Managing Sustainable Innovation with a User Community Toolkit: The Case of the Video Game *Trackmania*

Guy Parmentier and Romain Gandia

Today, innovating with a user community seems an effective strategy for developing a firm's innovation capacity. However, short-term benefits from this collaboration are no longer sufficient, and firms are now looking to develop a sustainable relationship with users, to maintain sustainable innovation. This study furthers our understanding of the way in which a user toolkit connected to a community serves to manage innovation of an existing product or service. The literature provides a limited understanding of the role of a user toolkit in the management of a sustainable innovation approach in firms. The research is based on a longitudinal case study of the video game *Trackmania*, which has an integrated toolkit connected to a large and active user community. Results confirm the crucial role of the toolkit in the construction, control and maintenance of a sustainable innovative approach with a user community. From the innovation perspective, the toolkit can be considered as a means of managing the boundary between the firm and the user community, because it enables the community to structure itself as a multi-sided platform, where all categories of users participate in value creation. Finally, we identify four modalities for managing sustainable innovation with a user community toolkit.

Introduction

More and more firms rely on communities of users to design new products and services. These firms use Internet technologies such as forums and social networks to provide consumers with the means not only to share information but also to design new content and functionalities for their products and services. They thus draw on these communities for new sources of innovation and renew their own innovative capabilities. However, profiting from a user community requires the establishment of two elements: (1) mechanisms of motivation to encourage users to innovate, and (2) private or collective appropriation models of innovation to integrate user contributions. In the literature, the combination of these two elements contributes to creating a business model focused on the user, which allows the firm to consider a user community as a strategic asset (Hienerth et al., 2012). However, sustainable maintenance of such a model remains a problem that needs to be solved. The majority of theoretical contributions concerning innovation management mechanisms for user communities focuses on short-term cause and effect, and only explores the sustainable dimension in a limited way (Bogers, Afuah & Bastian, 2010). To our knowledge, little research addresses the sustainable link between the firm and the user community, particularly from an innovation perspective. The adoption of a sustainable vision raises many questions: How can a company maintain a user community in a process of sustainable innovation? How does a firm support sustainable user motivation to innovate and yet retain the ability to appropriate user contributions? Is it possible to maintain a sustainable business model focusing on innovative users? These questions lead us to consider the tools available to firms for managing innovation within a user community. In this context, research on toolkits for innovation can provide answers to these questions.

User toolkits for innovation consist of a set of user-friendly tools which enable users to develop new products for themselves. The simplest ones enable users to personalize the product according to their own tastes, such as, for instance, on the NikeID website (nikeid.nike.com), while the most elaborate kits

10.1111/caim.12021

provide tools for creating new products, as on the Designbyme website (designbyme.lego.com). This toolkit modality allows firms to access ideas for new products or new product functions that have been discussed and evaluated by users. Several researchers have already studied the advantages of a user toolkit for innovation in an innovation process (Von Hippel, 2001; Von Hippel & Katz, 2002), the types of users of these tools (Jeppesen & Molin, 2003; Prügl & Schreier, 2006), and the role of user feedback in new product design (Jeppesen, 2005; Jeppesen & Frederiksen, 2006; Franke, Keinz & Schreier, 2008). However, few studies have focused on the way a toolkit can sustain long-term innovation by a user community. This research addresses the following question: How do toolkits participate in management of sustainable innovation with a user community?

To answer this question, we conducted a longitudinal case study of the video game *Trackmania*, which has an integrated toolkit connected to a large and active user community. The producer of the game, Nadeo, is a small firm which develops and publishes sports games. *Trackmania*'s integrated toolkit enables players to build their own car racing environments and to transform the game into an on-line racing server. This type of toolkit organizes interactions within the user community and between the community and the firm, facilitates production and exchange of innovations, and enhances the utility of the innovative product and service for all user categories. Based on this study, we show that a community using a user toolkit is structured as a multi-sided platform, enabling it to simultaneously manage sustainable innovation and community life.

In the first part of this paper, we review the concept of user innovation with a user community. We describe how the user community's toolkit manages innovation with motivation mechanisms and appropriation models. We then set out our qualitative methodology and the results of our longitudinal case study in the second and third parts. In the fourth part we discuss the consequences of the introduction of this type of toolkit on the management of user innovation.

Theoretical Framework: Management of Innovation via a User Community Toolkit

Innovation by a User Community

In this article, we define 'communities of users' as a group of users of a product or service who have a relationship consisting of trading, sharing and disseminating information and knowledge about that product or service, or other products based on it. When they use toolkits for innovation, they become creation communities (Sawhney & Prandelli, 2000), i.e., they focus on business creation and innovation around a firm's product and service. To stimulate users to innovate and profit from their creativity, firms use two main management modalities: motivation mechanisms and appropriation models.

