



Innovation problems and search for solutions in crowdsourcing platforms – A simulation approach



A. Natalicchio*, A. Messeni Petruzzelli, A.C. Garavelli

Politecnico di Bari, Department of Mechanics, Mathematics, and Management, Viale Japigia 182/B, 70126 Bari, Italy

ARTICLE INFO

Keywords:

Problem solving
Search process
Crowdsourcing
Innovation problems
NK fitness landscapes

ABSTRACT

Crowdsourcing initiatives are increasingly spreading among organisations aiming at outsourcing the development of solutions to internal innovation problems to external problem solvers. However, while knowledge about crowdsourcing is growing, a complete understanding of the underlying dynamics of these initiatives is still lacking. This study aims at elucidating this topic by investigating the influence exerted by the interplay between the characteristics of innovation problems, individuals developing solutions (problem solvers), and crowdsourcing platforms on the related problem solving performance. Specifically, we use NK fitness landscapes to simulate the search for solutions conducted by problem solvers in several scenarios, depending on the decomposability and accuracy of delineation of the innovation problems, the degree of bounded rationality of the solvers, and the cooperation policies of the crowdsourcing platforms. Our findings contribute to the development of the theory on search for solutions in crowdsourcing initiatives, by revealing the characteristics of problem solvers and the types of platforms that maximise the performance of the problem solving process, as the quality of the best solution provided and the time required to elaborate on it, according to specific innovation problems. Furthermore, our findings promote the formulation of guidelines for organisations using crowdsourcing to solve their innovation problems, and for the crowdsourcing platforms' managers.

1. Introduction

Crowdsourcing initiatives are increasingly spreading among organisations opening up their internal innovation processes to the inflow of external knowledge (e.g. Tucci et al., 2016). Indeed, crowdsourcing allows organisations facing internal innovation problems to broadcast them to a pool of external individuals that perform the problem solving process in their behalf, consequently reducing the solution development time, costs, and risks (Afuah and Tucci, 2012; Bayus, 2013; Garcia Martinez and Walton, 2014; Ghezzi et al., forthcoming; Jeppesen and Lakhani, 2010). Specifically, organisations may need solutions that are not internally available or that they deem as not strategically convenient to develop internally. In these cases, promoting crowdsourcing initiatives may offer organisations the opportunity to outsource the development of solutions to their innovation problems to external problem solvers, thus saving resources and time (e.g. Tapscott and Williams, 2006; Terwiesch and Xu, 2008). Moreover, by assigning the search for solutions process to a pool of external problem solvers, organisations may exploit the positive effects of having several different individuals engaged in multiple independent search processes. In fact, among a large number of solvers, concurrently performing search

processes through different paths and trajectories, it is likely that someone finds a highly valuable solution for the seeking organisation (Boudreau et al., 2011; Terwiesch and Xu, 2008). Finally, organisations aiming at developing solutions related to a knowledge domain deemed as distant respect to their competences may use crowdsourcing to engage problem solvers endowed with particular expertise, search routines, and cognitive frames grounded in that knowledge domain. In this way, firms may transform an uncertain distant search process to a local search process for the solvers, hence increasing the likelihood of finding valuable solutions (Afuah and Tucci, 2012).

The connection among organisations seeking solutions for their innovation problems and problem solvers is favoured by dedicated crowdsourcing platforms (Frey et al., 2011; Sieg et al., 2010). Through these platforms, organisations may promote their crowdsourcing initiatives and easily reach a wide pool of solvers, who may even be selected according to specific criteria (Garavelli et al., 2013; Morgan and Wang, 2010). In turn, the problem solvers submit solutions matching with the objectives of the seeking organisation and get a reward if their solutions are accepted by the same organisation.

The interest of scholars towards crowdsourcing is considerably growing, as witnessed by the increasing number of related studies

* Corresponding author.

