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# **Social Media for Open Innovation: A Study of Adoption Determinants**

*Completed Research Paper*

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## **Abstract**

*This study develops a conceptual model to examine determinants of social media adoption for open innovation at the firm level. Building on the technology-organization-environment (TOE) framework, six facilitating conditions are hypothesized to influence a firms' decision to deploy social media technologies for open innovation purposes. Partial least squares (PLS) analysis was used to empirically test our conceptual model on survey data from 120 firms operating in Greece and Cyprus. Outcomes show that large firms are more likely to adopt social media as part of their open innovation strategy, as are firms with a broad external knowledge transfer scope. High competitive intensity, technological dynamism, as well as stringent intellectual property protection regimes tend to positively impact adoption levels of social media.*

**Keywords:** Social Media, Open Innovation, Technology-Organization-Environment Framework, Empirical Study, Technology Adoption

## **Introduction**

Historically, companies have invested heavily in research and development (R&D) with the aim to innovate and outperform competitors. However, due to the dynamism of the current competitive environment, the model of vertical integration in which innovation development was assigned to a few people in the R&D department quickly eroded. The requirement for firms to adopt distributed external knowledge and capabilities, detect opportunities, and rapidly reposition their business strategies in order to remain competitive has led to the requirement of opening innovation boundaries (Chesbrough, 2003). In this view, firms should develop channels of communication and collaboration with internal as well as external entities in order to drive innovation. In such open innovation settings, all entities contribute to knowledge, and collaborate jointly with the aim of strengthening the innovation process. Building capabilities of inter-organisational collaboration and seamless knowledge sharing are noted as being some of the most important success factors in reaping benefits from engaging in such collaborative innovation settings (Cavusgil et al., 2003; Du Plessis, 2007). The spotlight has recently been placed on technologies that enable diverse functional units within the enterprise to actively participate in open innovation activities, by alleviating communication and collaboration boundaries (Carbone et al., 2012).

The use of social media technologies within the corporate sphere has emerged as a promising alternative to conventional knowledge management and collaborative IT systems (Bughin, 2008). McAfee (2006) refer to the use of social media within companies, between companies, or with their partners and customers, as Enterprise 2.0. It has been noted that these technologies empower a philosophy of mutually maximizing collective intelligence and added value for each participant by formalized and dynamic information sharing and creation (Schroth & Janner, 2007). Assimilating tools and services such as blogs, social networks, wikis, file sharing services and tagging, is suggested to promote inter-firm collaboration, and connection with external partners, suppliers and customers (Büchner et al., 2009). Traditional knowledge management systems have been criticized for their inability in capturing the tacit knowledge of knowledge workers (Grossman & McCarthy, 2007). To this end, social media have been advocated as being able to increase the value in knowledge intensive industries or ventures, where knowledge sharing and collaboration are fundamental (Levy, 2009). The main value of such technologies, lies in their capacity to capture tacit knowledge, best practices and relevant experiences, and increase visibility within the enterprise (McAfee, 2006).

Despite the hype that surrounds social media, few research studies have examined their adoption as part of a business strategy. Literature has primarily been engaged with adoption enablers and inhibitors at the personal level, largely disregarding adoption facilitators at the firm level (Schneckenberg, 2009). Although these studies have shed light on aspects that promote employee use of social media in the business environment, they do not explain what drives firms to deploy such initiatives as part of their strategies. Kärkkäinen et al. (2010) note that organizational adoption of social media in the business context is quite low when compared to personal-level engagement. The lagging deployment of social media in business is even more apparent for open innovation, with studies indicating that adoption for such purposes is still at an inaugurating state (Kärkkäinen et al., 2010). With the growing importance that the open innovation model is receiving, it is claimed that technologies that facilitate permeability of firm boundaries are of paramount importance (Sawhney et. al., 2005). Despite this assertion, there is limited research on what enables and inhibits firms to adopt social media for open innovation (Michaelides et al., 2013).

