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ABSTRACT

The introduction of internet technology has fundamentally changed the software industry. Instead of using the traditional licensing business model, software firms now compete with a wide variety of models, such as Software-as-a-Service, open source software models and virtual communities. However, there is yet very limited research on these new approaches. This exploratory paper contributes to the discussion on software business models and virtual communities by developing a taxonomy of how virtual communities are used as part of a business model. Using survey data collected from the Finnish software industry, a cluster analysis of the data reveals four different ways that firms utilize virtual communities in their business. The resulting high-level taxonomy contributes towards an understanding of the role of virtual communities in contemporary software firm business models.

Keywords

Virtual community, business model, taxonomy, cluster analysis, software industry

INTRODUCTION

The software industry has been traditionally divided into three categories: mass-market packaged software, enterprise software and professional services (cf. Hoch, Roeding, Purkert and Lindner, 2000). However, today the structure of the software industry has changed fundamentally, challenging this traditional classification (Campbell-Kelly and Garcia-Swartz, 2007). New ways of conducting software business, such as Software-as-a-Service, open source software and the utilization of virtual communities have emerged to challenge the traditional license-based model. In particular, the utilization of virtual communities has become increasingly popular as the Internet allows people around the world to interact socially, to work and to spend their free time in these communities without the restrictions of geographical boundaries. A virtual community can be loosely defined as a group of people interacting socially in a shared virtual space (cf. Preece, 2000). Stemming from their popularity, virtual communities have also been argued to offer substantial business opportunities for all types of firms (Hagel and Armstrong, 1997), and especially for software firms.

In this exploratory paper, we analyze the business logic of software firms employing virtual communities using the concept of business model. While there is yet no full consensus over the concept (Pateli and Giaglis, 2004; Shafer, Smith and Linder, 2005; Tikkanen, Lamberg, Parvinen and Kallunki, 2005), a business model can be defined as a description of how a firm makes money, i.e. how it creates value for its customers and then how it appropriates some of this value for itself. Previous research of business models in the information system literature has mostly focused on categorization of software firm business models concentrating mainly on software product firms employing qualitative or purely conceptual methods (e.g., Käkölä, 2003). Even though virtual communities have been researched from various perspectives (Preece, 2000), only a handful of studies have studied the use of virtual communities with respect to business models (Laine, 2009).

The purpose of this paper is to use quantitative research methods to answer the question: “How are virtual communities used as part of the business models of software firms?” The idea is to not focus on pure-play commercial virtual communities,

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such as Facebook or MySpace, but to inquire how virtual communities are used as supporting elements in the software industry. Defined broadly, virtual communities used in conjunction with other types of business are likely to be more prevalent than businesses making money directly from them (Messerschmitt, Peltonen, Laine and Oza, 2008).

To study the use of virtual communities, we first develop a survey instrument to measure software firm business models based on a review of literature on business models and virtual communities. After collecting data from the Finnish software industry, we then analyze these data using cluster analysis. As a result of this analysis, we find a taxonomy of four business models that we believe describes well the current state of how virtual communities are used within the software industry. Of these four models, two are traditional product and product-service hybrid models with a user community as a minor component of the firm offering. The other two models are more interesting. It comes as no surprise that first of the heavily community enabled businesses models is the open source product model, where a user community is empowered as developers. The final model in our taxonomy is a content and community centric model.

LITERATURE REVIEW

Business models

The concept of business model gained widespread use during the dot-com boom of the 1990s when the concept was linked to discussion on e-business (Mahadevan, 2000; Timmers, 1998; Afuah and Tucci, 2001). Since then, it has been increasingly popular in both practitioner and academic literature (Pateli and Giaglis, 2004). However, there is yet no consensus on the definition of a business model (Shafer et al., 2005; Tikkanen et al., 2005) or the theoretical grounding of the concept (Osterwalder, Pigneur and Tucci, 2005). This has caused some authors to dismiss the concept. Most notably Porter (2001) has argued that the concept is merely a part of “Internet’s destructive lexicon.” Furthermore, with few exceptions (Zott and Amit, 2007; 2008), extant empirical research is mostly limited to anecdotal evidence and case studies at best, indicating that research on business models is still in its infancy (cf. Edmondson and McManus, 2007).

