Learning Path to an Emergent Ecosystem: the Brazilian Public Software Experience

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ABSTRACT
Brazilian Public Software (SPB in Portuguese) is an innovative experience in public administration. It combines features of the free software production model with the concept of public goods and is delivered by a portal that links different people and interests. The evolution of SPB as a digital ecosystem can be best understood using Complex Thinking Theory (CTT). The paper describes how methodologies based on System Thinking, part of CTT, were used to obtain empirical evidence that the SPB ecosystem evolves in learning cycles and concludes that this could result in a maturity model for SPB.

Categories and Subject Descriptors
K.4.3 [Organizational Impacts]: Computer-supported collaborative work

General Terms
Maturity model, cooperative engineering.

Keywords
E-Government, digital emerging ecosystem, virtual network apprenticeship, network quality model

1. INTRODUCTION
This article presents a model with which to understand the learning process experienced by a cooperative network that produces public software in the Brazilian government sphere. Brazilian Public Software (SPB in Portuguese) is a project of the Planning, Budget & Management Ministry of Brazil (MPOG) that introduces a new concept and operating structure for software production. Its aim is to improve efficiency in government. It began officially in 2006 and is embodied in a portal (http://www.softwarepublico.gov.br/) with over 50,000 registered users. Some 30 software solutions are available via the portal, mostly developed by public entities with a few from private enterprise.

The SPB project is open source, allowing access to source code in accordance with the free software model, but it also includes the following obligations for entities interested in making software available as a public good: (a) software licenses must be GPL-compatible; (b) software guidebooks must be provided; (c) there must be a focal point to assure a communication interface with society; (d) associated services must be provided for communication with and among users (forums, blogs, version control tools etc); and (e) collaboration with the virtual community must be appropriately managed.

The ecosystem is evolving fast. This raises questions about the future of SPB, such as: How to understand this evolution? What metrics will show whether the ecosystem is evolving in terms of initial objectives, economic impacts etc? How to interact with the implementation of an emergent ecosystem? Can it be influenced or induced to produce better social results? The answers to these questions will help us understand the nature of the system’s growth. Like a living organism, the SPB ecosystem responds to pressure from its environment (i.e. its social, political and economic context).

To find the answers to these and similar questions, a methodology suited to the dynamic nature of SPB is required. Complex Thinking Theory (CTT) provides theoretical elements that adequately address the reality of SPB. System Thinking [3] is part of CTT and offers some cognitive tools for the systemic mapping of SPB. Some steps of the System Thinking approach were therefore applied.

The learning process generated by this mapping exercise showed that learning also occurs in the SPB ecosystem. Learning cycles and the corresponding actions can be used to build a maturity model for an emergent ecosystem like SPB. This is especially relevant to the SPB project given the importance of the quality of
the system as a whole, as well as the quality of each part, software quality, community response etc. Thus the study described below set out to comprehend the complex dynamic of the ecosystem, analyzing SPB not just as a set of components but as a universe of behavior patterns generated by the interaction of these components.

2. COMPLEX NATURE OF SPB AND LEARNING CYCLES

For a situation, challenge or system to be considered complex, at least two basic conditions must initially be met [1]: (i) identical past and present actions have entirely different results in time or space; and (ii) the perceptions and interests of different actors in the ecosystem add non-linearity and non-triviality to problem identification and resolution. These two conditions were detected in the SPB ecosystem via a preliminary qualitative survey comprising interviews, group meetings, and a review of secondary sources of information.

Applying the steps to build a systemic map of SPB and the main actors, we obtained the following set of critical variables that shape the ecosystem’s development path:

Table 1 – Critical Variables of SPB

<table>
<thead>
<tr>
<th>1. INFRASTRUCTURE &amp; ARTIFACTS</th>
<th>2. DISSEMINATION &amp; RELATIONSHIPS</th>
<th>3. OUTPUTS &amp; IMPACTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of portal users</td>
<td>Dissemination of SPB model and results</td>
<td>Software adoption cost reduction</td>
</tr>
<tr>
<td>Number of new software solutions</td>
<td>Partnerships</td>
<td>User satisfaction and loyalty</td>
</tr>
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<td>Investment in portal infrastructure</td>
<td>Political support</td>
<td>Training</td>
</tr>
<tr>
<td>Infrastructure capacity</td>
<td>Usage of BPS software</td>
<td>Meeting needs of society</td>
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<td>SPB software quality</td>
<td>Software industry interests</td>
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<td>Life cycle of SPB software</td>
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<tr>
<td>Quality of interaction inside SPB virtual communities</td>
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The evidence of these variables and clustering in groups (infrastructure, dissemination etc) led the team to analyze relations among them. In addition, learning cycles were found to focus the mind and raise doubts, questions, uncertainties, wishes etc. These cycles are not separate but form circles of causation: they are present in each community or working group, as well as the ecosystem as a whole.

Three learning cycles were observed in the SPB experience: (i) learning related to structural elements and components of SPB; (ii) learning related to relationships in the ecosystem; (iii) learning related to behavior patterns.

The cycles were found to occur in a sequence rather than being discontinuous. The first cycle continues in the second cycle, albeit less intensely, while the third cycle occurs during the first and second, but is not the focus. The following figure expresses this interweaving graphically:

The first cycle comprises learning related to portal infrastructure and basic operating routines, i.e. to the efficiency, security, stability etc of the IT structure. It also includes understanding, improvements etc related to the three basic elements of the SPB system: actors, entities and artifacts. Actors are the individual participants in the portal. Entities are the organizations that support the SPB’s existence or partner with it. Artifacts are the outputs of the SPB system. In this cycle the focus is on the quality of operations and of portal artifacts. There is a great deal of experimentation to determine the limits of platform tools and many improvements are made to basic routines thanks to contributions from participants in communities. As mentioned earlier, in this cycle there is already a certain awareness of ecosystem relationships and the behavior of the SPB system as a whole, but it is incipient because of the need to win the trust of portal users. Efforts are made to improve quality, usability, supporting activities etc. New artifacts beyond software are considered, such as quality guides, interoperability directives, new business models etc. There is a movement to expand the frontiers of the ecosystem by collaborating with universities, other government agencies etc. The second cycle expresses the maturity of the relationships encompassed by the ecosystem. In this cycle there is learning about the network of relationships and their intensity, extent, linearity or non-linearity, as well as the time taken to achieve results etc. Comprehension of the ecosystem’s potential broadens and its identity expands. The third cycle relates to a long-term vision of the ecosystem. It expresses the goal of assuring the continuity of the ecosystem on sustainable foundations. This cycle involves learning about the extent of SPB’s impacts and the systemic intelligence of the ecosystem. It encompasses learning from scenario studies, computing simulations and other elements that suggest ideas to adopt, strategic fields to consider etc. The end of the third cycle generates feedback for use in redesigning the basic structure of the SPB ecosystem and restarts the learning process at a higher level, like a spiral.

3. FINAL CONSIDERATIONS

The use of Complex Thinking Theory in the Brazilian Public Software project built a theoretical basis that adheres more closely to empirical evidence than conventional approaches. Its use enabled not only better insight into the system’s dynamics, but also the perception that the SPB project has evolved through cycles of learning. These cycles seem to indicate a basis for a maturity model, which the authors are now developing.

4. REFERENCES