A stock market for innovation (SMI): Unveiling the effects of gambling behavior on innovation performance

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Abstract: This study explores the effectiveness of an intra-firm online distributed innovation initiative, in the form of a Stock Market for Innovation (SMI). As in traditional stock markets, the SMI is prone to gambling activities. Controlling for a set of previously studied motivational factors affecting innovation performance, we study the impact of gambling behavior on effective innovative performance. On the one hand, our findings indicate that gambling activities are positively associated with innovation performance. On the other hand, we find that strict gambling behavior negatively impacts innovative performance. This evidence suggests that contributors speculating in the SMI innovate by doing so, but strict gambling behavior may be potentially obstructive. These findings contribute to the innovation management literature by shedding light on a stock market model of distributed innovation allowing the firm to leverage upon its entire workforce to expand its ability to innovate.

1 Introduction

Hayek [Ha45] reasoned that the economic problem was not simply an issue of resource allocation but rather a matter of effective utilization of the knowledge spread throughout society. In this sense, economies face the challenge of finding effective ways to access, evaluate, and use the knowledge held by its members in order to attain development goals. One way modern economies have managed to advance towards this goal is through competitive capital markets, where active trading of investment positions in competing sources of value, collectively helps identify their relative value. At the level of a large corporation, Hayek's arguments can be extrapolated to suggest that knowledge inside large multi-business firms may be just as widespread. Therefore the problem of knowledge utilization such firms face may be similar in nature. The question arises of how to effectively leverage upon the many valuable pieces of information scattered across thousands of employees inside a large multi-business firm. A stock market for innovation is being used as one such mechanism. We hereby offer insights about the effectiveness of such model of distributed innovation.

Different models of online distributed innovation external to the firm were identified as successful examples of how firms could tap from the knowledge dispersed across society beyond the firms' boundaries –also commonly referred to as "crowdsourcing" initiatives [Ho06]–, such as: Innocentive [JL10] (competitive), the Netflix Prize [VT10] (pseudo-competitive), TopCoder [BL10] (competitive vs. collaborative), among others. The emergent literature on "crowdsourcing" has been mostly focused on innovation initiatives external to the firm. What large multi-business firms are doing regarding crowdsourcing inside the corporate walls is little researched. Our study offers insights about this intra-corporate phenomenon. We analyzed a distributed innovation initiative inside a multi-business firm in the form of a Stock Market for Innovation (SMI).

2 The Stock Market for Innovation (SMI)

The Stock Market for Innovation (SMI) is an online platform which replicates some features of a financial stock market. On the SMI, company employees can speculate on ideas posted by peers. An idea is akin to equity or stock owned by an individual contributor, upon which others can choose to invest using a virtual currency.

Investors "buy" into an idea by placing an investment in it. They "sell" out of an idea and instantly recover the then current market value of the stock. Furthermore, investors "comment" upon an idea and receive additional currency in exchange. Finally, they "bid" for rewards using the proceeds of their participation in the SMI.

Participation in the SMI is anonymous. Each participant is given the same initial amount of credits. There is a time limit for each idea to be traded in the market. When the trading time for the idea expires, it leaves the market with a value representing the market's *belief* in it. At this time investors realize the gains or losses of their investment.

An idea 'submitted' to the SMI first goes through a process of 'validation' to ensure originality and clarity. A validated idea is then actively traded in the SMI. After the trading period expires, an idea with a *belief* value higher than a specified threshold is 'approved'. An idea approved by the market becomes candidate for implementation.

There are two aspects of the SMI: the Idea Trading Market (ITM) where ideas are traded, and the Reward Auction Market (RAM) where prizes are auctioned.