Therefore, the objective of this paper is to identify conditions that affect a firm's decision to adopt social media for open innovation. To explore this research objective, we build on the technology-organization-environment (TOE) framework which is aimed at identifying adoption enablers and inhibitors for technological innovations and information systems (IS) at the enterprise level (Tornatzky & Fleischer, 1990). We put forth a set of factors within the TOE framework that are hypothesized to be antecedents of adoption of social media for open innovation. By applying partial least squares (PLS), we test our hypotheses on a dataset of 120 Greek and Cypriot firms. The rest of the paper is structured as follows. In section 2 we discuss background work in various contexts based on the TOE framework, and develop hypotheses of adoption determinants of social media in the business environment. In section 3, the research method is delineated, while section 4 presents the empirical results. The paper concludes with a discussion of research findings, implications for firms engaging in open innovation strategies, as well as limitations and directions for future research.

## Background and Conceptual Model

### ***Technology-Organization-Environment Framework***

Information technology adoption has been a subject of bulk research over the past years. Studies have been divided into two main streams, those that examine facilitating factors for individual user adoption, and those reviewing aspects that contribute to enterprise-level adoption of IT innovations. Concerning social media applications in the business environment, the vast majority of studies have emphasized on determinants of user adoption. These research initiatives have explored adoption enablers and inhibitors for social media applications either as integrated sets of applications (Paroutis & Al Saleh, 2009), or for specific applications (Holtzblatt et al., 2010). The importance of their findings lies in that they delineate aspects that propel user adoption of IT innovations, thus explaining how to enhance their overall effectiveness and potential value. Despite this, the facilitating conditions that drive adoption of social media for open innovation at the firm level still remain under-researched.

To study conditions that affect adoption of IT innovations at the firm level, Tornatzky and Fleischer (1990) developed the technology-organization-environment (TOE) framework. The purpose of this framework is to examine elements that shape a firm's decision to deploy IT from a technological, organizational, and environmental stand-point. One of the main advantages of the TOE framework is that it can be applied for a vast range of IT innovations, since measures assigned under each dimension can be adapted according to context. Numerous studies have employed the TOE framework to examine the adoption of IT-based innovations such as e-business (Zhu et al., 2004), RFID (Li et al., 2010), e-CRM (Chang et al., 2005), knowledge management systems (KMS) (Lee et al., 2009), and electronic data interchange (EDI) (Kuan & Chau, 2001). Concerning the organizational dimension, a number of aspects have been examined as potential enablers/inhibitors of adoption, including amongst others firm size, centralization, formalization and complexity of its structure, as well as other resource quality criteria (Mikalef et al., 2014). The technological dimension includes elements such as internal and external relevant technological resources, attitudes towards IT in general, as well as perceptions regarding value that may accrue from adopting specific IT innovations. Finally, the environmental context deals with aspects relating to industry, competition, technological turbulence, and government policy.

In this paper, we employ the TOE framework to examine the facilitating conditions of social media adoption for open innovation. A conceptual model is devised based on adapted measures for each of the three dimensions reported in prior literature studies. The TOE framework is deemed as suitable in determining organizational adoption of IT-based innovations, since it allows for a holistic examination of internal and external critical factors. Through this lens, it is possible to detect constraints and opportunities that exist within the business environment.

### ***Social Media Adoption***

Our conceptual model proposes six predictors of *social media adoption for open innovation purposes* grouped according to the dimensions of the TOE framework. These predictors are derived from literature on enablers and inhibitors of IT adoption at the firm-level, whilst taking into consideration the contingencies relevant to open innovation settings. We define social media adoption as the degree to which a firm makes use of Web 2.0 technologies to support knowledge sharing and collaboration in the context of open innovation. Unlike past studies which examine adoption or non-adoption of specific social media technologies, we develop this notion as the degree to which social media technologies are embedded in a firm's strategy for open innovation (Grace, 2009).

