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Return On Contribution (ROC): A Metric for Enterprise Social Software

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Abstract. The value of enterprise social media applications, components, and users is difficult to quantify in formal economic terms such as Return On Investment. In this work we propose a different approach, based on human service to other humans. We describe a family of metrics, Return On Contribution (ROC), to assist in managing social software systems. ROC focuses on human collaboration, namely the creation and consumption of information and knowledge among employees. We show how ROC can be used to track the performance of several types of social media applications, and how ROC can help to understand the usage patterns of items within those applications, and the performance of employees who use those applications. Design implications include the importance of "lurkers" in organizational knowledge exchange, and specific types of measurements that may be of value to employees, managers, and system administrators.

Introduction

This short paper proposes a new measurement concept and initial quantification to measure the business benefits of social software applications. Rather than focus on financial advantages, which are typically very difficult to measure for social applications, we propose to emphasize the human benefits of systems that link workers in diffuse networks of mutual aid.

Many approaches to the evaluation of commercial systems rely on the concept of Return On Investment, or ROI (e.g., Webb, 2008). ROI is sometimes easy to measure, when for example the application fills a crucial, measurable business need. ROI is more difficult to measure for applications or tools that operate in a more diffuse or supporting function (Howlett, 2007; Webb, 2008).

For example, it is straightforward to measure the cost to provide a telephone on each employee's desk. For a few select jobs (e.g., call centers), it is possible quantify the business value of the telephone. But can an organization measure the value of that telephone for the rest of is employees (e.g., Howlett, 2007)? Is it appropriate to monitor the *usage* (calls made and received)? Is it appropriate to count *displacements* against other media – e.g., the number of physical letters not mailed? The contribution of the telephone itself is more difficult to measure than the many business functions of the employee who uses that telephone.

In this short paper, we propose a different approach. We define a set of measurements based on the concept of Return On Contribution, or ROC. Like ROI, ROC is a measure of benefit divided by cost. Unlike ROI, ROC focuses on human workers, and can be applied in situations without direct monetary metrics. Also unlike ROI, ROC emphasizes both the production of knowledge and the consumption of knowledge (as defined locally by human actors). In this way, ROC is part of the resurgence in interest in the subtle contributions of lurkers to their organizations (Nonnecke and Preece, 2001; Takahashi et al., 2003).

For the remainder of this note, we present a first definition of ROC, and show how that metric can be used to describe the overall *human* benefit of two enterprise social software applications. We then show how this concept can be focused on particular components and particular actors within such systems. We close with recommendations for design.

Return On Contribution

Return On Contribution is a ratio of benefit divided by cost. The "units" of the metric are persons. Within the framework of rational choice theory (see Pirolli, 2007, for a recent summary), we assume that employees make appropriate and strategic use of available collaborative resources. We therefore count each access to a resource a measure of the subjectively-defined value of the resource by the person who accessed it, and thus as an indirect measure of benefit to that person.

The core definition of ROC is the ratio of the number of people who benefit in this way from a resource (i.e., through rational consumption of that resource), divided by the number of people who create or contribute to that resource. For a social-media application, we can operationalize this definition by characterizing users as *originators* of the resources in the system, or as *consumers* of those resources. The primary focus of this project is to provide ROC as a metric of social value for social software systems in which users take actions to contribute

Measure	Social-Bookmarking	Social-Networking
Consumers	10896	21453
Originators	4213	8397
ROC_C =Consumers/Originators	**2.59**	**2.55**
Originators-&-Consumers	3654	7987
Lurkers (Consumers-only)	6683	13466
Originators-only	559	410
ROC_L = Lurkers/Originators	**1.59**	**1.60**

Table 1. Calculating Return On Effort. ROE_C is the overall ROE for all Consumers of information, in which some Consumers may also act as Originators. ROE_L is a revised figure based primarily on Lurkers (users who consume but never originate).

content, and other users receive value by receiving that content. Examples of such systems include social bookmarking sites, wikis, blogs, and file-sharing services.

Our analysis is different from the "authors vs. readers" approach of Noll and Meinel (2007). Their study compared the "authors'" formal metadata (in HTML structures and internet rating systems) vs. the bookmarks created by "readers." In our language, all of their users were *originators* ("authors" originate documents, while "readers" originate bookmarks), and there were no data about *consumers* who created neither documents nor bookmarks.

ROC on Entire Applications

Although ROC has a broad scope, here we applied the concept to two enterprise social media applications for which we had usage data (Millen et al., 2006; DiMicco et al., 2008) (Table 1).

- During July 2005 - April 2007, a social-bookmarking application contained contributions by 4213 bookmark-originators, and was directly used (consumed) by 10896 bookmark-readers. For this application ROC = 10896/4213 = 2.59 consumers of the work of each originator.
- During June 2007 - January 2008, a social networking application contained contributions by 8397 item-originators, and those contributions were viewed (consumed) by 21453 viewers. For this application ROC = 21453/8397 = 2.55 consumers of the work of each originator.

