

The Role of Feedback in Software Process Assessment

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INTRODUCTION

Processes play a pivotal role in business success of enterprises because effective processes increase their adaptability, efficiency and competitiveness in a global market (Lam, 2014). Lepmets et al. (2012) argued that effective software organizations should align their processes to overall business goals and goals on the operational level, which assumes continuous process assessment and improvement. However, in many cases processes are not well defined, which lead to poor and unsystematic implementation. According to Persse (2006), an organization that uses weak or misdirected processes will have weak products and services, and unpredictable outcomes of business activities. For solving problems with poorly defined and implemented processes, a number of approaches have been proposed and shaped in software process improvement (SPI) frameworks. SPI is a set of activities aimed at achieving better process performance, leading to increased quality of software products and services. However, analysis of reported SPI studies revealed a great variability in success of SPI initiatives (Rainer & Hall, 2003; Montoni & da Rocha, 2014). In addition, Bannerman (2008) argued that implementation of SPI initiatives does not always lead to business benefits.

Process assessment helps software organizations to improve themselves through identification of critical problems and appropriate improvement opportunities. Process assessment is the first phase in SPI cycle, which means that assessment outcomes serve as input for process improvement action plans. Effective assessment requires commitment and involvement of management at all levels in an organization, as well as involvement of staff who implement processes (Mathiassen et al., 2005; Herranz et al., 2013). According to Baddoo et al. (2000), a variety of experiences and attitudes of different groups of people within an organization positively contribute to realization of process assessment and improvement activities. O'Connor & Basri (2012) stated that people involvement in assessment and improvement activities is necessary because employees are the best source of information for these activities and should implement improvements in practice.

Feedback is one of the most valuable tools for achieving continuous organizational development and improvement (Roebuck, 1996). Feedback is essential in assessing and improving organization performance since it is in the core of problem solving activities and it influences decision making while searching for solutions for identified problems (Greve, 2010). Understanding feedback and its effects requires looking at intrinsic sources of information relevant for increasing knowledge and improving performance of individuals and organizations (Greller & Herold, 1975). Considering people as the main sources of feedback information in an organization positively influences the success of improvement initiatives. However, it is necessary to consider and weight potential sources of information, which is usually the task of people within an organization.

Software process assessment includes feedback as a core activity aimed at feeding data back to relevant individuals or groups within an organization. Feedback is usually a part of a typical sequence of activities, which includes collecting, analyzing and interpreting data. Dyba et al. (2004) proposed a measurement and feedback process in the context of software process assessment with the following steps: planning to use data, collecting data, analyzing data, feeding back data, and follow up. Feedback is also used as a method for learning in software organizations based on previous experiences. Heikkilä (2009) suggested that SPI initiatives should be more concerned with organizational learning and change management, which helps in improving processes gradually and based on lessons learned during SPI implementation. In addition, information included in feedback can be used as a basis for decision making. According to Halloran (1999), software process assessment and improvement facilitate organizational learning if all relevant information and knowledge is communicated to organisation's members.

BACKGROUND

The concept of feedback has been researched and used in many different fields, including education, management, marketing, professional training, human resource development, medicine and engineering. Feedback is a complex concept originated in systems thinking and cybernetics. Due to the specificity of different fields, the term feedback has been used and interpreted in many ways, which causes that there is no universally accepted definition of feedback in theory and practice. Ramaprasad (1983) provided the most general definition of feedback: *Feedback is information about the gap between the actual level and the reference level of a system parameter which is used to alter the gap in some way*. Examinations of this definition in recent literature revealed that it cues directions for learning and performance improvement in organizations (Hattie & Timperley, 2007). The most common usage of the term feedback in the research on humans relates to presentation of information to individuals regarding different aspects of performance, such as behavior or outcomes (Atkins et al., 2002). Assessment of functional mechanisms of feedback provides more useful and practical information for managers and practitioners than assessment of feedback characteristics (Alvero et al., 2001).