Business model has been conceptualized, for example, as a linking concept between technological innovation and business success (Chesbrough and Rosenbloom, 2002), between strategy and IT strategy (Osterwalder et al., 2005), or the focus of innovation activity (Chesbrough, 2007). However, as noted by Rönkkö and Valtakoski (2009), the business model can be seen as an extension of the value chain concept (Porter, 1985) and understood as a configuration of organizational factors that needs to be aligned with the environment, resources and competitive strategy of the firm to yield success (Meyer, Tsui and Hinings, 1993; Miller, 1986). In other words, a fit is required between all these factors to yield superior organizational performance (Venkatraman, 1989). The key issue is that a holistic approach is more appropriate in studying business models than analyzing individual factors of a firm’s business.

Therefore, we need to describe the constituent elements of a business model in order to analyze actual business models. Various categorizations have been proposed in the literature (cf. Shafer et al., 2005; Pateli and Giaglis, 2004). However, these categorizations have been limited by the lack of proper theoretical grounding for the concept. Considering the theoretical positioning of the business model concept, discussed above, we may conclude that the business model consists of four factors: the customer offering, activities required to provide the offering, supply network – how the required activities are divided within the business network of firms, and revenue model, which describes how the value created with the offering is distributed within the supply network. Following the previous work by Rönkkö and Valtakoski (2009) we may thus define business model as *a configuration of organizational factors that describes how the activities of the firm and its partners are configured at a certain point in time to produce value to the customer, and how this value is appropriated.*

Virtual communities

Virtual community as a term was first coined by Rheingold (1993). Consisting of individuals engaging in computer-supported social interaction (Preece, 2000), virtual communities have been suggested to present lucrative business opportunities for firms that initiate and facilitate them (Hagel and Armstrong, 1997). Indeed, a few successful firms have been able to realize these acclaimed benefits, including MySpace, Facebook and Habbo, who all have hundreds of millions of registered users in their communities. Yet, it is less known how existing software firms may utilize virtual communities as part of their business. In addition to advertising and registration and subscription fees that depend mostly on user volume, virtual communities offer also other, more elaborate business opportunities such as user-to-user assistance (Lakhani and von Hippel, 2003), targeted marketing (Kozinets, 2002), and end-user innovation (von Hippel, 2001).

Virtual communities have received growing attention in the academic literature (Schubert and Hampe, 2005) and the subject is also gaining popularity in management research, as evidenced by recent publications even in the top management journals (cf. Miller, Fabian and Lin, 2009). Yet, despite the suggested potential business opportunities and managerial implications of using virtual communities, these effects have not yet been fully explored due to the relative novelty of the phenomenon. In the business and management literature, research on virtual communities has concentrated on areas such as knowledge management, open-source software and trust (Laine, 2009). Extant studies have examined, for example, user-to-user-assistance and participation in open source software communities (Lakhani and von Hippel, 2003; Bagozzi and Dholakia, 2006).

Only limited previous research exists on business models in the context of virtual communities: Lechner and Hummel (2002) investigated business models and system architectures of virtual communities with an emphasis on peer-to-peer infrastructures for the creation of economic value. Leimeister and Krcmar (2004) proposed a framework for analysing business models of virtual communities, and applied it to two example cases. Koh and Kim (2004) studied knowledge sharing in virtual communities from an e-business perspective and found that community promotion affects loyalty toward the community provider and eventually profits. Macaulay et al. (2007) considered co-evolving a virtual community and a firm, and present a conceptual framework based on a case study. Choi and Perez (2007) explored online piracy communities, innovation and related legitimate business models. In summary, extant work has been limited to studies in subareas of virtual communities, and has been based on qualitative methods. As stated earlier, this lack of larger sample studies is a sign of immaturity of the business model construct as well as the research topic (Edmondson and McManus, 2007).

RESEARCH METHODS AND EMPIRICAL STUDY DESIGN

Our operationalization of the business model construct relies on the literature on configuration approach to management: One specific assumption of this approach is that due to mechanisms of external and internal adoption, only a limited number of configurations are feasible (Miller, 1986). Moreover, even larger number of variation can be presented by considering the real business model as a combination of various archetypes (Doty and Glick, 1994). From these starting points we may proceed to empirically develop a classification of business models that are either based on or use virtual communities.