### ***Technological Context***

When examining adoption of technological innovations either at the firm-level or at the individual-level, predispositions regarding the value of the technology are consistently found to be significant determinants of adoption (Zheng et al., 2006; Lee, 2009; Mikalef et al., 2016). These results are also supported in the study of Beatty et al. (2001) who found that corporate website adoption will be dependent upon the degree to which it is regarded as beneficial by the management team. Perceived value has also been tested in the context of the TOE framework regarding EDI adoption, with results validating the assumption that the greater the perceived potential benefit, the higher the degree of adoption (Kuan & Chau, 2001). Attitudes and perceptions regarding potential value of IT are aspects that are usually determined by top management when examined at the enterprise level. Thong and

Yap (1995) found that CEO attitudes towards the potential value of IT is an important determinant of actual adoption of IT innovations. Based on the aforementioned studies, we hypothesize the following:

*H1: Firms that regard IT as being a valuable resource will be more likely to adopt social media for open innovation.*

### **Organizational Context**

In a meta-analysis conducted by Damanpour (1992) firm size was recurrently noted as a significant determinant of organizational IT-based adoption. Recent studies also validate this finding (Zhu et al., 2002; Xu et al., 2004). The impact of size as an adoption enabler is particularly significant in the case of EDI, with the percentage of deployment being 95% for Fortune 1000 companies, and only 2% for small companies (Densmore, 1998). A possible justification as to why this occurs is put forth by Zhu et al. (2002) for the case of e-business adoption. The authors argue that large firms have more slack resources to facilitate adoption, are more capable of bearing risk associated with early adoption, and possess more power to urge partners to adopt technology with network externalities. We postulate that these are conditions that also apply for firms considering social media adoption for open innovation, and therefore hypothesize that:

*H2: Large firms are more likely to adopt social media for open innovation.*

The role of a network of collaborators is central in the idea of open innovation. Companies that engage in open innovation strategies do so in order to acquire external knowledge and competencies that don't exist within firm boundaries (Mikalef et al., 2015). Laursen and Salter (2006) refer to a firm's level of dependency on external knowledge through the notion of open search breadth, and define it as "the number of external channels from which the innovating company accesses knowledge". The main idea is that when the number of external linkages for knowledge access increases, so does the dependency for effective knowledge transfer. Companies that are dependent upon external collaborators are usually bounded by the mechanisms of transferring external knowledge and competencies (Mikalef & Pateli, 2017). To this end, IT has proven to diminish firm boundaries by minimizing knowledge transfer costs and delivery cycles (Hitt, 1999; Scott, 2000). We infer that companies that are more reliant on accessing external knowledge and skills, will be more prone to adopt social media for open innovation purposes. Hence, we hypothesize the following:

*H3: Firms with high scope of external knowledge transfer are more likely to adopt social media for open innovation.*

### **Environmental Context**

Competitive intensity is defined as the extent to which a company faces threats from competition in terms of price, product, technology, and distribution (Özsomer et al., 1997). This type of competitive pressure has been repeatedly found to be a strong predictor of a firm's decision to adopt IT (Chwelos, 2001, Low et al., 2011). Organizations that operate in competitive environments are urged to accelerate their innovation process (Jaworski and Kohli, 1993). As a result, it is a necessity to cooperate with external partners in order to conceive new ideas, develop new products/services, and improve operational efficiency. In order to deal with competitive intensity, firms turn to adopting IT solutions in order to avoid decline by increasing the rate at which they absorb external knowledge and deliver novel products and services (Liu et al., 2013). We postulate that under conditions of high competitive intensity firms are more likely to deploy social media to enhance their innovation process. Based on these, we hypothesize that:

*H4: Under conditions of high competitive intensity, firms will be more likely to adopt social media for open innovation.*

The rate at which technological changes take place in a market affects a firm's ability to adopt technological innovations, since the capacity to do so is cultivated over time (Damanpour & Schneider, 2006). Firms that work with stable (mature) technologies are in a relatively poor position to harness the potential of nascent technologies for collaboration and knowledge integration, as opposed to firms that operate in environments of high technological dynamism (Jaworski & Kohli, 1993; van de Wetering et al., 2017). This is due to the fact that they are not used to incorporating new technologies to their operations, in antithesis with firms that operate under conditions of high technological dynamism. Empirical evidence supports this statement and notes that firms that operate in

environments with high technological change are more susceptible to adopt new technologies that enable them to increase their competences (Heide & John, 1990). Hence, we can assume that:

