

A Tool for Transparency Evaluation in Software Ecosystem Portals

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Abstract. *Transparency is a key challenge in the information systems, particularly in software ecosystems (SECO), where developer portals directly influence developer experience (DX). Limitations in information clarity, accessibility, and usability can compromise SECO engagement and platform sustainability. In this context, this paper introduces a Tool for Transparency Evaluation in Software Ecosystem Portals (SECO-TransP), designed to support the assessment and improvement of transparency practices in developer portals. SECO-TransP was developed through an adapted Scrum-based process and verified in a small-scale evaluation. The tool enables SECO platform managers to identify critical transparency issues and provides practical guidance to improve transparency shortcomings. The initial results indicate that SECO-TransP can contribute to a precise and scalable transparency evaluation in SECO.*

1. Context

Some organizations have opened their software platform architectures to enable third-party developers to build new software components upon their technological artifacts. Such a practice characterizes software ecosystems (SECO) [Santos et al. 2024]. Developer portals or SECO portals serve as the primary interaction interface by centralizing documentation, libraries, and repositories [Meireles et al. 2019, Parracho et al. 2024]. To sustain engagement and developer experience (DX), these portals must ensure transparency, i.e., the condition of access to information and data of interest to the developer [Leite and Cappelli 2010]. When information is fragmented or difficult to navigate, platforms lose perceived value. In information systems (IS), this is understood as insufficient transparency [Nunes et al. 2017]. For example, recent developments in the Tailwind CSS ecosystem indicate a decline in direct access to its documentation and services as developers increasingly relied on artificial intelligence (AI) tools to obtain code and guidance, highlighting the need for transparent and trustworthy portal experiences that justify continued engagement in the face of automated alternatives [Jawad 2026].

In this context, this paper introduces a *Tool for Transparency Evaluation in Software Ecosystem Portals* (SECO-TransP)¹, designed to support the assessment and im-

¹Available at: <https://seco-tranp-website.vercel.app/>

provement of transparency practices in developer portals. The tool operationalizes transparency through a set of structured guidelines and collects feedback from developers interacting with the platform in realistic usage scenarios. Its primary goal is to capture developers' perceptions from a DX perspective and translate them into actionable insights. The resulting analysis enables SECO platform managers to identify critical transparency issues and provides practical guidance to diagnose, mitigate, and continuously improve transparency shortcomings.

SECO-TransP was developed through an iterative process inspired by the Scrum framework [Schwaber and Sutherland 2020], adapted to support incremental refinement within an academic research setting. The tool's innovation lies in its original proposal for an assessment workflow that integrates transparency guidelines with practical interaction analysis. This approach allows SECO managers to identify friction points caused by a lack of transparency and make improvement decisions based on actual DX data. The following sections describe the adopted process (Section 2) and present the resulting solution and its observed benefits (Section 3).

2. Adopted Process

The development of the SECO-TransP tool followed an agile, research-oriented process inspired by Scrum [Schwaber and Sutherland 2020], adapted to support incremental refinement within an academic research setting. The process comprised four stages, as described next: Initially, **(1) Conceptualization** involved structured meetings to define and refine the seven transparency guidelines proposed in [Zacarias 2025] that constitute the tool's theoretical foundation. Next, **(2) Iterative Development** operationalized these concepts through weekly increments, in which a researcher acting as product owner designed features and prioritized requirements while the team implemented and reviewed functionalities. To align with the academic setting, traditional Scrum ceremonies were simplified into a single weekly planning and review meeting that was used to assess progress and manage the backlog within a project management tool.

Subsequently, **(3) Stabilization** focused on debugging and incremental refinements based on feedback from collaborating researchers, supported by artifacts such as requirement notes, database models, and interface wireframes that guided implementation decisions. Finally, a **(4) Small-scale Evaluation** verified usability, clarity, and interaction flow through an exploratory study conducted on the Apple Developer portal. The evaluation involved five participants: one information technology (IT) manager who assumed the role of portal manager, responsible for configuring scenarios and validating dashboard outputs, and four students who acted as third-party developers tasked with assessing the portal's transparency.

3. Solution

3.1. SECO-TransP Tool

The main outcome of the process described in Section 2 is the SECO-TransP tool. It employs a set of seven transparency guidelines [Zacarias 2025] as the conceptual basis for conducting evaluations and translating them into structured assessment procedures. To support its application, a computational tool composed of a website and a browser extension was developed to operationalize the assessment process in an integrated environment, enabling its use in real-world scenarios.

The tool constitutes a technological solution designed to analyze, evaluate, and improve transparency in SECO portals by supporting DX data collection and interpretation throughout the assessment process. It includes an interactive dashboard that presents results in a visual and structured manner, facilitating the identification of adherence levels to the established guidelines. The assessment requires at least two roles: a SECO portal manager, responsible for configuring the evaluation and monitoring outcomes, and one or more third-party developers, who provide empirical data based on their real usage experience.

The evaluation process comprises six stages: **1)** the manager configures the evaluation by selecting the target portal; **2)** usage scenarios are defined (Table 1), and an evaluation code is generated and shared; **3)** developers access the SECO-TransP and UX-Tracking² extensions using the code and complete a profile questionnaire; **4)** they provide brief feedback on task execution and difficulties; **5)** the tool collects detailed assessments based on key success criteria (KSC); and **6)** results are processed and consolidated into a dashboard (Figure 1) with heatmaps highlighting critical interaction hotspots.