3 Theoretical Background and Hypothesis

Three theoretical lenses offer a context to describe the nature of the phenomenon addressed in this paper. Firstly, private-collective organization theory, where cross-boundary organizational processes take center stage [VV03]. These processes are based on the free revealing of proprietary information, contributing to the development of knowledge commons. Secondly, distributed innovation theory, which acknowledges the "distributed intelligence" found in online "communities of practice" [KM01]. Online

communities have been shown to be an increasingly important source of innovation [JM03; JL10]. Thirdly, human computation theory, in which humans act as an extension to the computer solving problems that are computationally intractable [Mo03]. Individuals take part in distributed algorithms to effectively enact innovation by engaging in online distributed games [GRS05; Vo06; ICB10]. These three lenses contribute to explain the socio-technical phenomenon commonly referred to as 'crowdsourcing', of which the SMI is a particular instance. In this context, the SMI is essentially a distributed task-oriented process to aggregate and assess the value of competing pieces of knowledge held the associated online communities.

3.1 Motivation in Crowdsourcing

A recent stream of research on motivation in external firm-sponsored crowdsourcing initiatives has found that factors such as fun, free time, challenge [La06; No07; VT09], are associated with higher innovation performance. The present research builds on that body of work, contrasting those previously studied motivational factors with those associated to gambling behavior, involving trading, commenting, and bidding.

3.2 Gambling Behavior and Innovation Performance

Placing a bet on one idea formalizes the positive belief that an individual has on the value of that one idea relative to other investment choices he has. One could therefore expect that the successful innovator is committed and places longer term bets on ideas.

H1.A: Buying behavior (in the Idea Trading Market) is positively associated with individual innovation performance.

Removing a bet from one idea removes the commitment an individual has on an idea she previously had placed a bet upon. The more an individual sells its positions on previously supported ideas, the less committed she is to the success of any one idea.

H1.B: Selling behavior (in the Idea Trading Market) is negatively associated with individual innovation performance.

Placing comments on the ideas of others is automatically rewarded with virtual credits that can be used for bidding on prizes, or speculating on the ITM. Hence, we argue that higher levels of commenting behavior could be negatively associated with innovation.

H2: Commenting behavior (in the Idea Trading Market) is negatively associated with individual innovation performance.

Prizes are expected to motivate participation which would in turn contribute towards the desired goal of innovation. However, the auction reward mechanism may encourage participants in the SMI to speculate, bidding for prizes instead of innovating.

H3: Bidding behavior (in the Reward Auction Market) is negatively associated with individual innovation performance.

4 Method and Data

4.1 Data and Variables

Two sources of data were used for analysis: (1) historical market transaction data for eight months on user's participation in the SMI, and (2) survey data of a sample of active SMI participants' motivations and demographics. These data were obtained in collaboration with the company hosting our study, a major information and communications services provider operating in Europe.

Table 1: Descriptive statistics of all variables of interest in the study

Variable	Description	N	mean	stdev	min	max
performance	[individual innovation performance]	331	6.00	16.09	0	184.6
age	[years]	331	35.47	8.32	22	57
gender	[female=1]	331	0.33	0.47	0	1
education	[highschool=1, doctoral degree =7]	331	3.26	1.33	1	7
tenure	*For how many months have you been participating in the SMI?*	331	5.21	2.77	0	12
gamble		331	0.16	0.37	0	1
buy	[number of 'buying' transactions made in the ITM]	331	42.08	182.65	0	2776
sell	[number of 'selling' transactions made in the ITM]	331	21.99	111.96	0	1681
comment	[number of 'comments' made on ideas in the ITM]	331	8.79	55.39	0	672
bid	[number of 'bidding' transactions made in the RAM]	331	0.75	2.84	0	25
freetime	*I contribute to the SMI because I have freetime available*	331	2.53	1.46	1	7
challenge	*Being succesful means having more ideas in the SMI than others*	331	2.81	1.62	1	7
fun	*Contributing to the SMI is fun*	331	5.08	1.23	1	7

Dependent variable. Innovation Performance. As stated in section 2, ideas go through a 3-stage process as they progress in the SMI. We attributed a growing weight to each stage, commensurate with the number of ideas that get past each stage in the process. This variable has a negative binomial distribution which matches the type of regression used in the statistical analysis.

Independent variables. A dummy variable 'gamble' defines strict gambling behavior in the SMI based on the following condition: never having had an idea validated for trading, and having either sold or bid. The remaining independent variables: buy, sell, comment, and bid, are transactional data from the SMI, described in Table 1.

