How to estimate the value of open intangible assets?

An exploratory study

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ABSTRACT

Open innovation practices are widespread in the industry. The software sector, marked by the rise of open source, is a striking example. This paper presents the preliminary results of an exploratory research on estimating the value of open intangible assets. Our approach favors simplicity and relies on a partial automation of the evaluation. An evaluation structure, distinguishing the different forms of value involved in open intangible assets, particularly applicable to software, is provided as an illustration of the proposed approach.

Author Keywords

open innovation; open source; business model; intellectual property; digital transformation.

1) CONTEXT

The concept of open innovation, popularized by the work of Chesbrough et al. (2006), arouses the interest of both researchers and industry. Companies are invited to exploit the innovations produced by third parties (inputs) and to valorize the innovations produced within them (outputs), not only through the marketing of new products but also by granting a right of use to third-party companies (eg licenses). These transactions typically involve the exchange of intellectual property rights (eg patents).

The opening of the innovation process precedes the work of Chesbrough. Previous decades had seen the emergence of free software and then open source (see Open Source Definition, https://opensource.org/osd) in the field of software. Faced with the reality of spin-offs such as open data (data) or open hardware (manufactured goods), Pénin (2011) proposes a framework, called open source innovation, generalizing the principles of open source (software) and distinguishing itself from open innovation by a wide sharing of knowledge (eg source code), an organization without hierarchy (development) and a weak appropriability regime (licenses). However, West (2003) has shown that within this very open concept of the innovation process brought about by open source, varying degrees of openness were possible (eg, open parts or partly open approaches). This question of the degree of openness arises outside the open source sector (eg co-creation with users) and implies changes in the use of intellectual property rights (Viseur, 2016b).

In the software domain, open source has been the subject of research for some fifteen years, whether on business models or project governance (for a summary: see Viseur, 2013 and 2016a). The rise of companies alongside communities has also been analyzed by Fitzgerald (2006). Over the years, many companies, young or well established, have chosen to invest in open source: Netscape (1998), IBM (2001), Novell (2003), Sun Microsystems (2006),... until the tremendous turnaround of Microsoft positioning in 2012 its Azure platform as the world's largest open source cloud! Major purchases from open source companies also came in: MySQL ($1 billion), Cygnus Solutions ($674 million), JBoss ($350 million) or Zimbra ($350 million). In particular, they asked the question of methodologies for estimating the value of open source companies and their assets. Indeed, the methodologies for evaluating the value of software (eg COCOMO and SQALE) are not sufficient for software whose ownership is shared with users (eg source code).

Morever we observe a growing interest in the valuation of immaterial assets such as software and trademarks but also human or organizational capital (Fustec & Marois, 2014).

2) METHODOLOGY

This preliminary work relies mainly on three working hypotheses.

First, the open source literature provides the necessary material for the proposition of a first set of solutions. Open source software represents an example of an open intangible asset whose development methodology has been the subject of experimentation, spreadings (eg Raspberry Pi or Arduino) and studies by professionals or scientists. Open source is also a major industrial sector (4.1 billion euros in France in 2015 according to the Conseil National du Logiciel Libre) that allowed large-scale experimentation of open innovation practices.

Second, the share of knowledge in manufactured goods is increasing (Foray, 2009). In practical terms, this involves both digital manufacturing techniques (eg 3D printing) and embedded intelligence (eg connected objects). The development of manufactured goods therefore increasingly passes through the accumulation and mobilization of

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knowledge, including software (whose source code can be seen as a highly codified form of knowledge).

Thirdly, the valuation of open intangible assets requires different levels (as, for example, of quality assessment), ranging from simple and approximate approaches (eg comparison of projects before possible buy-out) towards complex and precise approaches (eg finalization of a buy-back).

This preliminary work aims to outline a form of micro-evaluation of open intangible assets. It can be seen as an exercise in developing a simplified approach, allowing a quick estimation of the value of an asset, complementary to a more precise, complete and complex approach. In particular, it proposes a breakdown between different sources of value, in order to: (1) facilitate the understanding and explanation of the calculated total value (pedagogical dimension) and (2) facilitate the distribution of work (research, evaluation and evaluation) between complementary experts (multidisciplinary dimension). The results are based on a state-of-the-art literature dedicated to evaluating the value of software (eg COCOMO) and open source software (business models, intellectual property and governance).

3) RESULTS

We distinguished:

(1) the production value of the open intangible assets (eg open source software) and the value of the intellectual property (eg trademarks) ;

(2) the captured value of the open intangible assets (ie the part of the total value that the company is able to capture for its own benefit) ;

(3) the commercial value of the project associated to the open intangible assets.

Value of technical objects - The value of the technical objects is estimated by the size and characteristics of the project (eg COCOMO[1] method), less the value of the technical debt[2] (eg SQALE model), estimated from quality metrics (eg cyclomatic complexity or comment rate) possibly published (eg SonarQube).

Value of externalities - The value of externalities can be estimated from the value of the source code contributed by the community (contributions), possibly monitored and published (eg OpenHub), modulated by an annual growth rate. That rate depends on the company effort in software diffusion, software adoption, opening governance factor and animating the community. The governance openness can be calculated based on the Open Governance Index[3].

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Production value of an intangible asset      (€)
=       Value of technical objects           (€)
+       Value of externalities         (€ / year)
        x      3                       (year)
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Table 1. Production value of an open intangible asset (eg open source software).

The production value (Table 1) is computed for a given maturity level. The maturaty can be measured by TRL (Technology Readiness Level) scale (Mankins, 2009).