Table 1 shows examples of several variants on the ROC concept which are further refined by examining how many users act in the role of both originator and consumer. The top of the table shows the calculation of ROC_C (measured in terms of *all* Consumers), as described above. The bottom of the table shows the calculation for ROC_L (measured in terms of Lurkers *only*) – i.e., an ROC based on "pure" consumers who never explicitly contribute. These summary indices can be

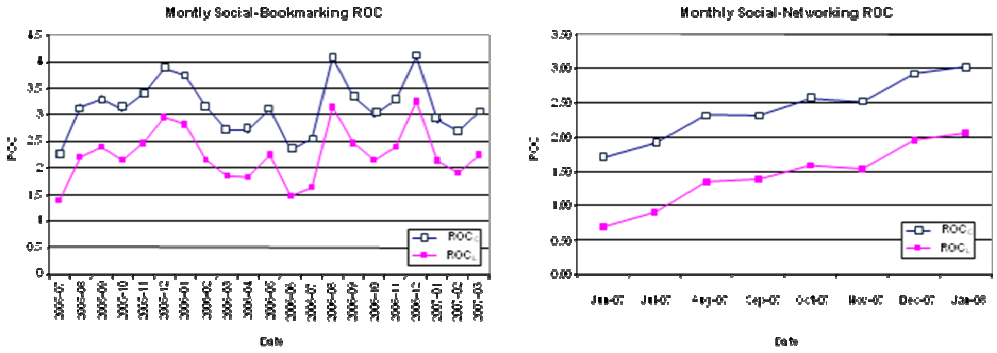

Figure 1. ROC over time for two social-media applications.

used to show the spreading benefit of social software, from a core group of originators to a much larger group of consumers. In the remainder of this paper we will focus on the ROC_C measures.

ROC Over Time

ROC can also be calculated on a temporal basis for an application, to support the examination of growth and change over time. An administrator might monitor the organizational value of a social software application through ROC. Changes in ROC might indicate barriers to usage, and could be used to sense opportunities to intervene so as to enable or facilitate greater participation and system adoption.

Figure 1 shows the growth in ROC for both of the social media applications mentioned above, during the respective study period for each application. The social-bookmarking application appears to have begun robustly, with an ROC over 1.0 during the first month. While the monthly figures are somewhat variable, the generalized ROC_C never dips below 2.0 consumers/originator, and even the more refined ROC_L never goes below 1.4. This is to be evidence of a relatively stable pattern of use. In the terms of rational choice theory, the social-bookmarking application appears to benefit both originators and consumers.

The social-networking application shows a different pattern. Since its initial deployment, it has experienced viral growth (DiMicco et al., 2008) as shown by the nearly monotonic increase in ROC measures over the first seven months of deployment. This application does not yet appear to have achieved a "steady state," so the administrator may look forward to even stronger patterns of usage.

ROC on Application Components and Persons

While ROC can provide an overall picture of benefit, administrators may want to uncover specific information about components of a social system that are driving the benefit. Are all media types and specific objects used with equal benefit? Are

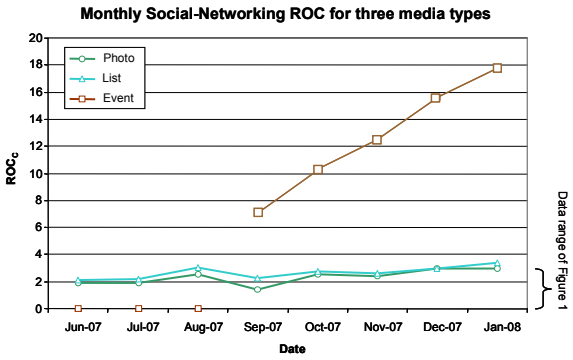

Figure 2. ROC_C for different components of the social-networking application. Events were introduced in September 2007

all contributors comparable? Variants of ROC can be targeted for detailed analysis of components and persons.

The social-networking application contains three major types of media whose usage can be measured on a per-item basis: Photos, Lists, and Events (DiMicco et al., 2008). Figure 2 shows the monthly ROC_C metric for photos, lists, and events.[1] There were small, suggestive upward trends in ROC for Photos and Lists from June-August, but the major increases in ROC occurred for the Event objects. An administrator – or the leader of an online community – might want to study the Event genre to determine which of its attributes led to so much user uptake.

The domain of social tagging offers additional opportunities to use ROC in more fine-grained analyses. As described in Ames and Naauman (2007), some content-originators use tagging to reach large audiences. In the enterprise domain, employees reach large groups of colleagues through the strategic use of social-tagging in roles such as "evangelist" or "publisher" (Thom-Santelli et al., 2008) or "information curator" (Muller et al., 2009).

