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# A Qualitative study on the Adoption of Open Source Software in Information Technology Outsourcing Organizations

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**Abstract.** The purpose of this paper is to identify the influence of Outsourcing on Open source software (OSS) and further investigate the factors that impact the adoption of OSS in global Information Technology (IT) outsourcing organizations serviced by Indian IT services providers. This exploratory research adopted positivism research philosophy and qualitative approach. An in-depth interview was conducted with ten participants across IT outsourcing organizations, IT service providers, and OSS service providers. The results show that IT outsourcing was not found to have an impact on OSS adoption. However, eight factors including management support and OSS support availability was identified to influence OSS adoption. IT services providers can utilize this research model to increase their understanding of why some IT outsourcing organizations choose to adopt OSS, while seemingly similar ones facing similar market conditions do not.

**Keywords:** Open source software, OSS adoption, IT Outsourcing, TOE, Diffusion of innovation, Indian IT

## 1 Introduction

Over the past two decades, open source software (OSS) has gained significant momentum and has changed the way software is perceived, developed and deployed. It is often seen as a disruptive technology that has changed the rules of the industry. In India, Information Technology (IT) industry is one of the most significant growth contributors. As a proportion of India's Gross Domestic Product, aggregate IT sector revenues have grown from 1.2% in 1998 to 8.1% in 2014 [1]. A Gartner report highlights that IT outsourcing organizations are compelled to look at OSS alternatives as concerns around security, performance and technical support are increasingly addressed and India-based IT services providers must evolve to capitalize on this OSS trend [2]. In this study, we explore the role of outsourcing in OSS adoption and develop a conceptual model for OSS adoption in Global IT Outsourcing Organizations (Clients) serviced by Indian IT services providers (Vendors). The scope of this study included Indian IT services providers that are members of the National Association of Software and Service Companies (NASSCOM), the industry association for the IT-BPM sector in India and their clients.

## 2 Related Work

OSS may be defined as a software that is released under the terms of a license that allows the licensee to use, modify, and redistribute, either gratis or for a fee. Over 75% of IT organizations

leverage nontrivial elements of OSS in their mission-critical IT portfolios, including cases where they might not be aware of it [3]. Researchers explored various aspects of OSS over the past decade and a number of special research areas have emerged. Feller *et al.* [4] analyzed 155 OSS research artefacts and concluded that the literature has large gaps, and that commercial organizations are underrepresented. Stol and Babar [5] reviewed 219 OSS publications and concluded that OSS in organizations attracted limited attention. Likewise, Hauge *et al.* [6] have done a systematic literature review and concluded that the overall rigor of the studies performed on OSS, both within organizations and in general, is furthermore not good enough. Ven and Verelst [7] investigated the OSS adoption in Belgian organizations based on TOE framework and identified five critical factors (i.e., software cost advantage, switching costs, reliability, presence of boundary spanners, and availability of external support).

## **2.1 Research Gap**

Previous studies conclude that there is a paucity of information in the models, theories, and frameworks to explain the adoption of OSS in organizations. Studies in the past have focused primarily on the OSS development model and the unique aspect of OSS. Having reviewed the previous studies in literature, it is apparent that some major gaps exist in the OSS research with respect to adoption in corporate sector. Studies lack a robust framework that helps organizations for adopting OSS. There are very limited studies on OSS usage in the context of outsourced software engineering process. In addition, there has been little study on OSS adoption in developing countries [8], like India. Even though there has been an increasing commercialization of OSS, only less information is available on adoption of OSS in IT outsourcing and IT services organizations. Raina and Wurster [2] state that Indian IT providers must find ways to coexist with open source by developing an open source revenue model that complements their current offerings in order to increase their market share in OSS space.

## **2.2 Theoretical Framework**

OSS adoption is a form of technology adoption that refers to a process in which the organization associates itself with OSS in one or many forms. This study uses the adoption model proposed by Hauge *et al.* [6] that includes a) using OSS development practices, b) participating in existing OSS development, c) providing OSS products, d) using OSS tools, or e) deploying OSS products. Much of the technology diffusion literature focuses on the adoption decisions of individuals [9]. Hammouda [8] proposed an empirical model for analysing OSS adoption in Tunisian Software Business leveraging Strauss and Corbin's [10] paradigm. However, this study develops the Diffusion of Innovation theory, which is at organization level, and especially the Technology-Organization-Environment (TOE) framework developed by Depietro *et al.* [11]. Since the aim of this study is to conduct a comprehensive investigation into the factors influencing the adoption of OSS, the TOE framework allows us to consider the broader context in which this adoption process takes place. The importance of taking into account organizational and environmental characteristics has been stressed by several other studies e.g., [12, 13].