Value of Intellectual Property - The value of intellectual property depends on the value of trademarks, patents and copyrights (eg software for opening parts). This section is more concerned with the assets privatized by the company (reinforced appropriability regime) and whose value is estimable on the basis of widespread expertises. The trademark is particularly important for open source companies. A taxonomy of brand valuation methods can be found in Salinas & Ambler (2009) including cost based methods, brand sales comparison and income based methods.

The brand value could be computed for a given maturity level measured by BRL (Brand Readiness Level) scale established by analogy to TRL.

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[1] Boehm has developed a hierarchical series of three models under the generic term COCOMO (Constructive COst MOdel). The models are called basic, intermediate and detailed COCOMO (Boehm, 1981). Basic COCOMO "*is intended to provide quick, early, rough order of magnitude estimates suitable for first cut costing exercises*" (Kitchenham & Taylor, 1984). At that time some additional thoughts about software estimating were added by Putnam (1978). OpenHub platform uses Basic COCOMO for estimating the value of public open source software. Similar approach was also used by McPherson et al. (2008) to estimate the value of Linux kernel and GNU/Linux distribution.

[2] The technical debt can be calculated as the effort required to correct quality flaws (e.g. undue complexity, lack of comments or code smells) that remain in the code. It is based on static source code analysis; its computation can be based on the SQALE (Software Quality Assessment based on Lifecycle Expectations) methodology (Campbell, 2016). The technical debt ratio can be defined as the ratio between the technical debt and the development effort. The efficiency indicator relays the capability of the development team to produce code with an expected quality level (Devos et al., 2013). It can be defined as the ratio between development effort reduced by technical debt and development effort.

[3] The Open Governance Index allows to measure the governance of an open source project and gives a score between 0 and 100%. If West (2003) asks "how open is open enough", Laffan (2011) answers how open is really open. The index uses 13 specific governance criteria accross four areas of governance: access, development, derivatives and community (Laffan, 2011; Laffan, 2012).

The company is able to capture only a part of the intangible assets value (Table 2).

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Captured value of an intangible asset         (€)
=       Production value of intangible asset  (€)
        x      degree of control              (%)
+       Value of the trademark                (€)
        x      degree of capture              (%)
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Table 2. Captured value of an open intangible asset (eg open source software).

The degree of control is a function of the internal development effort and the ownership of the source code (eg contributor agreement). It can be calculated by the percentage of source code produced by the company with a minimum of 50% if the contributions property is shared by contributor agreement or if the license is a permissive one (eg MIT or BSD).

The degree of capture is a function of the trademark ownership. The degree of capture is equal to 100% if the company is the owner and 0% if not. The power of the association between company name and the project name (trademark) could be used to offer a continuous measure (for example by a share of voice ratio).

<u>Commercial value</u> - The commercial value is estimable by the Net Present Value (NPV) of the project (Fraix, 1988). Based on the projected net cash flow of the project, the NPV can integrate future market-related opportunities and, in particular, the growth potential (eg disruptive innovation), which can be anticipated from trends (eg Gartner Hype Cycle).

The value is computed for a given maturity factor. The maturity factor estimates the potential for achieving a business goal. It can be based on the IRL[4] model (Innovation Readiness Levels). The IRL higher levels are influenced by the scalability of the solution based on the maturity of the development process (eg micro-evaluation) and the operational infrastructure (eg extensibility of the IT infrastructure), among other things.

4) EXAMPLE (FICTIVE CASE)

The software <fictivesoftware> accounts for about 305k lines of source code and represents an estimated effort of 80 person-years (Basic COCOMO method). The value is estimated at 4 millions (euros). The technical debt ratio accounts for 4.5%, so the efficiency accounts for 95.5%. The company produces the quarter of the source code and imposes a contributor agreement to the developers in the community, so the degree of control accounts for 50%. The community produces 30k lines of source code by year; the value is estimated at 400 thousands (euros). The Open Governance Index is evaluated at 40% and has to stay stable. All other things being equal the annual growth rate is of 0.0%. The name is protected by a popular brand whose the value is estimated at 1 million (euros). The Net Present Value is estimated at 5 millions (euros) over 3 years. The IRL of the software reaches 8 level, so the maturity factor accounts for 87.5%.

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Production value of the software <fictivesoftware>
=       € 4,000,000
        x 95.5%
+       € 400,000
        x 3
        x (1 + 0.0%)
=       € 5,020,000

Captured value of the software <fictivesoftware>
=       € 5,020,000
        x 50.0%
+       € 1,000,000
=       € 3,510,000

Commercial value of the software <fictivesoftware>
=       € 5,000,000
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Table 3. Production and captured value of an open source software (example).

The 3 years time interval is used as common investment payback period. The method leads to a cumulated value of 7,855,000 euros (Table 2).

CONCLUSION

This paper presents the preliminary results of an exploratory research on estimating the value of open intangible assets, favoring simplicity and relying on a partial automation of the evaluation. The evaluation structure distinguishes the different forms of value involved in open intangible assets and is illustrated by an example for software.

Opportunities for improvement consist, on the one hand, in the realization of a set of case studies of open source software acquisitions based on the factors identified in the literature and, on the other hand, in the generalization beyond software (eg adaptation and validation).

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[4] The IRL model (Innovation Readiness Levels) was developed in the context of GotoS3 Interreg project (Gillieaux & Erpicum, 2016). It is inspired by the TRL model (Technology Readiness Levels). As the TRL model allows to estimate the maturity of technology on a 9 levels scale, the IRL model allows to estimate the maturity of innovation on a 9 levels linear scale categorized in three layers related to exploration (eg requirement and early prototyping), market orientation (eg late prototyping and commercialization) and exploitation (eg scalability and growth).

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