Table 1. Example of a scenario used in the SECO-TransP tool.

Scenario	1 - Exploring Resources to Start Development
Scenario Context	Represents developers' first interaction with the ecosystem, where they need to understand what resources are available to begin working effectively.
Description for the Developers	Imagine that you have just joined a project within this software ecosystem and want to understand how to get started. Explore the portal freely to locate documentation, source code repositories, and available development tools (e.g., SDK, API, or technical guides). Your goal is to assess how easily these resources can be found and how clearly they are presented.

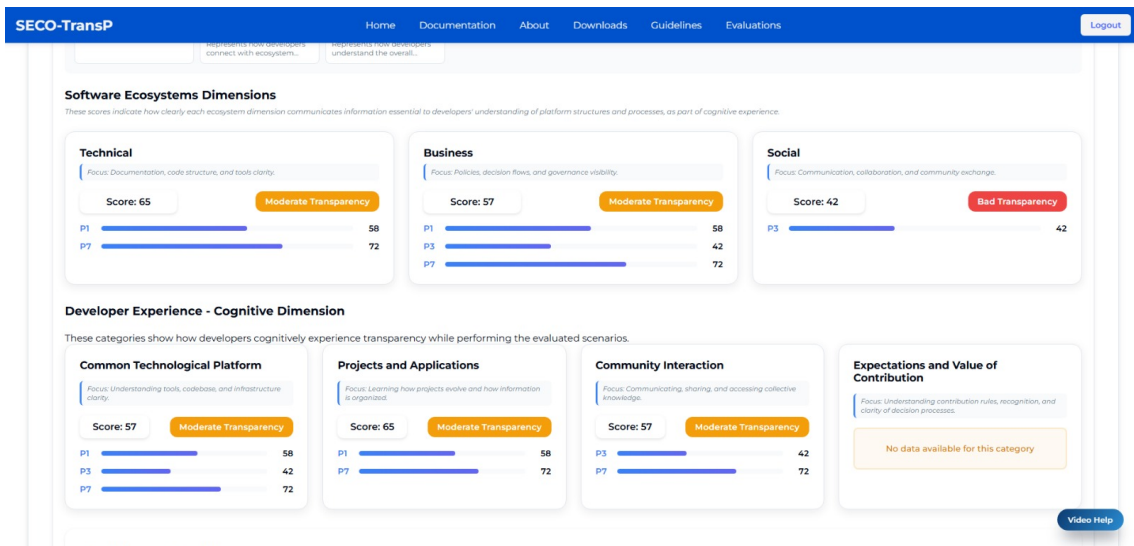


Figure 1. Evaluation dashboard.

From a technical perspective, the tool was implemented in Python using the Flask³ microframework, with data stored in a MySQL database. It follows a client-server architecture, where the browser extension collects interaction data, and the backend handles

²UX-Tracking records user interactions (e.g., mouse movements, clicks, and navigation paths) to analyze usability and user experience [Lima et al. 2022].

³Available at: <https://flask.palletsprojects.com>

storage and processing. The source code is available on GitHub⁴, with additional details about metrics and dashboard components in the documentation⁵ and in the supplementary material on Zenodo⁶. Although evaluated on a limited dataset, the architecture supports scalable data collection.

The small-scale evaluation yielded feedback that improved the tool and its application. Suggested additions, such as a usage tutorial, a glossary for SECO and transparency terms, and refined DX questionnaire items, were incorporated into version 2. The implementation was registered at the Brazilian National Institute of Industrial Property (INPI) under record BR512026000610-4 [Santos et al. 2025].

3.2. Benefits for Organizations and the Software Industry

SECO-TransP distinguishes itself by integrating transparency guidelines [Zacarias 2025], automated interaction data collection through a browser extension, and analytical visualization via a dashboard into a unified evaluation tool. Unlike traditional approaches based on manual inspections or isolated questionnaires, it gathers empirical evidence during real portal use through multimodal UX-Tracking [Lima et al. 2022], generating interaction hotspots to support transparency assessment.

Companies can adopt this approach within their continuous DX monitoring pipelines, enabling a data-driven evaluation process that bridges academic research and industrial practice. By grounding the analysis in real developer interactions, SECO-TransP identifies potential areas for transparency enhancement in usability, accessibility, and information comprehension, although these findings are limited by the small sample size. From a managerial perspective, dashboards prevent engagement declines (e.g., Tailwind) by supporting data-driven decisions that highlight critical portal friction points and prioritize retention-focused improvements.

SECO-TransP advances prior efforts such as ITRANSPE [Meireles et al. 2019] by moving beyond checklist-based assessments and incorporating cross-analysis of DX data from real interactions. It also complements UX-Tracking [Lima et al. 2022] by adding a semantic layer that interprets behavioral traces through transparency guidelines, turning interaction data into structured evidence within a unified workflow.

While multimodal tracking proved valuable, it introduces instrumentation and configuration challenges that may affect adoption. Future work includes refining deployment, exploring AI for data interpretation and automation, and conducting larger-scale evaluations with more participants across diverse real-world SECO portals.

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⁴Available at: <https://github.com/alexandr10cl/SECO-Transparency-Framework>

⁵Available at: <https://seco-tranp-website.vercel.app/doc>

⁶Available at: <https://doi.org/10.5281/zenodo.19372176>

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