceedings of the 28th Annual International Computer Software and Applications Conference. COMPSAC 2004, IEEE Computer Society Press, Los Alamitos, CA, USA, pp.50-57

[7] Serour, M.K. and Henderson-Sellers, B., 2004D, “Empowering a software development team with a new methodology: a case study of e-government in Australia”, Information Technology and Organizations in the 21st Century: Challenges & Solutions (ed. K.S. Soliman), International Business Information Management Association, Proceedings on CD

[8] Serour, M.K., Dagher, L., Prior, J. and Henderson-Sellers, B., 2004, “OPEN for agility: an action research study of introducing method engineering into a government sector”, Proceedings of the 13th Int. Conference on Information Systems Development. Advances in Theory, Practice and Education (eds. O. Vasilecas, A. Caplinskas, W. Wojtkowski, W.G. Wojtkowski, J. Zupancic and S. Wrycza), Vilnius Gediminas Technical University, Vilnius, Lithuania, pp.105-116

[9] Serour, M.K. and Younessi, H., 2006, Towards Method Engineering for Agile Software Development: Theory and Practice, Proceedings of the IBIMA 2006 conference on CD, “Managing Information in the Digital Economy: Issues & Solutions” (ed., Khalid S., Soliman), ISBN: 0-9753393-5-4, Bonn, Germany, June 19-21, 2006

[10] Wang, Y. and King, G., Software Engineering Processes: Principles and Applications, CRC Press LLC, Boca Raton, USA, 2000.

[11] Dorfman, M. and Thayer, R.H., Software Engineering, IEEE Computer Society Press, California, 1997.

[12] Avison, D. and Fitzgerald, G., Information Systems Development: Methodologies, Techniques and Tools (3rd ed), Maidenhead: McGraw-Hill, 2002

[13] Ovaska, P., Working with Methods: Observations on the Role of Methods in Systems Development, Proceedings of the 13th International Conference on Information Systems Development – Advances in Theory, Practice and Education (ISD’2004), Edited by Vasilecas, O., Caplinskas, A., Wojkowski, W., Wojkowski, G., Zupancic, J. and Wrycza, S., Springer US, 2005, 544pp.

[14] NESSI, 2006, From the Official launch of the Technology Platform NESSI (Networked European Software and Services Initiative), Brussels, September 2005 and the I2010 Conference “Towards a ubiquitous European Information Society, Helsinki, 2006

[15] Fitzgerald, B., Russo, N.L. and O'Kane, T. 2003, 'Software development method tailoring at Motorola', Commun. ACM, vol. 46, no. 4, pp. 64-70.

[16] Botezatu, C., and Botezatu, C., 2006, New aspects of Software Development in Economy, Proceedings of ICCCC 2006, Baile Felix, Oradea, Romania, pp. 100-104

[17] Lowe, D., and Henderson-Sellers, B., 2001, “Characteristics of web development processes”, SSGRR : International Conference on Advances in Infrastructure for Electronic Business, Science, and Education on the Internet (ed. V. Milutinovic), Scuola Superiore Guglielmo Reiss Romoli, Italy, 21pp.

[18] Haire, B., Henderson-Sellers, B. and Lowe, D., 2002, Supporting web development in the OPEN process: additional tasks, Procs. 25th Annual International Computer Software and Applications Conference. COMPSAC 2001,