Feedback is strategically important and valuable tool for assessing and improving organizations in highly dynamic, uncertain and competitive business environment. Based on the literature review on various types of feedback in organizations, DeNisi & Kluger (2000) found that studies reported inconsistent results concerning the effectiveness of feedback. For achieving the best positive effects on performance, and preventing possible negative effects, feedback should be carefully planned and designed. Feedback is generally used for evaluating the level of performance and for indicating improvements. In this sense, feedback is used for identifying a gap between what is observed in the practice and what is expected in improved practice. According to Grafton et al. (2010), the main uses of feedback in organizational context are for: (1) promoting organizational learning, (2) analyzing the impact of past decisions, (3) prompt examination of adopted strategies and targets, and (4) identifying needs for corrective actions. Feedback involves people that provide information and people that interpret provided information. Based on the interpretation of feedback information people make decisions in their organizations. Feedback forms loops between actual performance and established goals. According to Hattie & Timperley (2007), the main purpose of feedback is to reduce divergence between current understandings and performances and proposed objectives.

Types of Feedback

Several approaches for defining and observing feedback can be found in literature. Based on extensive literature review, Gabelica et al. (2012) differentiate two main types of feedback: (1) *performance feedback*, which is concerned with the outputs of observed tasks, and (2) *process feedback*, which is concerned with information how individuals or the teams perform tasks. Performance feedback can be used for performance assessment and improvement. Govaerts et al (2013) described a cyclic process of

performance improvement, which includes feedback. In this process, performance is observed and interpreted within assessment process. This assessment is cognitive process during which an assessor provides a judgment about observed performance. These information is available as feedback that should be correctly interpreted in order to enable performance improvement. Performance assessment activities result with feedback in both quantitative and qualitative formats. According to Gabelica et al. (2012), the following three types of process feedback can be distinguished: (1) *task related feedback*, which is related to information how individuals or groups deal in with tasks within a process, (2) *interpersonal feedback*, which is concerned with social conditions under which a group create and share understanding, and (3) *cognitive feedback*, which refers to cognitive interactions between people in a group.

Sengupta & Te'eni (1993) described advantages of using cognitive feedback compared with outcome or performance feedback. Cognitive feedback relates to information that enhances understanding of observed phenomena and quality of decisions in a given context. Cognitive feedback helps in clarifying past decisions and assists in selecting appropriate decision strategies, providing better control of change implementation within a system. This is very important in projects focused on assessing the state of the practice within organizations and planning and implementing proposed improvements. Outcome feedback, in contrast to cognitive feedback, provides only information about the outcomes of observed process, which is generally insufficient for building comprehensive view and understanding, and therefore leads to less effective decisions and further improvement actions (Sengupta & Abdel-Hamid, 1993).

Feedback Influence on Motivation and Commitment

According to Locke (1996), people need to check their progress while effectively pursuing to proposed goals. Feedback is essential for achieving proposed goals, which means that based on the observed situation it affects goal persistence, disengagement, and goal change (Fishbach & Finkelstein, 2012). In practice, feedback can be positive and negative, but effective assessment and improvement approaches assume proper use of both positive and negative feedback for achieving proposed improvement goals (Fishbach et al., 2010). Positive feedback encourages people to pursue in proposed direction towards proposed goals, increasing their motivation and commitment. At the other hand, negative feedback should be used for identifying weaknesses, the lack of accomplishments and inconsistencies in improvement. In addition, Vallerand & Reid (1988) suggested that positive feedback increases intrinsic motivation, which is largely mediated by the feelings of competence. Negative feedback can also be motivating through self-regulation process, which can lead to making progress towards reducing discovered discrepancy and pursuing toward stated objectives. According to Van-Dijk & Kluger (2004), positive feedback connected with wishes, and negative feedback connected with obligations, increase motivation and commitment.

Feedback and Learning in Organizations

Feedback, as an important and powerful tool for shaping learning in organizations, should be observed from the perspective of individuals, teams and whole organizations (Gabelica et al., 2012). According to Mausolff (2004), organizational processes are the primary source of learning in an organization, while feedback helps in initiating and sustaining organizational learning. The purpose of feedback in organizational learning is to provide information on actual implementation and performance of processes and activities (identification of strengths and weaknesses), encouraging critical reflections of involved people and guiding further activities related to practice improvement. According to Argote (2013), context based learning in organizations is usually based on direct experiences and depends on several factors, among which feedback takes significant role. London & Smither (2002) presented person–environment interaction view of feedback processes over time, and stated that individual positive attitude towards feedback, feedback orientation and feedback culture in an organization enhance performance improvement programs and learning within an organization. In addition, in the context of performance improvement and organizational learning, feedback is not isolated event but an intrinsic part of comprehensive management process over long period of time. Performance feedback that promotes and

facilitates organizational learning should be based on meaningful and sensitive communication between individuals at all organizational levels (Mayfield & Mayfield, 2012). Furthermore, feedback understanding should be enhanced by using consistent feedback terminology and appropriate transmission media.