### **Factors hypothesized to influence OSS adoption.**

**Reliability:** Studies [14] indicated that increase in reliability of the OSS would enhance the adoption rate among users. The study by Dedrick and West [15] claims that even in larger organizations, reliability played a significant role. This leads to Hypothesis 1 *“IT Outsourcing Organizations that perceive OSS to be reliable will exhibit a larger extent of OSS adoption.”*

**License and Legal concerns:** Organizations are concerned about the complications that emerge when various OSS components, governed by different licenses, are used in the same software system [16]. Previous studies [17, 2] confirmed this line of thought. This leads to Hypothesis 2 *“IT Outsourcing Organizations that perceive less concern related to OSS licensing and legal issues will exhibit a larger extent of OSS adoption.”*

**Software cost:** Literature states that the less expensive the technology, the more likely it is that it will be adopted [13]. Previous studies [15, 18, 7] perceived OSS as less expensive and influence adoption. This leads to Hypothesis 3 *“IT Outsourcing Organizations that perceive OSS to be less expensive will exhibit a larger extent of OSS adoption.”*

**Management Support:** OSS should be part of a strategy where management are involved in the decision making process [19]. Several studies confirmed the importance of management support in the adoption of the innovation [20, 19]. This leads to Hypothesis 4 *“IT Outsourcing Organizations in which management support is high will exhibit a larger extent of OSS adoption.”*

**Outsourcing** was mainly motivated by cost savings, but has now developed into a routine strategic management [21]. This leads to Hypothesis 5 *“IT Outsourcing Organizations in which IT outsourcing is high will exhibit a larger extent of OSS adoption.”*

**Availability of OSS Support:** Lack of support is identified as an important barrier for OSS adoption. Li *et al.* [22] state that the availability of support did have an influence on OSS adoption. This leads to Hypothesis 6 *“IT Outsourcing Organizations that perceive support for OSS to be available will exhibit a larger extent of OSS adoption.”*

**Software Vendor Relationship:** Structured vendor support should be in place to complement the existing IT support structures [15]. Organizations have created dependency on their vendors which influence OSS adoption [7]. This leads to Hypothesis 7 *“IT Outsourcing Organizations that have a relationship with an OSS vendor will exhibit a larger extent of OSS adoption.”*

**OSS Support Availability vs Software Cost:** Li *et al.* [23] states that the availability of the external human capital for OSS support will reduce switching cost. Evaluation of service providers requires time, effort and financial resources. This leads to Hypothesis 8 *“IT Outsourcing Organizations that perceive support for OSS to be available will perceive the software costs involved in adopting OSS to be lower.”*

### **3 Research method**

The objective of this research is to study the OSS adoption in IT Outsourcing organizations serviced by Indian IT services providers. The study attempts to answer the following research question: What are the enablers/inhibitors of OSS adoption in IT outsourcing organizations serviced by Indian IT service providers? Thus, IT Outsourcing organizations (Clients) are the unit of analysis. The study used an exploratory qualitative and the multiple case study approach

(including vendors and clients), which provides a rich and in-depth analysis of OSS adoption decisions of Organization. Table 1 below summarizes the research findings based on the cases sampled using Theoretical sampling strategy [24]. The variations in type, size of organization, position of respondents allowed exploring diverse organizational and environmental issues.

**Table 1.** Overview of the Organizations in the Qualitative Study

Case	Designation of Interviewee	Company Profile	Company Location	Size <sup>^</sup>	Type	OSS Adoption level
C1	Senior Vice President & Chief Technology Officer	Leading financial processing services provider in Canada	N.America	Medium	IT Outsourcing Organization	Extensive
C2	Vice President & Head of IT	Private Life Insurance company	India	Large	IT Outsourcing Organization	Nil
C3	General Manager - IT Services	One of Top 15 Indian IT service providers	India	Large	IT Service Provider	Extensive
C4	Associate Vice President & Senior Delivery Manager	One of Top 5 Indian IT service providers	India	Very Large	IT Service Provider	Sporadic
C5	Chief Executive Officer	Open Source software Solutions Service Provider	Europe	Very Small	OSS Service Provider	Extensive
C6	Vice President, Sr. Technology Manager	Multinational banking and financial services corporation	N.America	Very Large	IT Outsourcing Organization	Sporadic
C7	Senior Manager, Portfolio Leader	Multinational IT, consulting service provider	India	Very Large	IT Service Provider	Sporadic
C8	Principal Architect	Leading Insurance major in USA	N.America	Large	IT Outsourcing Organization	Sporadic
C9	Delivery Manager	One of Top 5 Indian IT service providers	India	Very Large	IT Service Provider	Sporadic
C10	Commercial and IP Licensing Lawyer	Consulting company in OSS/embedded systems	India	Very Small	OSS Service Provider	Sporadic

