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Introduction

Open Source Software (OSS) is increasingly adopted in industry in various ways, two of which are:

- Adoption of **OSS components** in product development
- Adoption of **OSS development practices** for product development (Inner Source)

In both scenarios, software is developed in a “Bazaar-style,” in the first case an external bazaar, and the second case an internal bazaar. In both scenarios, the developed software is integrated into a final product.

Product development with software “from the bazaar” has been a topic of little study.

Objectives and Research Questions

The research had two research objectives. For the external bazaar (Open Source):

Objective 1: To document challenges and to provide guidance in product development with OSS components.

This objective led to the following research questions:

- RQ1:** What are the challenges associated with integration of OSS products?
- RQ2:** What is the state of the art of OSS evaluation and selection methods?
- RQ3:** What is the importance of architectural knowledge for OSS integrators?
- RQ4:** How can architectural patterns in OSS products be identified?

The second research objective relates to the internal bazaar, or Inner Source:

Objective 2: To identify challenges in Inner Source and to provide insights into when and how Inner Source can thrive.

This led to the following research questions:

- RQ5:** What are challenges and approaches to mitigate them in Inner Source?
- RQ6:** What are the key factors to consider in adopting Inner Source?

Research Methodology

To answer RQ1: A **Systematic Mapping Study** to identify, aggregate and categorise challenges that may arise in product development with OSS products.

To answer RQ2: A **literature study** to identify and compare OSS evaluation methods that have been proposed so far in the literature. This study includes the development of a **comparison framework** (grounded in literature) that is used to compare a number of the OSS evaluation methods.

To answer RQ3: An **exploratory survey** to empirically investigate the importance of architectural knowledge of OSS products.

To answer RQ4: An **empirical study** based on the Improvement Paradigm to develop and assess a process to guide practitioners to identify architectural patterns in OSS products.

To answer RQ5: An **industrial case study** to identify, document and categorise challenges in an Inner Source organisation. The identified challenges are also compared to the challenges related to the use of OSS products.

To answer RQ6: A **literature review** to develop a **framework** to guide the assessment of an organisation’s fit with Inner Source. The framework-based assessment is demonstrated with data drawn from an **in-depth industrial case study** at an organisation that had indicated an interest in adopting Inner Source.

Contributions and Future Work

This research led to six contributions. Figure 1 shows them organized by contribution type and bazaar type (Open Source v. Inner Source).

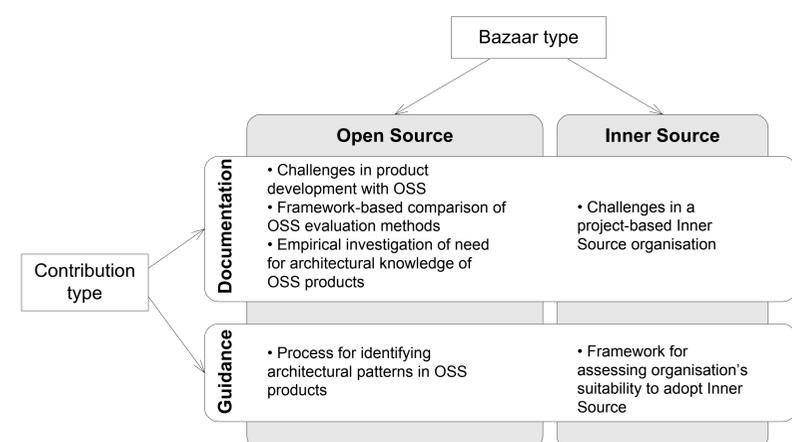


Figure 1. Contributions of the research.

The contributions related to the Open Source literature are:

- A **synthesis and categorization of challenges** in product development with OSS [1][8]
- FOCOSEM: A **framework for comparing OSS evaluation methods**, including the results of the application of the framework [2][8].
- An empirical investigation of the need for architectural knowledge in OSS products, including the **classification of architectural knowledge needed** [3][8].
- IDAPO: A **process for identifying architectural patterns** in OSS product [4][5][8].

The contributions related to the Inner Source literature are:

- An **empirical study of challenges** in Inner Source and a **comparison** of those challenges to an Open Source context (see contribution 1) [6][8].
- A framework for **assessing an organization’s suitability** for adopting Inner Source [7][8].

Future work will focus on Inner Source. In particular, open questions are:

- What are the essential steps for organizations to adopt Inner Source?
- What are the key success factors of a successful Inner Source program?
- How to build a thriving developers’ community within an organization’s boundaries?

Publications

[1] Stol K and Ali Babar M (2010): *Challenges in Using Open Source Software in Product Development: A Review of the Literature*, Proceedings of the 3rd Workshop on Emerging Research in Free/Open Source Software, collocated with ICSE 2010, Cape Town, South Africa,

[2] Stol K and Ali Babar M (2010): *A Comparison Framework for Open Source Software Evaluation Methods*, in: Open Source Software: New Horizons, proceedings of the 6th International IFIP WG2.13 Conference on Open Source Systems (OSS)

[3] Stol K, Ali Babar M, Avgeriou P (2011): *The Importance of Architectural Knowledge in Open Source Software*, in: Hissam, S., Russo, B., de Mendonça Neto, M.G., Kon, F. (Eds.), Open Source Systems: Grounding Research, proceedings of the 7th International IFIP WG2.13 Conference on Open Source Systems (OSS), Salvador, Brazil, IFIP Advances in Information and Communication Technology (AICT), vol. 365.

[4] Stol K, Avgeriou P and Ali Babar M (2010): *Identifying Architectural Patterns Used in Open Source Software: Approaches and Challenges*, in: Proceedings of the 14th Conference on Evaluation and Assessment in Software Engineering (EASE), Keele University, UK.

[5] Stol K, Avgeriou, P, Ali Babar M (2011): *Design and Evaluation of a Process for Identifying Architecture Patterns in Open Source Software*, in: Crnkovic, I., Gruhn, V., Book, M. (Eds.), Proceedings of the 5th European Conference on Software Architecture (ECSA), Essen, Germany, Lecture Notes in Computer Science (LNCS), vol. 6903.

[6] Stol K, Ali Babar M, Avgeriou P, and Fitzgerald B.(2011): *A comparative study of challenges in integrating Open Source Software and Inner Source software*, Information and Software Technology (IST), vol. 53 (12)

[7] Stol K, Avgeriou P, Ali Babar M, Lucas Y, Fitzgerald B (*under review*) *Assessing Organizational Fit with Inner Source: A Framework and Case Study*, Under review at Trans. Softw. Eng. Methodol. (TOSEM)

[8] Stol K (2011) *Supporting Product Development with Software from the Bazaar*, Ph.D. dissertation, University of Limerick.