IEEE Computer Society Press, Los Alamitos, CA, USA, 383-389.
[19] Hackathorn, R., Karimi, J., (1993) A Framework for comparing information engineering methods. MIS Quaterly, June. 114. Hammer, M., Champy, J., (1993) Reengineering the Corporation- A manifesto for business revolution
[20] Glass, R.L.: "Process Diversity and a Computing Old Wives'/Husbands' Tale", IEEE Software 17, 4, (2000), 128–127.
[21] Henderson-Sellers, B. & Serour, M.K. 2005, 'Creating a dual-agility method: the value of method engineering', Journal of Database Management, vol. 16, no. 4, pp. 1-23.
[22] Henderson-Sellers, 2002, Agile or rigorous OO methodologies – getting the best of both worlds, Cutter IT Journal, 15(1), 25-33.
[23] Cockburn, A., 2000, 'Selecting a project's methodology', IEEE Software, Vol. 17, No. 4, pp.64-71
[24] Henderson-Sellers, B., 2003, Method engineering for OO system development, Comm. ACM, 46(10), 73-78
[25] Avison, D.E., Lau, F., Myers, M. and Nielsen, P.A., 1999, "Making Academic Research More Relevant", Communications of the ACM, Vol 42, No. 1, pp.94-97
[26] Rapoport, R., 1970, "Three Dilemmas in Action Research," Human Relations, Vol. 23, No. 4, pp.499-513
[27] Lewin, K., 1974, "Frontiers in Group Dynamics I. Concepts, Method and Reality in Social Sciences: Social Equilibria and Social Change", Human Relations, Vol. 1, pp.5-41
[28] Susman, G.I. and Evered, R.D., 1978, "An Assessment of the Scientific Merits of Action Research", Administrative Science Quarterly, Vol. 23, No. 4, pp.582-603
[29] Hult, M. and Lennung, S., 1980, "Towards a Definition of Action Research: A Note and Bibliography", Journal of Management Studies, Vol. 17, No. 2, pp.241-250
[30] Argyris, C., Putnam, R. and Smith, D.M., 1985, "Action Science: Concepts, Methods, and Skills for Research and Investigation", Jossey-Bass Publisher, San Francisco, CA, 480pp.
[31] Reason, P., 1993, "Three Approaches to Participative Inquiry", in Denzin, N. and Lincoln, Y. (Eds), Handbook of Qualitative Research", Sage Publications, London, pp.324-339
[32] Lau, F., 1999, "Toward a Framework for Action Research in Information Systems Studies", Information Technology & People, Vol. 12 No. 2, pp.148-175
[33] Elden, M. and Chisholm, R.F., 1993, "Emerging Varieties of Action Research: Introduction to the Special Issue", Human Relations, Vol. 46, No. 2, pp.121-42
[34] Firesmith, D.G. and Henderson-Sellers, B., 2002, 'The OPEN Process Framework. An Introduction', Addison-Wesley, Harlow, Herts, UK, 330pp.
[35] Kumar, K. and Welke, R.J., 1992, 'Methodology engineering: a proposal for situation-specific methodology construction', in Challenges and Strategies for Research in Systems Development (eds. W.W. Cotterman and J.A. Senn), J. Wiley, Chichester, pp. 257-269.
[36] Brinkkemper, S., 1996, 'Method engineering: engineering of information systems development methods and tools', Journal of Information Software Technology, Vol. 38, No. 4, pp.275-280.
[37] Ralyté, J. and Rolland, C., 2001, An assembly process model for method engineering, in K.R. Dittrich, A. Geppert and M.C. Norrie (Eds.) Advanced Information Systems Engineering), LNCS2068, Springer, Berlin, 267-283.
[38] Rolland, C. and N. Prakash, 1996. A Proposal for Context-Specific Method Engineering. In Procs. IFIP WG8 International Conference on Method Engineering. Atlanta, GA.
[39] Brinkkemper, S., 1996, 'Method engineering: engineering of information systems development methods and tools', Journal of Information Software Technology, Vol. 38, No. 4, pp.275-280.
[40] Ter Hofstede, A.H.M. and T.F. Verhoef, 1997, On the feasibility of situational method engineering, Information Systems, 22, 401-422.
[41] Brinkkemper, S., Saeki, M. and Harmsen, F., 1998, 'Assembly techniques for method engineering', Proceedings of CAISE 1998, Springer Verlag, pp.381-400.
[42] Graham, I., Henderson-Sellers, B. and Younessi, H., 1997, 'The OPEN Process Specification', Addison Wesley, Harlow, UK, 314pp.