*H5: Under conditions of high technological dynamism, firms will be more likely to adopt social media for open innovation.*

One of the greatest challenges for firms willing to adopt collaborative and knowledge sharing tools is to overcome their concern regarding trust between collaborating entities. The main apprehension managers' face is to establish mechanisms by which the intellectual property of each collaborator can be secured (Chesbrough et al., 2006). Intellectual property protection serves as an enabler for knowledge transfer and springs the inventive proclivity of firms (Graham & Mowery, 2006). A strong intellectual property protection regime enhances the efficiency of knowledge transfer through the use of collaborative tools (Lichtenthaler, 2009). Therefore, we can argue that if intellectual property protection mechanisms are established, firms will be more open to exchange knowledge over social media applications. Therefore, we hypothesize that:

*H6: Under conditions of high intellectual property protection, firms will be more likely to adopt social media for open innovation.*

## **Data Collection and Measurement**

### ***Data Collection***

To actualize the objectives of this study a custom questionnaire was developed and sent to respondents to fill out, either electronically (online questionnaire) or in print (by mail). Our target population consisted of over 500 companies operating in Greece or Cyprus, with respondents filling out the questionnaire required to be at a managing position. Companies were selected from online governmental databases on the basis that they were engaging in an open innovation strategy. The time-frame for which the data gathering was active was approximately 4 months. In order to reduce non-response bias, respondents were sent two reminder emails which were followed by a contact by phone. The final number of valid responses that was retained for further analysis reached 120, yielding a response rate of approximately 23%.

Following the data collection, we tested for late response bias by comparing two sub-samples (20 responses each) from early and late responses to examine if any significant differences were observed. By performing t-tests for each construct separately, no significant deviations were noted. Additionally, we checked for common-method variance (CMV) by performing Harman's single factor test. All items were loaded to one construct as part of a confirmatory factor analysis, which revealed that the majority of variance was not accounted by a single factor. From our final sample, the majority of firms operated in the consumer goods sector (40%), with companies from the financial, energy, and health industries representing the smallest proportion (5%). From these, the vast majority (87%) belonged to SME size-class (1-249 employees), with only 13% being large enterprises (250+ employees). More specifically, from the SME grouping, micro firms (0-9 employees) accounted for 15,8% of our sample, small firms (10-49 employees) for 42,7%, and medium-sized (50-249 employees) firms for 28,5%. Respondents were employed in executive positions, with the most common ones being CEOs (31%), operation managers (20%), product development officers (17%), CIOs (17%), and IT managers (15%).

### ***Construct Measures***

*Perceived value (PCV)* measured the respondents' beliefs regarding the potential value of IT in the context of open innovation. This construct was measured as a single item (five-point likert scale) in accordance with Kuan and Chau (2001), and Lee (2009).

*Firm size (SIZE)* was measured using an ordinal variable based on the size-class categorization provided by the European Commission(2003/361/EC), distinguishing between micro (0-9), small (10-49), medium (50-249), and large (250+) enterprises.

External Knowledge Transfer (EKT) was conceptualized as a formative first-order, formative second-order construct (Type IV) (Jarvis et al., 2003), and defined as the extent to which companies seek external knowledge and competencies as part of their open innovation process. The use of a multidimensional constructs has been advocated in a number of studies (Wetzels et al., 2009; Johnson et al., 2012; Mikalef & Pateli, 2016). The proponents of the use of higher-order constructs argue that they allow greater theoretical parsimony and reduce model complexity (Becker, 2012).

Literature on cooperation networks classifies firm partners for knowledge acquisition and collaboration into market entities (customers, suppliers, producers, and competitors), government agencies (public universities, government research institutes, and public bodies), and intermediary institutions (private research institutes, technology transfer organizations, and professional consortia) (Zeng et al., 2010). Therefore, the underlying dimensions of this construct and the respective items follow this taxonomy (Escribano et al., 2009). Respondents were asked to rate the extent to which they use each of these entities as a source of knowledge in their innovation development process on a five-point likert scale (1 – no use, 5 – high use).