FEEDBACK IN SOFTWARE PROCESS ASSESSMENT

Performance assessment evolved from a purely measurement based focus to one that recognizes the importance of social and cognitive processes in organizations (Levy & Williams, 2004). Assessment activities are usually implemented within an organization and highly depend on the context that should be completely understood in order to maximize positive outputs. Effective performances of processes require access to relevant information, which comes from many sources like process performers, management, customers and other stakeholders (Heidrich et al., 2006). Collecting information from various sources ensures comprehensive view of processes and more reliable assessment aligned with organization's business objectives. Better process performances lead to better organizational performances and increases maturity of an organization (McBride, 2010).

Due to the longevity and complexity of assessment and improvement projects, the following questions deserve special attention (Aaen et al., 2001): how participants in these projects know whether they as individuals and as the whole organization achieve proposed goals, how they know if perceived benefits are realized, and how they know what are the next steps based on the observed state of the project? According to Aaen et al. (2001), feedback is essential for effective management in software process assessment and improvement initiatives because it helps in: obtaining visible results in several important points during project implementation, keeping the effort in the focus, and maintaining motivation, commitments, and legitimacy. Further, Arent et al. (2000) suggested that project (with included processes) assessment, with feedback provided to relevant people in an organization, supports commitment, participation and learning in an organization conducting SPI project.

Presenting Results

Information included in feedback provides the basis for decision making related to revealing the next activities in an assessment and improvement project. During process assessment, feedback can be seen as information provided by stakeholders regarding understanding of the current state and results. According to Atkins et al. (2002), feedback format should be carefully designed in order to enable integration of data that have emergent characteristics and to provide a relevant basis for judgments. Majority of assessment processes use information in both quantitative and qualitative formats, enabling more comprehensive understanding and evaluation of processes' performances (Brutus, 2010). Feedback results should be presented to all relevant people in an organization, ensuring active participation of employees that are the main source of knowledge. Therefore, their involvement in discussion and interpretation of results is invaluable for the success of assessment project.

Dyba et al. (2004) presented an overview of several techniques for presenting and interpreting assessment results, such as mind maps, brainstorming, tables, diagrams and charts. Stojanov et al. (2013) outlined an assessment approach in which feedback includes information presented to company personnel in the form of trends that are based on statistical analysis of data extracted from the maintenance repository in a small software company. Trends were presented with different types of diagrams (lines, charts, pies) and tables. Zarour et al. (2015) identified feedback sessions as one of the best practical techniques in process assessment aimed at presenting assessment results to organization being assessed. Presenting results in an appropriate way enables their validation, as well as continuous improvement of assessment methods.

Directing and Maintaining Motivation and Commitment

Commitment and motivation play the key roles in process assessment projects, because it is recognized that motivated and supported people are willing to reward greater effort in their work. Arent et al. (2000) pointed out the positive effect of active participation and commitment to assessment project activities and overall SPI process, while Mishra & Mishra (2008) underlined positive effects of periodic feedback sessions on the personnel motivation in assessment projects. Active involvement of organization's staff creates opportunities for maintaining motivation and overcoming many difficulties that may occur during assessment. Dyba & Moe (1999) stressed the importance of active cooperation between employees in an organization and researchers, which ensures maintaining the focus in assessment project, especially in feedback sessions that serve as an effective tool for analyzing the state and directing further activities. Baddoo & Hall (2002) identified feedback as an important motivating factor for developers and senior managers, which can positively affect implementation of SPI projects. In addition, Baddoo & Hall (2003) discovered the lack of management commitment and the lack of feedback to developers as important demotivating factors in SPI projects. Better understanding of actual processes through staff involvement in assessment activities helps in sharing experiences and defining more realistic improvements goals, which increases their motivation toward improvement project (von Wangenheim et al., 2006).