A common statistical method for developing classifications based on data is cluster analysis, which calculates a measure of similarity (or dissimilarity) between each pair of observations in the data. Based on this similarity matrix, the data is then grouped by a clustering algorithm. Although cluster analysis has its weaknesses and is seldom employed in information systems or more general management research, it can yield insights that would be unattainable with other methods. The main weaknesses of this family of methods are the lack of objective measures of quality of the result and the dependence on researcher judgment when choosing and interpreting the results (Ketchen and Shook, 1996). However, with careful analysis using multiple approaches and various checks for feasibility and robustness of the cluster solution, cluster analysis can provide valid results to research problems where classification of data on case-basis is desired (Ketchen and Shook, 1996).

In this study, we conceptualize business model as the configuration of the software firm's offering. Based on the configuration approach, i.e. a fit between all business model components, the components of the offering should provide an adequate proxy measure for the business model. This simplification also enabled us to use mail survey to collect data to answer the research question.

Data collection

The data for this paper comes from a larger survey that is described in detail elsewhere (Rönkkö et al., 2008). Due to limited amount of space in this paper, the sampling and survey procedures are described only briefly. Our data was collected from the Finnish software industry following a modified version of the tailored design (Dillman, 1999). Postal mail and web-based form with email invitations were used to collect the data between May and August 2008 targeting the CEOs of software firms in Finland.

We operationalized the firm offering as a set of 14 five-point scales describing various components (e.g. product, training and user community) that a software firm can offer to its customers. The informant was asked "Of which of the following parts does your offering consist and how important are these for your end customer?" and response options were anchored ranging from "1 = not part of our offering" to "5 = most important part of the offering". Survey was developed in Finnish and double blind translation and back translation (Brislin, 1970) was used to translate the survey form to English as a second response option. This questionnaire was developed iteratively and pre-tested with several managers with profiles closely matching the target informants prior to using it in the survey. The English translations of the items are included in the tables of the results section.

After contacting the firms in the sample five times, 581 replies to the business model scale were obtained translating to a response rate of roughly 35% of the target population. For this paper, a subset of the data was used. Since our focus is on virtual communities, we excluded all firms that responded not having a user community as a part of their offering. User communities are here understood as virtual communities offered by firms and targeted towards the end-users. In total, 60 firms responded having a business model that contained a user community component.

Data analysis

Prior to data analysis we performed various checks on the data to ensure that the key assumptions of cluster analysis were satisfied and to be able to make an informed choice among the different possible similarity measures and clustering algorithms. The primary concerns with our data were potential common method variance and multicollinearity. Method variance is a common problem with survey research; the variance of each variable in the data is a sum of variance caused by how informants respond to the particular question type and how they see the underlying issue[2]. If the ratio of former to the latter is too high, the results become biased. In the case of 5 point scales used in this research this, most common problems are consistency (people tend to answer similarly to questions that are close to each other) and extreme aversions (some people prefer to use the middle part of the scale while others prefer the ends). We tested for common method variance using Harman's single factor test. The unrotated factor solution revealed one main factor explaining 51.9% of variance and loading positively on twelve out of fourteen items, suggesting a problem with method variance in the data. After considering potential statistical remedies (Podsakoff, MacKenzie, Lee and Podsakoff, 2003), we decided not to use any explicit modeling approach but to use a similarity measure that is less sensitive to systematic differences in means of items across respondents but rather emphasizes the "shape" of the responses.

Multicollinearity or correlations between the independent variables can cause problems by artificially weighting variables. The correlations in Table 1 reveal that some items are highly correlated. As a remedy, we weighted the data with the amount of unique variance of each item. Finally, the means and standard deviations in Table 1 suggest that the data are not normally distributed. Transformations of data were considered, but instead we chose to accept this feature in our data and to use a type of cluster analysis that is not sensitive to non-normality.

Several texts on cluster analysis (e.g. Hair et al., 2006) suggest that researchers using cluster analysis adopt several different techniques and compare solutions. We used three different similarity measures and two different hierarchical clustering algorithms. Due to method variance and right skewness of several of our variables, angular similarity measure was most appropriate after transforming the variables to a zero to four interval. Angular similarity measures the cosine between the vectors formed by two responses. Two additional measures were also used: correlation between cases and Euclidean distance. The latter was chosen since it is the default method in many packages and we wanted to test if the measures that are more suitable for our data could provide better results than the default approach.