Control variables. Demographic controls are age, gender, education, and tenure. Motivation controls are free time, challenge, fun.

4.2 Method

We present six regression models with individual innovation performance as the dependent variable. First, Model 1 is our base model exploring the association of strict gambling with performance. Second, Models 2-5 introduce buy, sell, comment and bid, one at a time to analyze the incremental effect of these determinants of gambling behavior on performance. Finally, Model 6 extends our analysis to control for alternate explanatory factors previously found to be associated with innovation performance.

5 Results

Our statistical analysis exploring the association between gambling behavior in the SMI and innovation performance is presented in Table 2.

Table 2: Regression analysis using innovation performance as the dependent variable

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
gamble	**-2.746*** **	**-2.625*** **	**-2.420*** **	**-2.246*** **	**-2.296*** **	**-2.326*** **
	(0.335)	(0.326)	(0.299)	(0.291)	(0.301)	(0.295)
buy		**0.004** **	**0.005** **	**0.003** **	0.000	0.000
		(0.002)	(0.002)	(0.001)	(0.001)	(0.000)
sell			**-0.015** **	**-0.007** **	**-0.011** **	**-0.011** **
			(0.006)	(0.003)	(0.005)	(0.005)
comment				**0.010***	**0.006*** **	**0.006*** **
				(0.005)	(0.002)	(0.002)
bids					**0.196*** **	**0.197*** **
					(0.033)	(0.033)
freetime						0.031
						(0.057)
challenge						-0.015
						(0.055)
fun						**0.111***
						(0.058)
_cons	1.149	0.935	0.394	-0.387	-0.309	-0.982*
	(0.929)	(0.826)	(0.677)	(0.584)	(0.551)	(0.591)
/lnalpha	1.008***	0.861***	0.860***	0.727***	0.555***	0.543***
	(0.115)	(0.114)	(0.107)	(0.110)	(0.106)	(0.107)
N	331	331	331	331	331	331

Negative binomial regressions with robust standard errors in paretheses

*** p<0.01, ** p<0.05, * p<0.1

Results from Model 1 show that strict gambling behavior has a negative and statistically significant ($p<0.01$) association with innovation performance. Models 2 to 5 show that this association remains strong as concurrent explanatory variables are introduced. Moreover, commenting and bidding behavior are found to be positive and statistically significant ($p<0.01$) determinants of performance. Finally, selling behavior, is found to be negatively associated ($p<0.05$) with innovation performance. Model 6, controlling for fun, free time, and challenge, confirms the previous findings about gambling behavior, since the statistical associations found in previous models do not change. Therefore, we find support for hypothesis H1B, while rejecting categorically H2 and H3. Finally, we find no strong support for H1A. This means that controlling for strict gamblers, some gambling behavior on the part of SMI participants is actually positively associated with higher individual innovation performance.

6 Conclusions

In this paper we developed a study of the effectiveness of an intra-corporate crowdsourcing initiative for innovation, referred to as the Stock Market for Innovation (SMI). The speculative nature of such a model of online distributed innovation suggests that it may be prone to gambling behavior, as observed in financial markets, possibly trading the effective valuation of innovative output in exchange for the immediate

rewards that result from gambling behavior, operationalized as a combination of observed selling, commenting, and bidding activity on the platform.

The results of a statistical regression analysis combining survey responses with transactional data from the SMI show that: (1) gambling activities –bidding and commenting– are positively associated with innovation performance, although selling does have a negative effect, and (2) strict gambling behavior –defined as focusing nearly exclusively on trading and bidding activities– is negatively associated with innovation performance. This evidence suggests that contributors speculating in the SMI innovate by doing so, but strict gambling behavior may be potentially obstructive.

These findings contribute to the innovation management literature by shedding light on a stock market model of distributed innovation allowing the firm to leverage upon its entire workforce to increase its ability to innovate. Future research should explore the link between individual motivational factors towards the organization, and the features of the platform that contribute to make the SMI an effective online distributed model for innovation in corporations.

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