E-mail addresses: angelo.natalicchio@poliba.it (A. Natalicchio), antonio.messenipetruzzelli@poliba.it (A. Messeni Petruzzelli), claudio.garavelli@poliba.it (A.C. Garavelli).

published in academic journals (see Ghezzi et al., forthcoming). The extant research literature has investigated, so far, several aspects that influence the search processes performed by problem solvers, such as the formulation of innovation problems (e.g. Sieg et al., 2010; von Krogh et al., 2012), characteristics of successful solvers (e.g. Frey et al., 2011; Jeppesen and Lakhani, 2010) and different types of platforms (e.g. Chesbrough, 2006; Garavelli et al., 2013), as well as the features of the solutions provided (e.g. Frey et al., 2011). However, despite this increasing attention, a number of fundamental aspects remain unclear (Ghezzi et al., forthcoming; Majchrzak and Malhotra, 2013; Tucci et al., 2016), hence opening avenues for further investigations that may contribute to enhance the effectiveness of crowdsourcing strategies. Indeed, till now, very few studies have focused on the impact of the interplay of different features related to a crowdsourcing initiative on the search processes performed by solvers and, therefore, on the related problem solving performance, such as the quality of the best solutions retrieved and its speed, namely its development time (Afuah and Tucci, 2012; Atuahene-Gima, 2003; Macher, 2006).

Therefore, in the present research, we aim at expanding the understanding of crowdsourcing by investigating how the characteristics of innovation problems, problem solvers, and crowdsourcing platforms interact with each other and affect the solvers' search processes, and consequently, the related problem solving performance.

Specifically, we focus on two main performance dimensions of problem solving, as the quality and speed of the best solutions provided by solvers (Afuah and Tucci, 2012; Atuahene-Gima, 2003; Macher, 2006). In fact, while the importance of the quality of the best solution submitted is clear, also its speed may assume great relevance for the seeking organisation. In particular, when organisations need to comply with definite and tight time constraints, they may accept to source a sub-optimal solution delivered in a short time, even though it is not the best that problem solvers are able to develop. An exemplary case is the crowdsourcing initiative promoted by British Petroleum to find solutions to the pressing problem of the oil spill from the Deepwater Horizon platform (Piezunka and Dahlander, 2015). Additionally, we also evaluate the average quality of the submissions, to check the robustness of the crowdsourcing approach against the risk of not picking the best solution (Blohm et al., 2013; Piezunka and Dahlander, 2015). We expect these performance dimensions to be dependent on a set of distinctive features of innovation problems, solvers, and platforms. Notably, innovation problems are mainly characterised by their complexity (Afuah and Tucci, 2012; Fleming, 2001; Nickerson and Zenger, 2004; Simon, 1962), which may, in turn, be defined by the degree of interaction among distinct knowledge components, and the number of components involved in the innovation problem delineation (Felin and Zenger, 2014; Jonassen, 2004; Leiblein and Macher, 2009; Simon, 1969; Sommer and Loch, 2004). These, consequently, affects the decomposability of the problem (Nickerson and Zenger, 2004; Simon, 1962) and the accuracy of its delineation (Funke, 1991; Leiblein and Macher, 2009), respectively. These two characteristics of innovation problems are crossed, and used for classifying them into four distinct categories, as: i) high-interaction and well-delineated problems; ii) decomposable and well-delineated problems; iii) high-interaction and ill-delineated problems; and iv) decomposable and ill-delineated problems.

With reference to problem solvers, the extant literature suggests that they are characterised by cognitive limits that bound their rationality (Cyert and March, 1963; Simon, 1990), thus limiting their awareness of the search space. However, the cognitive limits of individuals may be partially overcome by their expertise, competences and education, which, consequently, loose the constraints on individuals' rationality (Gruber et al., 2013; Siggelkow and Rivkin, 2006). The degree of individuals' bounded rationality has been included in our analysis, since this significantly influences individuals' search for solutions (Fleming, 2001). Finally, we consider the existence of crowdsourcing platforms' policies that favour (or limit) cooperation among solvers,

thereby affecting their search for solutions (Bullinger et al., 2010; Hutter et al., 2011).