Learning in Software Process Assessment

Feedback can be used as a method for learning in an organization based on the previous experiences and identified issues in assessment process. One of the most effective ways to provide information to people in an organization is by using feedback meetings, where employees can interpret collected data and results from analysis, as well as pack and store knowledge in a way suitable for reusing in future software projects (Mishra & Mishra, 2008). According to Dyba et al. (2004), conducting several feedback meetings helps in transforming individual experiences to collective knowledge in a company. Cater-Steel et al. (2006) pointed out that feedback can be used for collecting experiences from organizations participating in assessment projects, which can be used for providing recommendations for these organizations in future projects, as well as for improving assessment methods.

Dyba & Moe (1999) presented two industrial case studies in which participants from software organizations were provided opportunities to analyze, interpret and learn from the assessment results. Feedback to participants was provided during half-day workshops by using several techniques such as gap analysis, scatter plots, bar charts and histograms. Dyba & Moe (1999) stressed the importance of active participation of company employees, which contributes to better implementation of identified improvements and to learning from the experience. Arent et al. (2000) underlined the significance of learning effect in assessment projects that are based on active involvement of people and on-time feedback provided to relevant stakeholders. In such software organizations, learning occurs at different levels - people learn from each other, positive experiences are transferred between different projects, and managers gain a higher level of professionalism and deeper understanding of practice. Kim et al. (2005) presented an experience factory model for accumulating and utilizing process assessment experiences, which is based on database designed for saving all analyzed data in forms of root words. Collected experiences help in decision making and establishing optimal improvement strategies.

SOLUTIONS AND RECOMMENDATIONS

Success of assessment and SPI projects requires a cross-disciplinary group of assessors that includes researchers and key experts available in software organizations (Pettersson et al., 2008; Feliz, 2012), as well as proper use of feedback during all phases in projects (Takeuchi et al., 2014; Stojanov et al., 2015; Zarour et al., 2015). Due to the complexity of software processes that should be comprehensively investigated, assessment should be based on both quantitative and qualitative data collected in the organizational context (Feliz, 2012, Stojanov et al., 2015). Appropriate and timely analysis, combined with feedback, contribute to the efficiency of assessment, facilitate decision making and identification of the most relevant improvements.

FUTURE RESEARCH DIRECTIONS

Software process assessment plays important role in investigating and improving everyday practice in software organizations. However, new trends in organizing work of geographically distributed teams, and recognized importance of human factors, introduce new challenges regarding practical issues that should be investigated and understood. Based on these observations, development of new methods and techniques that will facilitate work of distributed teams of assessors can be expected. These new methods and techniques will be based on the contemporary Internet and mobile technologies. In addition, the complexity of human factors' effects on practice will require creation of multidisciplinary teams that will include experts specialized in disciplines such as sociology, psychology and human resource management.

CONCLUSION

It has been recognized by both industry and research communities that assessment of software processes is necessary for maintaining and increasing the quality of products and services. This requires effective plans and guidelines for conducting assessments, resulting with identification and implementation of the most valuable improvements. Effective communication between people involved in assessment projects is a premise for success. This communication includes preparation and implementation of assessment plans, but also requires the use of efficient feedback techniques in all phases of assessment in order to achieve the best outcomes.

REFERENCES

- Aaen, I., Arent, J., Mathiassen, L., & Ngwenyama, O. (2001). A Conceptual MAP of Software Process Improvement. *Scandinavian Journal of Information Systems*, 13(1), 79-99.
- Alvero, A. M., Bucklin, B. R., & Austin, J. (2001). An Objective Review of the Effectiveness and Essential Characteristics of Performance Feedback in Organizational Settings (1985-1998). *Journal of Organizational Behavior Management*, 21(1), 3-29.
- Arent, J., Iversen, J. H., Andersen, C. V., & Bang, S. (2000). Project Assessments: Supporting Commitment, Participation, and Learning in Software Process Improvement. In *Proceedings of the 33rd Hawaii International Conference on System Sciences (HICSS)*. Maui, Hawaii, USA.
- Argote, L. (2013). *Organizational Learning: Creating, Retaining and Transferring Knowledge, Second Edition*. New York, USA: Springer US.
- Atkins, P. W. B., Wood, R. E., & Rutgers, P. J. (2002). The effects of feedback format on dynamic decision making. *Organizational Behavior and Human Decision Processes*, 88(2), 587-604.
- Baddoo, N., Hall, T., & Wilson, D. (2000). Implementing a people focused SPI programme. In *Proceedings of the 11th European Software Control and Metrics Conference and The Third SCOPE Conference on Software Product Quality* (pp. 373-381). Munich, Germany.
- Baddoo, N., & Hall, T. (2002). Motivators of Software Process Improvement: an analysis of practitioners' views. *Journal of Systems and Software*, 62(2), 85-96.
- Baddoo, N., & Hall, T. (2003). De-motivators for software process improvement: an analysis of practitioners' views. *Journal of Systems and Software*, 66(1), 23-33.