*Competitive intensity (CMPI)* was measured using five items, which asked respondents to evaluate on a five-point likert scale the degree of perceived competitive pressure within their industry (Zhu et al., 2002). Amongst others, items measured the degree to which the firm was subjected to intense marketing competition, the number of substitute products/services, and the level of pressure to reduce prices (Jaworski & Kohli, 1993).

*Technological dynamism (TDNM)* has been operationalized in literature under various names but in essence refers to the degree to which there is high or low technological velocity in an industry (McCarthy et al., 2010). We measured this construct using five items which evaluated the intensity of technological changes within the industry of the firm on a five-point likert scale (1 - low to 5 - very high). Items reflected the extent to which firms perceive technology as necessary, the difficulty in predicting technological-related change over 2-3 years, and the importance of closely monitoring changes regarding technology (Jaworski & Kohli, 1993; Mikalef et al., 2016).

The final measure of the external context, *Intellectual Property Protection (IPP)*, quantifies the degree to which intellectual property is protected through 3 items. Respondents were asked to evaluate on a five-point likert scale (1 - low to 5 - very high) the level to which a firm feels protected by property rights when engaging in collaboration that involves exchange of intangible knowledge assets.

Social media adoption (SMA) comprises 6 items reflecting the extent to which social media technologies are used at the firm level for open innovation purposes (Bughin, 2008; McAfee, 2009). The level of social media application use was measured using a five-point likert scale, with 1 denoting no use and 5 a high use. We conceptualized the dependent variable as a formative construct based on the criteria set by Diamantopoulos and Siguaw (2006). Respondents were asked to evaluate the degree to which their company used each of the following technologies: blogs, forums, podcasts & streaming media, wikis, social media, and virtual worlds (Gambardella et al., 2007).

## Empirical Results

### Measurement Model

We employ partial least squares (PLS) path modeling techniques to put the conceptual model to test. The software package smartPLS was used to perform both instrument validation and structural path modeling (Ringle et al., 2005). Reflective latent variables were subjected to reliability, convergent validity, and discriminant validity analyses before path analysis. Construct reliability was assessed through the composite reliability measure, with values being above 0.85, thus exceeding the required threshold of 0.7 (Nunnally, 1978). Validity of constructs was determined through convergent and discriminant validity tests. While convergent validity tests if items grouped under a construct are related, meaning that they measure the same underlying concept, discriminant validity identifies if constructs that are supposed to measure different notions are indeed unrelated. Convergent validity was established by examining AVE values. All constructs surpass the lower limit of 0.5 (Fornell & Larcker, 1981). Discriminant validity evaluates if measures that are meant to be unrelated are, in fact, unrelated. We tested for discriminant validity by examining if square roots of AVEs` are greater than the highest correlation with any other construct. Additionally we examined item discriminant validity by confirming that indicator outer loadings on their assigned constructs were higher than cross-loadings with other constructs. Items that did not load significantly on their assigned constructs were omitted. All remaining indicators exhibit higher loadings on their constructs and lower loadings on other constructs. Discriminant validity was established by examining if the square root of each constructs AVE is greater than the inter-correlation with the rest of the constructs. This outcome is presented in the diagonal of Table 1, in which all bolded values (square root of AVE) are greater than other inter-construct correlations.