We can conduct analyses of the ROC of specific tags, by counting the number of people who include each such tag while they are creating bookmarks, and by counting the number of people who search on each such tag to find bookmarked content. These analyses allow us to find tags with relatively high ROC. For example, an "evangelist" was promoting awareness of social-media using the tag "web2.0", and that tag had a per-tag ROC of 1.95 consumers/originator. Similarly, a periodic internal podcast "publication" was bookmarked by its authors with the tag "Tag-City", and that tag had a per-tag ROC of 7.41.

We can also find specific creators whose tags are searched by a large number of their colleagues. In the previous paragraph, the "web2.0" tag was searched by many information-consumers, so the "evangelist" user who communicated

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[1] The curves for ROC_L were very similar. We omit those results to conserve space.

Service	Consumers	Originators	ROC_C
Wiki server	238838	36377	6.57
Discussion server	150000	23000	6.52
People-tagging application	20973	3102	6.76
File-sharing service	68762	11276	6.19

Table 2. ROCs for four enterprise social software services.

through that tag had a personal ROC of 1245.0. Similarly, the "Tag-City" tag was searched by a large number of information-consumers, so each of the two "publisher" authors of the podcasts had a personal ROC of 63.0. These ROC values are strong evidence of the contributions of the originators to their consumers and their organizations.

ROCs for Other Enterprise Social Software Services

We obtained summary data from four additional enterprise social software applications that were beyond the scope of our detailed study. The provisional ROCs for these services were all greater than 6.0 consumers/originator (Table 2).

Summary

We have shown that ROC can be used to assess an entire system, and to track the usage of that system over time. We have shown how ROC can be applied to specific types of objects in a system, and we believe that ROC can also be used to compare the organizational significance of genres of objects (e.g., photos, lists, and events in Figure 2). Finally, we have shown briefly that ROC can be used to compare specific points of articulation (e.g., tags) within a social media application, and can also show the service of particular employees to their colleagues.

Looking toward the future, we envision more ways to use ROC. This paper examined the ROC of applications in which users make *explicit* contributions of content or ratings. ROC can also be an effective measure in systems that are purely lurker-driven. For example in Collaborative Web Search (Freyne and Smyth, 2006), users' search activities are interpreted by the application as relevance judgments, and are displayed to assist subsequent users with similar searches. Because all users are, by definition, both explicit consumers (they search) and implicit contributors (their searches produce useful data), the ROC of such systems would be always be 1.0. By contrast, the systems that we studied in this paper have ROCs in the range of 2.0-3.0, and the systems summarized in Table 2 have ROCs in the range of 6.0-7.0. With more experience, we may be able to describe "characteristic ROCs" for different genres of social media.

Implications for Design

The ROC metrics depend crucially on measures of information-consumption, as well as information-creation or origination. CSCW systems have tended to focus on the creators of information, and to leave the consumers unmeasured – or to dismiss consumers as "lurkers" or "free-riders." Indeed, lurkers have often been considered to be a problem because they consume but do not contribute – an issue that has been discussed in the language of the "tragedy of the commons" (for review, see Curien et al., 2006; Kollock and Smith, 1996). By contrast, certain web metrics have begun to highlight the importance of consumers' behaviors for website maintenance (Saleem, 2008) or marketing (Fox, 2007; Webb, 2008).

With our ROC metric, we join Nonnecke and Preece (2001) and Takahashi et al. (2003) in the re-evaluation of the role of lurkers, especially in an organizational context. Nonnecke and Preece reported that some lurkers lurk for altruistic, pro-social reasons. Takahashi et al. showed that some lurkers use the information they have found to make contributions in ways other than the creation of entities in software applications. Enterprises often designate employees whose job involves the *origination* of knowledge and information, and other employees whose job involves the responsible *consumption* of that knowledge and information. These employees who are, in effect, "paid to lurk" perform valuable work for their organization and, often, for their clients and customers. The ROC metric focuses on measuring how these lurkers consume that information, and thus helps to highlight the importance of lurkers in organizational performance.

These observations lead us away from "tragedy," and toward a "celebration of the commons." Specifically:

- Social media applications should record and analyze the activities of information-consumers, not only to improve performance and to extend their marketing, but also to understand what information and knowledge is proving to be valuable to employees, and to tune the resources and their distribution to improve the sometimes *mission-critical lurking* of these employees. Summary statistics across groups of lurker-workers can help organizations to highlight the most important resources for those workers.
- Social media applications should allow administrators to track the ROC of the application as-a-whole.
- Social media applications should allow information originators to examine the ROC of the items that they originate, so as to evaluate and manage their effectiveness in reaching their intended audience.
- Managers of information-originators may wish to examine the ROC of the resources produced by their employees. More controversially, managers may also wish to examine the per-employee ROC. This idea is common in journalism, publishing, and information services. It remains to be seen whether this concept can also become part of the organizational

recognition of the contributions of knowledge work and knowledge-workers.

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