Prior to exploratory clustering, we eliminated all cases with mean angular similarity of less than .5 or maximum similarity less than .8 as outliers resulting in exclusion of two cases from the further analyses. After this, we did several rounds of hierarchical (agglomerative) cluster analysis with average linkage and centroid linkage algorithms. These methods were chosen to minimize within-cluster variance but still allow the emergence of clusters of different size and density. Each analysis was run four times to cover all combinations of weighted or unweighted variables and with or without outliers in the data. In total this resulted in 24 runs of the exploratory clustering. To increase the discriminating ability of the user community item it was entered into each analysis twice. The exploratory analyses were interpreted with the help of dendrograms and by profiling all major cluster joins.

After the exploratory analyses, k-means clustering was applied to different levels of each cluster tree to further check the results of exploratory clustering using cluster centroids of the hierarchical solutions as cluster seeds for this confirmatory analysis. After this analysis, all resulting clusters were profiled in a way described above as well as by cross-tabulating the cluster memberships given by the exploratory analysis with those of the confirmatory analysis. If the results of exploratory analysis and confirmatory analysis differed substantially, the solution was rejected as not being stable.

RESULTS AND DISCUSSION

Table 1 shows the descriptive statistics and correlations. The table indicates that the user community is most strongly associated with content as a part of the offering. This comes as no surprise considering the current popularity of user created content in various web-based services. In addition, the negative correlations with the typical service components – software engineering service (which can refer to, for example, testing services) and training – were negatively correlated. However, what is surprising is the low correlation between open source components and the user community. Considering the relative amount of attention given to the open source communities by researchers and the use of open source development as an

[2] This is a simplification. For a full treatment of the issue, see Podsakoff et al. (2003).

exemplar case of user-driven innovation, this feature of the data needs further analysis. We will return to this issue when discussing the cluster results.

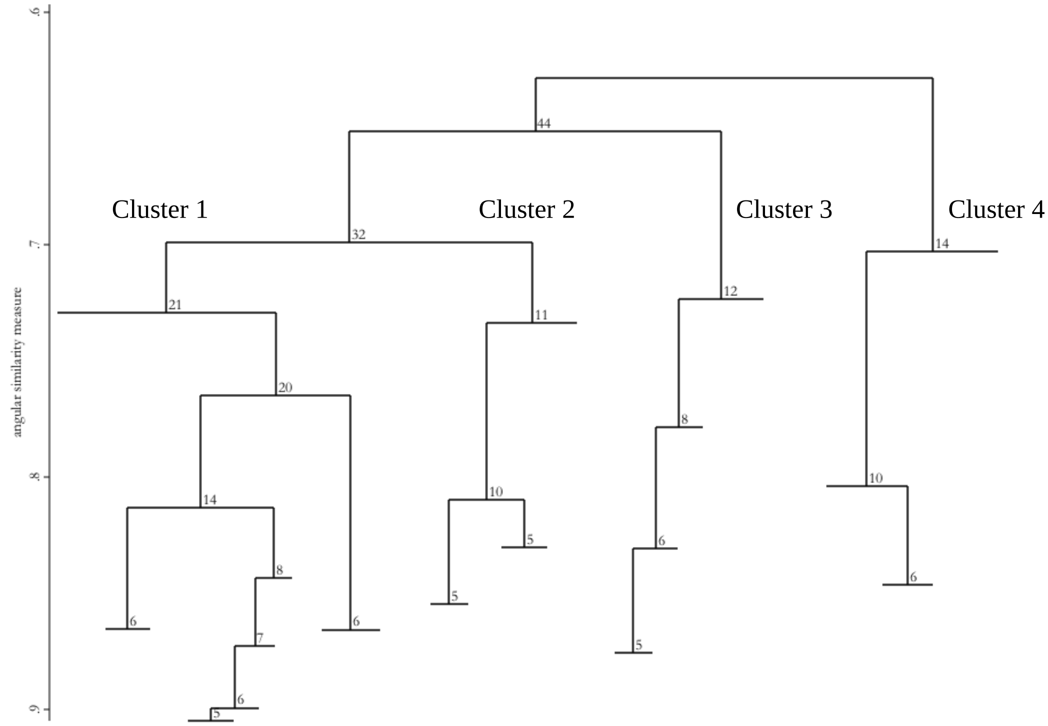
Table 1. Descriptive statistics and correlations