Composite Reliability	AVE	Mean	Standard Deviation	1.	2.	3.	4.	5.
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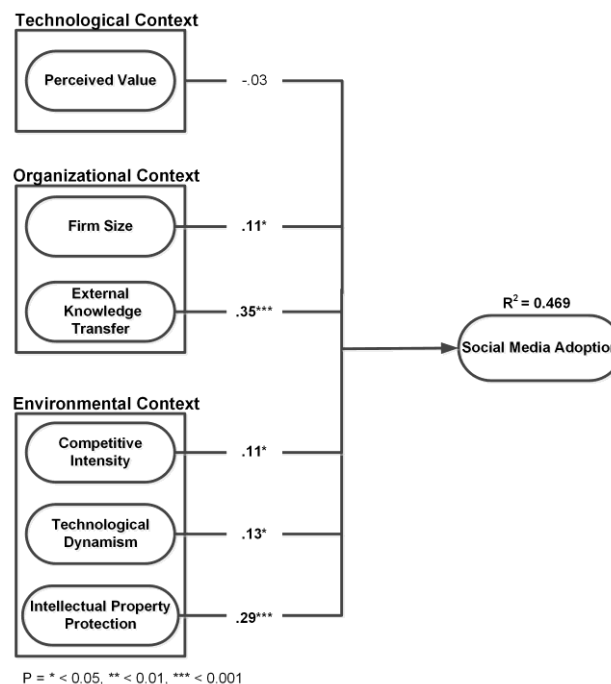
1.00	1.00	3.420	0.816	<b>1. PCV</b>	<b>1.00</b>				
1.00	1.00	-	-	<b>2. SIZE</b>	0.10	<b>1.00</b>			
0.85	0.59	3.136	0.716	<b>3. CMPI</b>	0.01	0.17	<b>0.77</b>		
0.92	0.75	2.668	0.933	<b>4. TNDM</b>	0.34	0.07	0.35	<b>0.87</b>	
0.94	0.84	2.280	1.367	<b>5. IPP</b>	0.28	0.26	0.22	0.44	<b>0.92</b>

**Table 1 Assessment of the measurement model and discriminant validity of reflective constructs**

Formative constructs, as opposed to reflective ones, are not subject to reliability and internal consistency tests since these tests are meaningless for variables of this nature (Hulland, 1999). Unlike reflective constructs which are usually viewed as producing a behavior that is captured by its indicators; formative constructs are formed by their indicators, and therefore have inversed causality. Additionally, since formative constructs are composed by their indicators, omitting an item may result in the omission of part of the construct (Roberts & Thatcher, 2009). In our analysis, we make use of five first-order formative constructs, as described in the previous section. According to Diamantopoulos et al. (2008), the validity of formative measures can be assessed by examining if item correlation is significant on the construct and there is absence of multicollinearity. However, researchers agree that despite construct validity being increased by removing items, content validity is severely affected by doing so (Jarvis et al., 2003; Petter et al., 2007). As note by Mackenzie et al. (2005), dropping a measure from a formative-indicator model may omit a unique part of the conceptual domain and change the meaning of the variable, because the construct is a composite of all the indicators (p. 712).

## Structural Model

Having established reliability and validity for all measures, we proceeded to perform the structural analysis. We followed a two stage approach in order to estimate the parameters of the hierarchical latent variable firm knowledge scope (Anderson & Gerbing, 1988; Ringle et al., 2012). The two stage approach has the advantage that latent variable scores are determined in PLS analysis, thus producing latent variable scores for lower-order latent variables (Tenenhaus et al., 2005). Additionally, it is regarded as the most appropriate approach when the interest is only for the effect between the second-order constructs and endogenous variables, and not for the underlying dimensions (Becker et al., 2012). In Figure 1, path coefficients and notations representing the level of significance are presented. Since we use a second-order factor as an independent variable, we perform a 2-step analysis using latent variable scores for inner model structural weights and significance levels.





### **Figure 1 PLS measures for structural model**

Results of the empirical analysis provided support for seven out of eight hypotheses. Specifically, we reject H1, since we find that higher perceived value regarding the impact of IT does not influence the degree of social media adoption for open innovation purposes ( $b=-0.03$ ,  $p>0.05$ ). Contrarily, organizational size has a positive impact on social media adoption ( $b=0.11$ ,  $p<0.05$ ), meaning that larger firms are more likely to adopt such applications for open innovation (H2 supported). We also find that external knowledge transfer has a positive and significant effect on a firm's adoption level of social media for open innovation purposes, thus confirming H3 ( $b=0.35$ ,  $p<0.001$ ). This means that firms that have a greater dependency on external knowledge are more likely to adopt social media for social innovation. When examining the environmental context, we found that under conditions of high competitive intensity firms are more prone to adopt social media for open innovation, hence H4 is supported ( $b=0.11$ ,  $p<0.05$ ). The same is found to apply when firms operate in an environment of high technological dynamism (H6 accepted) ( $b=0.13$ ,  $p<0.05$ ). Finally, the most significant predictor of social media for open innovation appeared to be the degree to which firms feel safeguarded by their environment's intellectual property protection regime ( $b=0.29$ ,  $p<0.001$ ). This means that the higher the protection offered for firms' intellectual property rights, the greater the use of social media for open innovation purposes. The explanatory power of the model is quite high concerning the determinants of social media adoption within firms, with the coefficient of determination ( $R^2$ ) being 0.469, thus explaining 46.9% of variance.

