Introduction to the Workshop on Technology Transfer in Software Engineering

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ABSTRACT

The goal of the Workshop on Technology Transfer in Software Engineering is to increase our understanding of technology transfer in software engineering, and to learn from successful case studies. We wanted to bring researchers and practitioners together to create an inventory of problems in software engineering technology transfer as seen from both the research and practice points of view, and identify best practices and solutions that have been shown to work.

Categories and Subject Descriptors

K.0 [**Computing Millieux-General**]: Technology transfer in software engineering

General Terms: Management, Experimentation.

Keywords: Empirical studies, technology transfer

1. Introduction

In this workshop foundations and examples of software engineering technology transfer from research labs to industry are discussed. There are indications that software engineering technology transfer is not what is should be: Developments coming from industry often receive scorn from academia but are nevertheless widely used (e.g., UML). Practitioners cannot find the time to reflect on their practice and academics are happily producing solutions of their own, to problems not always perceived to exist by practitioners.

In this workshop introduction we briefly discuss the papers presented in the workshop, classified under the four workshop themes: Conceptual foundations of software technology transfer, problems in technology transfer from the academic and from the industrial perspective, and success stories.

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2. Conceptual Foundations and Empirical Studies of Technology Transfer

Two papers were presented in this theme. In a paper based on his own experience both in academia and in industry, Mikio Aoyama provides some patterns of failed software technology transfer, and provides a co-evolutionary model of successful transfer, in which a mediator matches services provided by research labs to technology requests by software vendors. Research labs, mediators, software vendors and their customers jointly evolve their services and needs by mutual feedback. This paper is a reflection on the author's own experience in industry and in academia.

Alves and Castro discuss the S-shape curve of the lifecycle of emerging technology, and apply it to software technology transfer. The S-shaped curve divides the introduction of new technology in three stages, Introduction, Growth and Maturity. In the introductory stage, industry may sponsor R&D projects to create technology. Consumer wishes are not precisely characterized and market potential at this stage is still uncertain. In the technology growth stage of the S-shape curve, producers aim for a mass market. Close cooperation between research and commercial departments is a key factor to gain market share. In the maturity stage, producers finally have an installed base of customers and there is increasing demand for complementary products and services.

3. Problems in Technology Transfer from the Academic Perspective

Punter, Krikhaar and Bril present a model of technology transfer in which technology engineering mediates between research and industrial practice. At the research side, technologies are developed and empirically validated. When a technology is empirically validated, it is still considered a non-proven technology by industry. At the industry side, new technology is embedded by training users and introducing the technology. Intermediate between research and technology embedding is technology engineering, in which the impact of the technology on the business is investigated. In the

technology engineering stage, a business case for the technology is made, stakeholders identified, tools are scaled up, and risk mitigation measures are taken. The authors point out that successful communication, the availability of technology champions, and a positive return on investment within the time horizon of the responsible manager are critical success factors in this process.

This point is emphasized too by Dave Dorenbos, who advocates making a business case for new technology that makes clear what the impact of the proposed new technology is on elements that go into a profit-and-loss statement, such as Net sales, Cost of sales and Selling, general and administrative (SG&A) expenses. Dorenbos also points out the discrepancy between the time in which a new technology will impact profit-and-loss statements (typically several years) and time in which the impact of alternative measures, not involving new technology, will have on the profit-and-loss statement (typically 3 to 6 months). Software engineering technology transfer requires a convincing business case.

4. Problems in Technology Transfer from the Industrial Perspective

Magnus Larsson, Anders Wall, Christer Norström, and Ivica Crnkovic observe the importance of having a clear transfer strategy. They present the case for having an industrial research center take technologies from academia that are not yet mature, find, applications for them, and assist in their deployment within an organization's business units.

Orit Hazzan and Yael Dubinsky view technology transfer from the perspective of change. They discuss, through the use of illustrative case studies, the value of initially limiting the scope of technology to be transferred from one organization to another, and gradually expanding the transfer over time. In their analysis they observe the importance of initial planning to manage the process.

Pankaj Bhawnani, Guenther Ruhe, Franz Kudorfer and Ludger Meyer describe a technology transfer project between Siemen's Corporate Technology organization and a university. They elaborate on a five stage process: technology creation; preliminary evaluation; advanced evaluation, packaging and support culminating in technology diffusion.

Scott Tilley and Shihong Huang argue that academics need to do a better job of selling the benefits of their technology to their industry partners. They discuss the importance of proactively anticipating and addressing potential objections that an industry partner may have, and give examples of what some of these objections might be.

5. Examples of Successful Technology Transfer

NASA has a long history of successful technology transfer efforts. Michael G. Hinchey, Thomas Pressburger, Lawrence Markosian and Martin S. Feather describe the NASA Software Research Infusion Initiative that brokers collaborations among practitioners and researchers. They have developed a model that has successfully integrated NASA funded research efforts into practice using relatively modest amounts of resources.

Ken McGill, Wes Deadrick, Jane Huffman Hayes, and Alex Dekhtyar discuss the evolution of the research model within the NASA Software Assurance Research Program. They observe the importance of a measurement criteria that includes both the project's organizational penetration, as well as traditional academic measures such as publication in peer reviewed venues.

Obviously many other organizations have been active in technology transfer from academia to industry. Matthew Bass describes several alternate approaches Siemens has taken to effect technology transfer and discusses the lessons learned: appropriate expectation setting, the importance of a transition agent, alignment with corporate initiatives and a recognition that time, not money is often the most precious resource of a development organization.

6. Conclusions

The papers contributed to this workshop represent a variety of issues and approaches based upon a diverse set of experiences in transferring software engineering technology from one organization to another. These experiences and thoughtful reflections on the problems and solutions will contribute to the Workshop's goal of increasing our understanding of technology transfer in software engineering and inventorying universal problems and solutions.

The results of our activities will be posted after the workshop at:

http://www.cs.pdx.edu/~warren/wottse

It is our hope that the Workshop will contribute to more efficient technology transfer and broader impacts on society.