	Mean	SD	Uniq.	1	2	3	4	5	6	7	8	9	10	11	12	13
1 Customization of our software	1.77	1.12	0.57													
2 Open source software	1.00	1.34	0.70	-0.02												
3 Maintenance of systems and infrastructure	1.40	1.25	0.63	0.14	0.12											
4 System and software integration	1.48	1.36	0.30	0.39**	0.17	0.42***										
5 User support of our software	1.83	1.04	0.25	0.12	-0.02	0.27*	0.34**									
6 Service supporting customer's software development	1.02	1.21	0.29	0.30**	0.20	0.42***	0.63***	0.23*								
7 Training related to our software	1.62	1.09	0.41	0.11	-0.14	0.21	0.24*	0.48***	0.27*							
8 Business consulting	1.15	1.30	0.46	0.13	0.01	0.23*	0.40***	-0.01	0.35**	0.33**						
9 Maintenance and updates of software	2.10	1.15	0.28	0.20	0.09	0.27*	0.32**	0.72***	0.15	0.26*	-0.09					
10 Software product	2.82	1.38	0.58	-0.29*	-0.06	0.10	-0.07	0.22*	-0.14	-0.10	-0.24*	0.25*				
11 Content related to our software	1.78	1.51	0.60	0.23*	0.04	-0.07	-0.02	0.06	0.08	-0.12	-0.00	0.21	-0.14			
12 Customer specific software development	1.95	1.33	0.30	0.44***	0.36**	0.16	0.52***	0.04	0.53***	0.02	-0.02	0.19	-0.26*	0.11		
13 Technical consulting	1.28	1.32	0.29	0.29*	0.03	0.43***	0.57***	0.16	0.69***	0.38**	0.51***	0.00	-0.23*	-0.03	0.35**	
14 User community of software	1.88	1.03	0.57	0.02	0.06	-0.09	-0.13	0.08	-0.22*	-0.33**	-0.13	0.15	0.15	0.40***	-0.08	-0.21

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The cluster analysis with angular similarity measure and average linkage clustering with fully treated data (weights used and outliers removed) expectedly provided the most sensible solution that also passed the robustness check. Moreover, the cluster analyses using Euclidean distance, which is sensitive to the type of method variance present in our data, generated solutions that were almost impossible to interpret.

The relationships between exploratory cluster analysis and the coefficients of agglomeration that describe the within cluster similarity are best presented as a dendrogram, which is shown in Figure 1. Moreover, a cluster dendrogram has a key role in interpreting the admissibility of a cluster solution and when determining how many clusters to use for the confirmatory analyses and cluster profiling. The profiles of the clusters after the confirmatory K-means are shown in Table 2, and the comparison of the cluster memberships from the hierarchical analysis with those produced by the K-means analysis in Table 3. We chose to use the four cluster solution for two reasons. First, as shown in Figure 1, the four chosen clusters had a similar coefficient of agglomeration indicating that they were "of the same level". Second, the interpretation of this solution was more meaningful than any more granular solution since the clustering algorithm tends to capitalize on error variance when the number of clusters increases. Finally, the four cluster solution was the most parsimonious of all of the alternatives considered.



Clusters with less than five members are not displayed.

Figure 1. Dendrogram of the cluster analysis

The final cluster analysis was interpreted using the cluster profiles from the confirmatory K-means cluster analysis as presented in Table 2 below and with the help of the dendrogram in Figure 1. In addition, the profiles of each cluster join above the chosen level were inspected (Clusters 1-3 combined vs. cluster 4 and clusters 1-2 combined vs. cluster 3). Starting from the top of the dendrogram, cluster 4 is the most dissimilar with all other cases. We named this cluster "Content and community", since these are the two dimensions on which the cases in this cluster ranked most significantly higher than firms in other clusters. This business model is a model where non-programmer users act as contributors of content (Messerschmitt et al., 2008). The customization component in the model can be explained by considering that this cluster includes not only firms owning virtual community sites but also firms building and hosting them for other firms.