## **Discussion**

Despite the fact that collaborative technologies within the enterprise are receiving increasing attention over the past years, we still know very little regarding conditions that prompt firms in deploying such solutions as part of their open innovation process. To increase understanding of the conditions that favor adoption of social media in open innovation settings, we developed a model based on the Technology-Organization-Environment framework (Tornatzky & Fleischer, 1990). Empirical analysis demonstrated several key findings as well as some differences compared to adoption enablers of other IT innovations which are discussed below.

In congruence with most studies employing the TOE framework, we found that firm size has a positive and significant impact on the degree to which a firm may adopt social media. This means that larger firms deploy social media technologies for innovation to a greater extent than smaller firms. An explanation as to why this occurs can be attributed to the fact that larger firms have more resources and are not subject to so much risk as smaller enterprises when investing in social media (Zhu et al., 2002). Brender and Markov (2013) find this to be applicable when considering cloud computing adoption, since larger firms usually possess broader technological expertise which makes them better prepared to embrace new technologies. However, this finding does not mean that smaller firms do not deploy social media to support their open innovation strategies, but that the breadth of applications or the degree of use is considerably lower. This can be justified by the fact that smaller enterprises may have fewer requirements for collaboration and knowledge transfer and as a result make use of specific social media applications. In contrast, larger enterprises may be part of larger cooperation networks, which requires them to make use of a broad range of social media technologies in order to fulfil the full spectrum of knowledge exchange demands with their collaborators.

This logically extends our finding that the breadth of firm knowledge transfer affects a firm's degree of social media adoption. Specifically, we found that when the dependency on external entities to transfer knowledge and competencies increases, so does the degree of social media adoption. The degree to which firms are reliant on external knowledge has been noted in literature as being the primary factor in driving companies to forge links with external entities. Technology can greatly reduce the cost and time required for knowledge acquisition, while simultaneously increase the breadth of possible collaborating entities (Selander et al., 2013). Therefore, it is justifiable that firms that exhibit a greater knowledge scope will demonstrate enhanced levels of social media adoption (Westergren & Holmström, 2012). The appropriateness of certain social media technologies for specific activities or for distinct types of collaborative arrangements poses an interesting avenue for future research in order to consolidate task-technology fit.

Apart from internal firm aspects, characteristics of the external environment also play an important role in determining the degree of social media adoption for open innovation. Consistent with past studies, our results indicate that competitive intensity is an important driver in the decision of firms to adopt collaborative technologies for innovation purposes. When firms sense that competitive pressure is rising, they undertake actions in order to reposition themselves in the market. The deployment of

technological resources is noted as a mechanism by which firms manage to survive when market competition increases (Lin, 2014). This allows firms to collaborate with external entities to leverage complementary resources that are non-existent within firm boundaries. Social media therefore extend firm cooperation networks, and provide access to new knowledge resources and capabilities. This implies that firms tend to implement changes more aggressively when they face strong competition.

Additionally, we found that under conditions of high technological dynamism, adoption of social media for open innovation is amplified. Firms that operate in industries of high technological dynamism are acquainted with frequent changes and have therefore accumulated experience on detecting and deploying emergent technologies. The requirement of constantly learning about new technologies and implementing them leads to an early adoption of IT innovations. Thus, the higher rates of social media adoption are warranted for companies that operate under conditions of technological dynamism.