- Bannerman, P. L. (2008). Capturing business benefits from process improvement: Four fallacies and what to do about them. In *Proceedings of the 1st International Workshop on Business Impact of Process Improvements, BiPi '08* (pp. 1-8). Leipzig, Germany.
- Brutus, S. (2010). Words versus numbers: A theoretical exploration of giving and receiving narrative comments in performance appraisal. *Human Resource Management Review*, 20(2), 144-157.
- Cater-Steel, A., Toleman, M., & Rout, T. (2006). Process improvement for small firms: An evaluation of the RAPID assessment-based method. *Information and Software Technology*, 48(5), 323-334.
- DeNisi, A. S., & Kluger, A. N. (2000). Feedback Effectiveness: Can 360-Degree Appraisals Be Improved? *The Academy of Management Executive*, 14(1), 129-139.
- Dyba, T., & Moe, N. B. (1999). *Rethinking the concept of software process assessment*. In *Proceedings of the 6th European Software Process Improvement Conference, EuroSPI'99*. Pori, Finland.
- Dyba, T., Dingsoyr, T., & Moe, N. B. (2004). *Process Improvement in Practice - A Handbook for IT Companies*. Norwell, MA, USA: Kluwer Academic Publishers.
- Feliz, T. (2012). Lightweight Software Process Assessment and Improvement. In *Proceedings of Thirtieth Annual Pacific Northwest Software Quality Conference, PNSQC 2012* (pp. 405-424). Portland, Oregon, US.
- Fishbach, A., Eyal, T., & Finkelstein, S. R. (2010). How Positive and Negative Feedback Motivate Goal Pursuit. *Social and Personality Psychology Compass*, 4(8), 517-530.
- Fishbach, A., & Finkelstein, S. R. (2012). How feedback influences persistence, disengagement, and change in goal pursuit. In H. Aarts & A. J. Elliot (Eds.), *Goal-Directed Behavior*. New York, NY, USA: Psychology Press.
- Gabelica, C., Van den Bossche, P., Segers, M., & Gijssels, W. (2012). Feedback, a powerful lever in teams: A review. *Educational Research Review*, 7(2), 123-144.
- Govaerts, M. J. B., van de Wiel, M. W. J., & van der Vleuten, C. P. M. (2013). Quality of feedback following performance assessments: does assessor expertise matter? *European Journal of Training and Development*, 37(1), 105-125.
- Grafton, J., Lillis, A. M., & Widener, S. K. (2010). The role of performance measurement and evaluation in building organizational capabilities and performance. *Accounting, Organizations and Society*, 35(7), 689-706.
- Greller, M. M., & Herold, D. M. (1975). Sources of feedback: A preliminary investigation. *Organizational Behavior and Human Performance*, 13(2), 244-256.
- Greve, H. R. (2010). Designing Performance Feedback Systems to Guide Learning and Manage Risk. *Organizational Dynamics*, 39(2), 104-114.
- Hattie, J., & Timperley, H. (2007). The Power of Feedback. *Review of Educational Research*, 77(1), 81-112.

Heidrich, J., Münch, J., Riddle, W., & Rombach, D. (2006). People-oriented Capture, Display, and Use of Process Information. In S. T. Acuña & M. I. Sánchez-Segura(Eds.), *New Trends in Software Process Modeling* (pp. 121-179). Series on Software Engineering and Knowledge Engineering, Vol. 18. Singapore: World Scientific Publishing Company.

Heikkilä, M. (2009). Learning and Organizational Change in SPI Initiatives. In *Proceedings of the 10th International Conference on Product-Focused Software Process Improvement, PROFES 2009* (pp. 216-230). Oulu, Finland.