<sup>^</sup> No. of Employees Very Small (<100), Small (101-1000), Medium (1001-10,000), Large (10,001-100,000), Very Large (>100,000)

This study ensured construct validity by reconciling multiple sources of evidence (triangulation) such as multiple case study and OSS literature and reports related to OSS [24, 25]. Further the case study process (semi-structured interviews) by selecting the concepts to be studied for this research from the literature. Additionally self-selection bias was eliminated by ignoring responses from: a) participants who are not from the specified NASSCOM member list, and b) participants whose company names are not available/who did not reveal company names.

### 3.1 Within-case Analysis

The initial list of codes was defined based on the factors that were identified during the literature review. The transcripts were coded to determine factors that influenced the OSS adoption decision. Data pattern-matching [25] was used to identify relevant text extracts for each factor. The data analysis process was flexible and opportunistic [24, 25], wherein new adoption factors were identified iteratively. Data displays were used to summarize and analyze the qualitative data. For each case, a table was constructed that provided an overview of the perception of the organization toward the various adoption factors.

### 3.2 Cross-case Analysis

Cross-case analysis allows to compare factors across all cases and then to select the most logically replicated and generalizable factors [24]. 22 codes emanated from the eight factors identified in the literature review in addition to eight new codes that emanated from the cases. Table 2 shows all the factors identified in with-in case analysis. Factors with a minimum frequency count of four cases were identified to determine which factors had an important influence on the organizational adoption decision.

**Table 2.** Frequency Analysis of Factors

Context	Factors	Cases	Frequency (* >= 4)
Technological Context	Reliability	C1↑, C2↑, C3↑, C5↑, C6↑, C7↑, C8↑, C9↑	8*
	License Concern	C4↓, C8↓, C9↓, C10↓	4*
	Legal Concern	C1↓, C2↓, C8↓, C9↓, C10↓	5*
	Software Cost	C1↓, C2↓, C3↓, C5↓, C6↓, C7↓, C8→, C9↓, C10↓	9*
Organizational Context	Management Support	C1↑, C2↑, C3↑, C4↑, C6↑, C7↑, C8↑, C9↑	8*
	IT Outsourcing	C1↑, C10→	2
Environmental Context	OSS Support Availability	C1↑, C2↑, C3↑, C6↑, C7↑, C8↑, C9↑, C10↑	8*
	Software Vendor Relationship	C1↑, C2↑, C6↑, C8↑	4*