Firms however, are in many occasions reluctant to deploy IT to support collaborative arrangements, even when competition pressure is high. We found that when firms feel that their intellectual property rights are protected, the degree of social media adoption rises. Unlike other IT-based innovations, social media for open innovation requires extensive knowledge transfer to and from other entities. Therefore, policies that explicitly define and protect intangible assets of firms on digital collaboration platforms are necessary. If the business environment does not embrace such protection mechanisms, firms may decide not to adopt social media for open innovation, or may not be able to harness the full potential that they offer. Wu (2012) rationalizes his findings of low technological adoption in circumstances of high competitive pressure based on the idea that opportunistic behaviors are cultivated when risks of intellectual property loss are high. Establishing intellectual property protection regimes facilitates cooperative behaviors, thus limiting inhibitions to adopt technologies to support collaboration and knowledge sharing. This finding could potentially serve as a motivation for the development of intellectual property protection rights in future research, designed specifically for social media platforms.

In contrast with past studies arguing the positive impact of perceived value of IT actual adoption (Kuan & Chau, 2001; Lin & Lin, 2008), we found that in the case of social media this does not apply. This means that the assumption made, that the higher the perceptions of top managers regarding value of IT, the greater the adoption of social media for open innovation, does not stand. Since the independent variable measures the perceived benefit of Information and Communication Technologies from the managers' perspective, this outcome could have multiple meanings. For instance, the decision to adopt social media for open innovation could be out of the locus of control of managers, and thereby be a necessity in order to keep up with changes in the market. In cases of very high environmental turbulence, managers may be forced to adopt technologies despite their scepticism of their value just to be on par with their main competitors' moves. This is partially supported by our previous findings which show that social media adoption for open innovation is determined by factors relating to the firms' organizational and environment context.

Even though our study provides initial results on determinants of social media adoption for open innovation, it has some limitations which could be addressed by future research. The variance explained by our conceptual model is set at 46.9 %. Future studies could include supplementary variables or even detail existing ones in order to create a better understanding on what facilitates social media adoption for open innovation purposes. A step further from the boundaries of this study would be to determine the impact that social media has for innovation development taking into consideration internal and external-organizational factors, such as type of technological resource to be developed, partner network, agreement type with partners, resource contribution, market dynamics etc.

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## Appendix A. Questionnaire Items

### Perceived IT Value

Please indicate the extent to which you believe IT systems can contribute positively in an open innovation strategy (1 – Not at all, 5 – To a great extent)

### External Knowledge Transfer

Please indicate the extent to which your company uses the following sources of information and knowledge in order to promote innovation. (1 – Not at all, 5 – To a great extent)

- Market
  - Suppliers
  - Customers
  - Competitors
  - Commercial laboratories and R&D departments of other firms
- Government Agencies
  - Universities or other higher education institutes
  - Public research bodies
  - Public sector (e.g. Government offices)
- Intermediary Institutions
  - Private research institutes
  - Professional consortia and meetings
  - Joint ventures
  - Online data repositories

### Competitive Intensity

To what extent do the following statements best describe the level of competitiveness in your industry? (1 – Not at all, 5 – To a great extent)

- Fierce competition
- There are many promotional wars in our industry
- There are many similar or substitute products by competitors
- Tough competition on prices is indicative of our industry
- There are new competitive actions almost every day
- Competitors in our industry are powerful

### Technological Dynamism

To what extent do the following statements best describe the level to which technological changes occur in your industry? (1 – Not at all, 5 – To a great extent)

- Technologies in our industries change rapidly
- Technological changes entail great opportunities
- It is very difficult to predict technological changes in our industry in the next 2-3 years
- A great number of new products/services has been produced through technological achievements in our industry
- Closely monitoring technological developments is crucial for long term success in our industry

### Intellectual Property Protection

To what extent do the following statements best describe the level of intellectual property protection in your industry? (1 – Not at all, 5 – To a great extent)

- Almost all developed technologies are protected by intellectual property rights, and in particular patents
- Intellectual property rights are an important part of our corporate strategy
- Capitalizing with external parties on technology is performed on the basis of intellectual property rights

### Social Media Adoption

Please indicate the extent to which you use the following social media technologies in your company as part of your open innovation strategy (1 – Not at all, 5 – To a great extent)

- Blogs

- Forums
- Wikis
- Social networking sites
- Podcasts and streaming media
- Virtual worlds