We adopted a simulation approach to analyse how these features interact with each other and influence the solvers' search for solutions. Specifically, we selected the NK fitness landscapes approach (Kauffman, 1993). In fact, fitness landscapes are an appropriate metaphor to describe the search processes performed by agents, allowing the analysis of the impact exerted by the concurrent effects of multiple factors (Afuah and Tucci, 2012; Davis et al., 2007; Fleming and Sorenson, 2004; Kavadias and Sommer, 2009; Levinthal, 1997). Simulations' results allow inferring propositions regarding the characteristics of problem solvers and platforms' typologies that maximise the performance of the problem solving process for different innovation problems, hence offering both theoretical and practical contributions.

From a theoretical perspective, this study extends our comprehension of the search for solutions by individuals in problem solving activities (e.g. Nickerson and Zenger, 2004; Simon, 1962). Moreover, we also dig deeper into the emerging use of crowdsourcing initiatives to address a specific innovation problem (e.g. Afuah and Tucci, 2012; Jeppesen and Lakhani, 2010), and consequently, increase our comprehension of the role of crowdsourcing in effectively supporting organisations embracing the open innovation paradigm (e.g. Chesbrough, 2006; Tucci et al., 2016). Regarding the practical contribution, this study provides organisations using crowdsourcing initiatives and platforms' managers with guidelines suggesting the most suitable match between different types of innovation problem and platforms, therefore allowing them to use and manage these platforms more effectively.

The paper is organised as follows. In the next Section 2, we review the relevant literature on crowdsourcing, discussing the main features of innovation problems, solvers, and platforms. In Sections 3 and 4 we present the simulation methodology, and its application to our problem, respectively. In Section 5, we describe and discuss the results of the simulation, also inferring related propositions. Finally, the last Section 6 concludes the study by highlighting its theoretical and managerial contributions, limitations, and identifying streams of investigation as avenues for further research.

2. Theoretical background

The term 'crowdsourcing' was developed to identify the act of outsourcing a task traditionally performed by an agent, as an employee, to an undefined crowd, through an open call (Howe, 2006). From this early definition, many others were generated (for an overview, see Estellés-Arolas and González-Ladrón-de-Guevara, 2012). However, four general, common characteristics of crowdsourcing initiatives may be spotted, such as: i) an organisation need a task to be performed; ii) a crowd wants to perform the task; iii) an online platform allows for the interaction between the crowd and the organisation; and iv) both players involved receive benefits (Brabham, 2013). Therefore, a wide spectrum of initiatives falls under the crowdsourcing term. Nonetheless, in this work, we specifically focus on 'tournament-based crowdsourcing', in which each agent in the crowd self-selects to take part in an innovation contest promoted by an organisation aiming at finding solutions to an internal innovation problem (Afuah and Tucci, 2012; Jeppesen and Lakhani, 2010; Poetz and Prügl, 2010; Terwiesch and Xu, 2008). This approach may be especially beneficial for organisations facing innovation problems that cannot be solved by using their existing knowledge (Jeppesen and Lakhani, 2010). Moreover, crowdsourcing initiatives play a prominent role in favouring the purposive inflow of external knowledge within organisations (Chesbrough, 2006) by bridging the gap between organisations seeking external knowledge, and individuals or organisations that own that requisite knowledge (Enkel et al., 2009). Currently, companies are increasingly adopting, and getting advantages from their participation in crowdsourcing. For instance, in a well-known case, Netflix successfully outsourced to the crowd the development of an improved movie recommendation algo-

Download English Version:

<https://daneshyari.com/en/article/5110327>

Download Persian Version:

<https://daneshyari.com/article/5110327>

[Daneshyari.com](https://daneshyari.com)