Halloran, P. (1999). Organisational learning from the perspective of a software process assessment and improvement program. In *Proceedings of the 32nd Hawaii International Conference on System Sciences*. Maui, HI, USA.

Herranz, E., Colomo-Palacios, R., & Amescua-Seco, A. (2013). Towards a New Approach to Supporting Top Managers in SPI Organizational Change Management. *Procedia Technology*, 9, 129-138.

Kim, G., Lee, M., Lee, J., & Lee, K. (2005). Design of SPICE experience factory model for accumulation and utilization of process assessment experience. In *Proceedings of the third ACIS International Conference on Software Engineering Research, Management and Applications* (pp. 368–374). Mount Pleasant, Michigan, USA.

Lam, V. S. (2015). The Basis and Core Knowledge of Business Process Management. In M. Khosrow-Pour (Ed.), *Encyclopedia of Information Science and Technology, Third Edition* (pp. 5303-5314). Hershey, PA: Information Science Reference.

Lepmets, M., McBride, T., & Ras, E. (2012). Goal alignment in process improvement. *Journal of Systems and Software*, 85(6), 1440-1452.

Levy, P. E., & Williams, J. R. (2004). The Social Context of Performance Appraisal: A Review and Framework for the Future. *Journal of Management*, 30(6), 881-905.

Locke, E. A. (1996). Motivation through conscious goal setting. *Applied and Preventive Psychology*, 5(2), 117-124.

London, M., & Smither, J. W. (2002). Feedback orientation, feedback culture, and the longitudinal performance management process. *Human Resource Management Review*, 12(1), 81-100.

Mathiassen, L., Ngwenyama, O. K., & Aaen, I. (2005). Managing Change in Software Process Improvement. *IEEE Software*, 22(6), 84-91.

Mausolff, C. (2004). Learning from Feedback in Performance Measurement Systems. *Public Performance & Management Review*, 28(1), 9-29.

Mayfield, M., & Mayfield, J. (2012). Effective performance feedback for learning in organizations and organizational learning. *Development and Learning in Organizations: An International Journal*, 26(1), 15-18.

McBride, T. (2010). Organisational theory perspective on process capability measurement scales. *Journal of Software Maintenance and Evolution: Research and Practice*, 22(4), 243–254.

Mishra, D., & Mishra, A. (2008). A Study of Software Process Improvement in Small and Medium

Organizations. In H. Oktaba & M. Piattini (Ed.), *Software Process Improvement for Small and Medium Enterprises: Techniques and Case Studies* (pp. 140-157). Hershey, PA: Information Science Publishing.

Montoni, M. A. & da Rocha, A. R. C. (2014). Applying grounded theory to understand software process improvement implementation: a study of Brazilian software organizations. *Innovations in Systems and Software Engineering*, 10(1), 33-40.

O'Connor, R., & Basri, S. (2012). The effect of team dynamics on software development process improvement. *International Journal of Human Capital and Information Technology Professionals*, 3(3), 13-26.

Persse, J. R. (2006). *Process Improvement Essentials: CMMI, Six SIGMA, and ISO 9001*. Sebastopol, CA, USA: O'Reilly Media, Inc.

Pettersson, F., Ivarsson, M., Gorschek, T., & Öhman, P. (2008). A practitioner's guide to light weight software process assessment and improvement planning. *Journal of Systems and Software*, 81(6), 972-995.

Rainer, A., & Hall, T. (2003). A quantitative and qualitative analysis of factors affecting software processes. *Journal of Systems and Software*, 66(1), 7-21.

Ramaprasad, A. (1983). On the definition of feedback. *Behavioral Science*, 28(1), 4-13.

Roebuck, C. (1996). Constructive feedback: Key to higher performance and commitment. *Long Range Planning*, 29(3), 328-336.

Sengupta, K., & Abdel-Hamid, T. K. (1993). Alternative Conceptions of Feedback in Dynamic Decision Environments: An Experimental Investigation. *Management Science*, 39(4), 411-428.

Sengupta, K., & Te'eni, D. (1993). Cognitive feedback in GDSS: Improving control and convergence. *Management Information Systems Quarterly*, 17(1), 87-113.

