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International Journal of Information Management 24 (2004) 457–472

International Journal of

**Information
Management**

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Prescription, description, reflection: the shape of the software process improvement field

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Abstract

This article reviews 322 representative contributions to the software process improvement (SPI) literature. The contributions are categorised according to a simple framework: whether their primary goal is prescriptive (to tell SPI professionals what to do), descriptive (to report actual instances of SPI programs in software organisations), or reflective (theoretically analytical). The field is found to be rather dominated by one approach (the capability maturity model (CMM)) and heavily biased towards prescriptive contributions. Neither of these trends is necessarily beneficial, and it is argued that more theoretically reflective contributions could encourage a diversity of approaches which might also benefit practitioners.

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Keywords: Software process improvement; Capability maturity model; Literature review

1. Introduction

Software process improvement (SPI) is an applied academic field rooted in the software engineering and information systems disciplines. It deals primarily with the professional management of software firms, and the improvement of their practice, displaying a managerial focus rather than dealing directly with the techniques that are used to write software. To date, it has been primarily practised and studied in America, Scandinavia and Australia. In terms of its theoretical heritage, SPI is equally indebted to the software engineering tradition and the Total

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Quality Management movement (Deming, 1982; Juran & Gryna, 1988). Classical SPI techniques (such as those built upon the capability maturity model (CMM)) relate software processes, standardisation, software metrics and process improvement. However, the field has also expanded to include other approaches (such as the software factory approach) and (at first sight unrelated) issues such as the personal discipline of software engineers and commitment. SPI stakeholders include SPI practitioners (who are responsible for improvement programs), software supplier organisations and the organisations they contract for, government bodies sponsoring research, academics and consultants.

Many of the major contributions to SPI originate from the Software Engineering Institute (SEI) at Carnegie Mellon University (where Watts Humphreys has played a major innovative role). The Institute is industry-facing and supported by the American Department of Defense, whose principle interests are to identify competent software suppliers and ensure the delivery of high quality software. Analysis of the SEI's income for 2002 (the latest available year) showed that 65–73% of their income came from American Department of Defense or American military sources.¹ Many consultancy, teaching and licensing activities are also associated with the SEI, and their directly-sponsored project work amounted to half their income.

In this article, we develop a picture of the shape of the SPI field by analyzing it against three categories representing forms of writing. *Prescriptive* contributions are primarily concerned with informing SPI practitioners how they can carry out software process improvement initiatives. *Descriptive* contributions are primarily concerned with describing those initiatives. *Reflective* contributions are primarily concerned with setting the other contributions in a theoretical context, or developing theory. The analysis framework is described more fully in Section 2.2. In principle this simple framework could be used to analyse any applied academic field. By developing such a picture, we expose some strengths and weaknesses of the field and contribute to focusing the direction of future research.

2. Research method

Webster and Watson (2002) suggest that literature reviews are an important part of the development of the IS field. They offer the opportunity to synthesize and reflect on previous theoretical work, thus providing secure grounding for the advancement of knowledge. They suggest that the elements of a good literature review include a structured approach to identifying the source material and the use of a concept matrix or other analytical framework leading to 'a coherent conceptual structuring of the topic'.

2.1. Article selection approach

The article selection approach focuses on identifying SPI related contributions from top IS journals, SPI heavy journals, special issues on SPI, literature review articles from within the SPI field, key SPI contributors, SPI schools (such as that based at SEI), key authors, relevant e-search tools, and finally identifying books written on SPI. To qualify, contributions should name software process improvement in the title, abstract or keywords and in addition have relevant

¹<http://www.sei.cmu.edu/publications/documents/02.reports/02ar/staff/funding-support.htm>

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