↑ Enabler to OSS Adoption

↓ Inhibitor to OSS Adoption

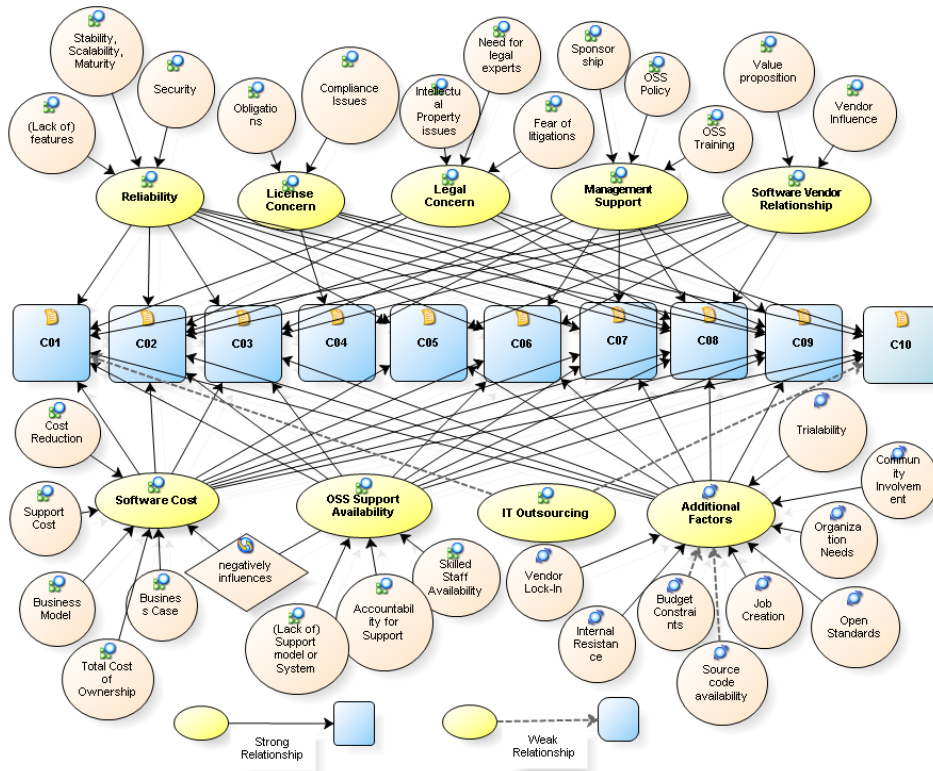
→ No impact/neutral on OSS Adoption

## 4 Discussion of the Findings

Fig 1. below depicts the summary of case study findings.

### 4.1 Enablers of OSS Adoption

**Reliability:** Eight organizations indicated that the high reliability of OSS was an important factor in the adoption decision. Three organizations (C1, C5, C7) stated that OSS was highly reliable and they used OSS in production, whereas five organizations (C2, C3, C6, C8, C9) highlighted lack of reliability for not adopting OSS. Reliability was expressed in terms of the following items: security, stability/scalability/ maturity, and lack of features. The participant in case C5 mentioned that: “*system is afterwards (of OSS deployment) [...] more efficient to manage, more stable. So, it is really worth it*”. The finding of the study is in line with the previous studies which indicated that an increase in reliability of OSS would enhance the adoption rate among users [14]. Consequently, the technology context attribute *Relative Advantage* was seen in terms of *Reliability*, and played an important role in OSS adoption.



**Fig. 1.** OSS Factors in Case Study Findings

**Software Cost:** Nine organizations indicated that the software cost was an important factor in the adoption decision. Software cost was expressed in terms of the following items: business case, business model, support cost, total cost of ownership, and Cost reduction. While some of the wealthiest banks moved towards OSS to save costs (C5), couple of organizations (C7, C9) considered cost as a trade-off and not as a decision making parameter. Cost reduction and lower total ownership cost of the software including exit costs of proprietary software and ongoing support costs was mentioned as a critical factor in OSS adoption. Several studies [15, 18, 7] perceived OSS as less expensive and hence have an influence on OSS adoption. Consequently, the technology context attribute *Relative Advantage* was seen in terms of *Software cost*, and played an important role in OSS adoption.

**Management support:** Eight organizations indicated that management support was an important factor in the adoption decision. Management support was expressed in terms of the following items: OSS training, OSS policy, and sponsorship. OSS training could increase the knowledge quotient of employees and subsequently increase adoption (C4, C7). Six organizations (C2, C3, C4, C6, C7, C9) discussed about role of OSS policy while organizations (C1, C2, C3, C6, C9) discussed about role of sponsorship in OSS adoption. Management team acted as a *Boundary spanner* to evangelize OSS initiative across the organization. Consequently, the organization context attribute *Boundary spanners* was seen in terms of *Management support*, and played an important role in OSS adoption.

**Availability of Support:** Eight organizations indicated that OSS support availability was an important factor in the adoption decision. OSS support availability was expressed in terms of: accountability for support, lack of support model or system, and skilled staff availability. Three organizations (C1, C2, C7) discussed about accountability for support of OSS. The participant in case C1 mentioned that: “*The auditor wants to know if a system breaks how you are going to get support*”. Four organizations (C1, C3, C8, C10) emphasized lack of availability of skilled staff for OSS. Consequently, the environment context attribute *Support infrastructure* was seen in terms of *OSS support availability*, and played an important role in OSS adoption.

**Software vendors:** Four organizations indicated that the software vendor influences OSS adoption. Software vendor relationship was expressed in terms of: vendor influence, and value proposition. Organizations were concerned about smaller vendors offering OSS support, wherein the net worth of the vendor was many times less than the indemnification value and hence were perceived to be unstable (C2). This was highlighted by Ven & Verelst [14], wherein the long-term viability of small organizations were questioned. Consequently, the environment context attribute *Network effects* was seen in terms of *Software vendor relationship* and played an important role in OSS adoption. Further, case study provided additional insights into the OSS adoption by identifying other factors that affect OSS adoption (such as OSS community involvement, organization needs, open standards, and job creation).