Stojanov, Z., Dobrilovic, D., & Stojanov, J. (2013). Analyzing Trends for Maintenance Request Process Assessment: Empirical Investigation in a Very Small Software Company. *Theory and Applications of Mathematics & Computer Science*, 3(2), 59-74.

Stojanov, Z., Stojanov, J., & Dobrilovic, D. (2015). Knowledge Discovery and Systematization through Thematic Analysis in Software Process Assessment Project. In *Proceedings of IEEE 13th International Symposium on Intelligent Systems and Informatics* (pp. 25-30). Subotica, Serbia.

Takeuchi, M., Kohtake, N., Shirasaka, S., Koishi, Y., & Shioya, K. (2014). Report on an assessment experience based on ISO/IEC 29110. *Journal of Software: Evolution and Process*, 26(3), 306-312.

Vallerand, R. J., & Reid, G. (1988). On the relative effects of positive and negative verbal feedback on males' and females' intrinsic motivation. *Canadian Journal of Behavioural Science*, 20(3), 239-250.

Van-Dijk, D., & Kluger, A. N. (2004). Feedback Sign Effect on Motivation: Is it Moderated by Regulatory Focus? *Applied Psychology*, 53(1), 113-135. doi: 10.1111/j.1464-0597.2004.00163.x.

von Wangenheim, C. G., Anacleto, A., & Salviano, C. F. (2006). Helping Small Companies Assess Software Processes. *IEEE Software*, 23(1), 91-98.

Zarour, M., Abran, A., Desharnais, J-M., & Alarifi, A. (2015). An investigation into the best practices for the successful design and implementation of lightweight software process assessment methods: A systematic literature review. *Journal of Systems and Software*, 101(March 2015), 180-192.

ADDITIONAL READINGS

Bourque, P., & Fairley, R. E. (Ed.). (2014). *Guide to the Software Engineering Body of Knowledge, Version 3.0, SWEBOK*. IEEE Computer Society.

Christensen, M., & Thayer, R. (2002). *The Project Manager's Guide to Software Engineering's Best Practices*. Piscataway, NJ, USA: Wiley-IEEE Computer Society Press.

Florac, W. A., Park, R. E., & Carleton, A. D. (1997). *Practical Software Measurement: Measuring for Process Management and Improvement, Guidebook CMU/SEI-97-HB-003*. Pittsburgh, PA, USA: Software Engineering Institute, Carnegie Mellon University.

Greve, H. (2003). *Organizational learning from performance feedback*. Cambridge, UK: Cambridge University Press.

ISO/IEC 12207. (2008). *Systems and software engineering - Software life cycle processes*. Geneva, Switzerland: International Organization for Standardization (ISO).

Jones, C. (2010). *Software Engineering Best Practices: Lessons from Successful Projects in the Top Companies*. New York, NY, USA: McGraw-Hill.

Münch, J., Armbrust, O., Kowalczyk, M., & Soto, M. (2012). *Software Process Definition and Management*. The Fraunhofer IESE Series on Software and Systems Engineering. Springer-Verlag Berlin Heidelberg.

Oktaba, H., & Piattini, M. (2008). *Software Process Improvement for Small and Medium Enterprises: Techniques and Case Studies, First edition*. Hershey, PA: Information Science Publishing.

Sommerville, I. (2011). *Software Engineering, 9th edition*. Boston, MA, USA: Addison-Wesley.

West, M. (2013). *Return On Process (ROP): Getting Real Performance Results from Process Improvement*. Boca Raton, FL, US: CRC Press.

KEY TERMS AND DEFINITIONS

Cognitive Feedback: Information that enhances understanding of observed phenomena and quality of decisions in a given context.

Feedback: Information or individual's responses on difference between actual level and proposed level of a system parameter.

Learning: Activity or process of acquiring knowledge or skills through studying or practical experience.

Motivation: The state when someone desires or is willing to do something.

Commitment: The state of being dedicated and focused to do something.

Performance Feedback: Information about different aspects of performances of a task, a system or individuals, which can be used as a basis for improvement.

Software process: A set of activities related to development, maintenance and management of software systems.

Software process assessment: A set of activities planned and conducted with the aim to get insight into the current state of software processes.

Software process improvement: A set of activities planned and conducted with the aim to achieve better performances of software processes, which leads to higher quality of delivered software products and services, as well as to better organizational performance.