The second fork in the dendrogram separates cluster three from clusters one and two. The Mann-Whitney U tests indicated that the firms in this cluster ranked significantly higher on the product dimension only and the cluster was subsequently named as "Software product". This model can be interpreted as the traditional software product firms that are using user communities as a minor part of their offering, for example by providing a discussion forum for users to enable user-to-user assistance (Lakhani and von Hippel, 2003).

The last cluster fork analyzed was that between clusters one and two, which we labeled "Product service hybrid" and "Open source product". The main distinction between these clusters is the product-service dichotomy that is often presented in the literature on software business models (cf. Hoch et al., 2000). Model two has open source software and software products as the other major components, providing support for the previous findings about the role of virtual communities with open source software firms. However, this finding is seemingly in contradiction with the correlation table that indicated no relationship between open source software and user community. A closer analysis of the data revealed that there are two types of uses of open source software in our business model framework. Some firms operating with model one include open source components developed by third parties and hence even if they include open source in their offering, they do not consider the development community a component of their business model. Finally, it is interesting to note that all clusters had a relatively high emphasis on software products. On a scale from zero to four, the smallest cluster mean for the product dimension was 2.3.

Table 2. Cluster profiles

	Cluster							
	1		2		3		4	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Customization of our software	2.20**	0.80	1.20*	1.10	0.80***	0.60	2.40*	1.30
Open source software	1.20	1.30	2.60***	0.80	0.00**	0.00	0.00***	0.00
Maintenance of systems and infrastructure	2.20***	0.90	1.20	1.10	1.20	1.50	0.60**	1.00
System and software integration	2.50***	0.90	1.40	1.20	0.40**	0.70	1.10	1.50
User support of our software	2.00	0.90	1.80	0.90	2.00	0.90	1.60	1.40
Service supporting customer's software development	2.20***	1.00	0.60	0.70	0.10**	0.30	0.30**	0.80
Training related to our software	2.00**	0.80	1.00	0.90	1.60	1.40	1.30	1.10
Business consulting	1.80**	1.20	0.80	1.30	0.60	1.20	0.90	1.20
Maintenance and updates of software	2.20	0.90	2.40	0.90	1.90	1.40	2.10	1.50
Software product	2.40**	1.30	3.70**	0.90	3.90**	0.30	2.30*	1.50
Content related to our software	1.90	1.30	1.50	1.60	0.30***	0.50	3.10***	1.10
Customer specific Software development	2.80***	0.90	1.80	1.40	0.80**	1.10	1.60	1.30
Technical consulting	2.40***	1.00	0.50*	0.70	0.60*	1.10	0.90	1.30
User community of software	1.30***	0.60	2.50*	1.10	1.50	0.70	2.60**	1.00
N		22		11		11		14

Mann-Whitney U tests between one group and the rest. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3. Comparison of hierarchical and K-means solutions

Hierarchical cluster	K-means cluster 1	2	3	4	Total
1	21	0	0	0	21
2	0	11	0	0	11
3	0	0	11	1	12
4	1	0	0	13	14
Total	22	11	11	14	58
Cramer's V = 0.9561					

CONCLUSIONS

Our empirical analysis of business models leveraging virtual communities in the software industry can be considered as an initial step towards more mature discourse on the relationship between virtual communities and business models. Even though the results seem robust even with the relatively small sample size, the fact that the presence of a user community in the firm offering was measured with only one item makes us conclude that the current classification should be further validated with follow-up survey studies. As an additional limitation, the results are likely to be applicable only to this particular industry. This, however, seems to be a common feature of all business model classifications (Rönkkö and Valtakoski, 2009). In all, due to our various checks of the data and that the cluster analysis method that in theory should have produced the best results indeed did so, leads us to conclude that the results probably have good validity.

In sum, the paper contributes to the discourse on business models and virtual communities (Leimeister and Krcmar, 2004; Lechner and Hummel 2002; Pateli and Giaglis, 2004) by providing empirical evidence that on a high level of abstraction, virtual communities can be used in three different ways: as a minor complement to a more traditional business model, through utilizing open source development communities, and by basing the business on content created by the community.

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