## 4.2 Inhibitors of OSS Adoption

Four organizations indicated that the license concerns impacts OSS adoption. License concern was expressed in terms of: compliance issues, and obligations. The participant in case C10 mentioned that: “... *must be compliant with license attached to that (OSS) software [...] need to check permissive license or restrictive license*”. All four organizations highlighted concerns related to OSS license obligations. Five organizations indicated that the legal concerns hinder OSS adoption. Legal concerns were expressed in terms of: intellectual property issues, fear of litigations, and need for legal experts. Two organization (C1, C2) highlighted fear of litigations. For instance, the participant in case C1 mentioned that: “*The one thing you can't stop (in OSS) is (...) litigation*”. Case C8, C9, C10 discussed about the needs for legal experts. This suggests that clients had limited expertise in understanding the OSS legal nuances and needed legal experts. The need for legal expertise was also highlighted by Hammouda *et al.* [16] that stated some of the OSS licenses were fundamentally incompatible with each other. Consequently, the technology context attribute *Compatibility* was seen in terms of *License and legal concerns*, and played a role in inhibiting OSS adoption. **Organization size** was chosen as a moderating variable in this study. However, the findings from qualitative analysis do not support a relationship between size of organization and OSS adoption. While this contradicts the study by Fichman [12] that stated organization size has frequently been found to have a positive impact on the assimilation of new technologies, a possible explanation could be that smaller organizations have fewer resources and might adopt OSS to reduce costs. Further, case study provided additional insights into the OSS adoption by identifying other factors that hinder OSS adoption (vendor lock-in, internal resistance, and lack of support).



### 4.3 Factors that do not impact OSS Adoption

**IT outsourcing:** Only two organizations mentioned about the role of IT outsourcing in OSS adoption. IT service providers were just soliciting advice on OSS. Given that only two cases reported IT outsourcing, the organization context attribute *Formalization* in terms of *IT Outsourcing* was not found to have an impact on OSS adoption. Further, case study provided additional insights into the OSS adoption by identifying other factors that do not impact OSS adoption (like budget constraints, source code availability, and trialability).

## 5 Conclusion

The present research contributes to the organizational adoption literature by exploring the adoption of OSS in IT outsourcing organizations serviced by Indian IT service providers. To investigate this research problem, the study proposed a conceptual model that describes a number of factors which were hypothesized to influence the adoption of OSS. The perceptions of different organizations differed based on their needs and their clients' requirements. The findings summarize that the OSS products which were highly reliable and mature were used in production servers in a significant way. In addition, OSS product must have desired minimum features and a roadmap for continuous improvement compared to similar proprietary software. Cost savings was an important factor in enabling OSS adoption. The perceived litigations/IP issues were hindrance to OSS adoption. Management had to deal with many issues in the OSS adoption decision process including career path for internal support team, indemnification issues, capital expenses vs. operational expenses, higher cost for external support etc.,. Lack of defined OSS support model and non-availability of skilled staff, was a hindrance for OSS adoption. Technology innovation requires organizations to simultaneously 'change' to fix and improve the past as well as 'transform' to create a futuristic vision. While factors like Reliability, Software Cost, Management support etc. can be classified as 'change' category, factors like Software vendor relationship, Organizational needs, Availability of support, would be classified as 'transformation' category.

### 5.1 Theoretical Contributions and Implications

There are limited studies on OSS adoption in the context of outsourcing software development process and many studies were focused on the management aspect of developing software. In addition, empirical findings obtained from the present study will contribute to the literature on OSS adoption in Indian outsourcing organization, an area where empirical studies are scant. The framework can be used by Indian IT services providers to better frame their strategies to service their clients. IT services providers can use this research model to increase their understanding of why some IT outsourcing organizations choose to adopt OSS, while seemingly similar ones facing similar market conditions do not. IT services providers can offer "OSS as a service" for its clients and help them address the gaps in support availability and achieve reduction in total cost of ownership of software.

## 5.2 Limitations and Future Research

The main limitation of our research is that it is focused on IT outsourcing organizations serviced by Indian IT services providers. Hence, we cannot safely generalize our finding to other regions. We decided to use the TOE framework as theoretical base. However, the use of a stronger theoretical framework could have provided a richer insight in our data. Therefore, it would be interesting, if future studies try to build on the results from this study and study the adoption of OSS using a strong theoretical foundation. Since this study encompasses OSS in general, future studies could also determine if our results are also applicable to all types of OSS.

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## Appendix

### Themes used in semi-structured interview questions

- How and to what extent is the (client) organization currently facilitating in adopting OSS?
- OSS usage within the organization (Success stories/Failures in OSS Adoption)
- Experience about the availability of support and maintenance of OSS products
- Impact of factors identified in literature on OSS adoption in the organization
- IT Service providers' role in OSS adoption strategy (For IT Outsourcing organizations)
- IT Service providers' strategy with respect to OSS (For IT service provider)