Motivation Mechanisms for Innovating

These communities encompass very dense social networks involving users with diverse and heterogeneous competencies. The presence of users with extensive knowledge of the product or service is indispensable for generating innovations (Jeppesen & Molin, 2003) and providing support between users (Lakhani & von Hippel, 2003; Franke, Keinz & Schreier, 2008). The most active individuals in these communities have a lead user profile (Morrison, Roberts & von Hippel, 2000; Franke & Shah, 2003), and they create new content and functionalities that can meet other users' needs (Prügl & Schreier, 2006). These community members are generally highly motivated by the prospect of improvements to the focal product or service. They may also be motivated by a need for social recognition and career prospects that may appear in recognition of their contributions (Shah, 2006). These factors of intrinsic motivation refer to a desire to fulfil one's own needs and expectations in relation to a product or service (Lakhani & von Hippel, 2003). This is why community members are willing to share in the development, testing, translation, writing of documentation, and user support, as a function of their competencies (Franke & von Hippel, 2003; Von Krogh, Spaeth & Lakhani, 2003). In addition, firms may resort to extrinsic motivation mechanisms to encourage users to innovate, such as recognition by the firm (Jeppesen & Frederiksen, 2006), emulation, peer evaluation (Hertel, Niedner & Herrmann, 2003) and monetary incentives. However, sustaining this motivation requires extensive resources and skill, regular community monitoring and renewed motivation mechanisms over time.

Appropriation Models for Innovation

Appropriating the benefits of user community innovation can be complicated for firms. Indeed, sharing innovations prevents firms from using classical mechanisms of control and appropriation (Franke & Shah, 2003).

Instead, they have to align their strategies with the community and integrate users' input into their innovation process (Dahlander & Magnusson, 2008) using suitable appropriation models. In the literature, there are private and collective models. Private models are based on the capture of user innovation as an idea (e.g., crowd-sourcing) or a finished product (e.g., open-source) (West & Gallagher, 2006). Here, user innovation can be commercialized by firms if the users want to sell licenses and if they cater to a sufficiently broad niche (Shah & Tripsas, 2004). In other cases, users may even create firms to commercialize their innovations (Hienerth, 2006; Dahlander & Magnusson, 2008). However, appropriation is difficult and expensive, because it may lead to intellectual property conflicts if the firm does not obtain consent from the user innovator (Pisano & Teece, 2007). Collaborative models are based on co-creation and co-innovation through a collaborative platform (Jeppesen & Frederiksen, 2006) or a toolkit for innovation (Von Hippel & Katz, 2002). Under these conditions, appropriation by the firm may be legitimate if the user community is federated around an idea that belongs to the firm (Jeppesen & Frederiksen, 2006). But intellectual property problems may still appear and eventually lead to conflicts between the firm and its users (Dahlander & Magnusson, 2005). From a sustainable perspective, it is vital to avoid conflict to maintain optimum appropriation capacity. Although they enhance innovation, the activities of user communities are, nonetheless, difficult to align over the long term with a firm's constraints and strategies.

Limits of a Sustainable Approach

There are other problems with a sustainable approach that relate to the creation of a community. Users contribute when the community proposes sufficient quantity and quality contributions (Wiertz & de Ruyter, 2007). Usually, a community initially relies on a core of lead users (Morrison, Roberts & von Hippel, 2000; Jeppesen & Frederiksen, 2006) but its development subsequently requires the involvement of all the other users, in a multitude of activities that create value (Schau, Muniz & Arnould, 2009). In a sustainable approach, managing this involvement and coordination between users becomes complex and increases as the community grows and develops. There are, nevertheless, few highly active members and it is difficult to maintain their contributions over time (Nov, Naaman & Chen, 2010). The sustainable management of innovation with a community of users is therefore tricky. The firm's challenge is to facilitate the involvement of a maximum of users without being directly involved in the life of the community, and to orient users toward creations and innovations that are of value to both the community and the company. From this perspective, the firm may resort to use of a toolkit, which acts as an intermediate object between the firm and the user community. We believe that this toolkit can help a firm manage sustainable innovation with a user community.

User Toolkits for Innovation

A User toolkit for innovation consists of a set of user-friendly design tools that enable users to be involved in product design, by providing them with specific tools for the creation and personalization of content and functionalities (Von Hippel & Katz, 2002). It is a design interface that facilitates learning by trial and error and direct visualization of the result. A problem can thus be formatted and solved using the same application. Von Hippel and Katz define five characteristics that toolkits should have if they are to favour innovation by the user (Von Hippel, 2001): the possibility of learning by doing via trial and error; an appropriate solution space; the availability of libraries of models to ensure that users do not have to start from scratch; user-friendly tools; and the direct transfer of users' designs to production, without translation. The user toolkit for innovation requires no particular know-how; through a gradual learning process, it allows the emergence of users' needs and their direct formalizations in products and services.

The least elaborate toolkits have limited personalization functionalities that deliver products adapted to each consumer, rapidly and at limited additional cost. Configurators of e-commerce, such as the Dell website, offer a space with limited and predetermined choices. The more complex toolkits make design tools and not simply configurators available to users. They afford access to a vast range of options and to functionalities that stimulate user creativity, enabling them to find new solutions to already identified problems, and to identify new problems.

A User Community's Toolkit for Innovation

The user toolkit for innovation defined by Von Hippel focuses on the isolated user whose needs are directly materialized in the results of his or her personalization or creations. User innovation in open source communities shows, however, that users build dense relationships between themselves to co-design new software together. Such virtual environments are conducive to high quality and increase the fluidity of interactions, thereby

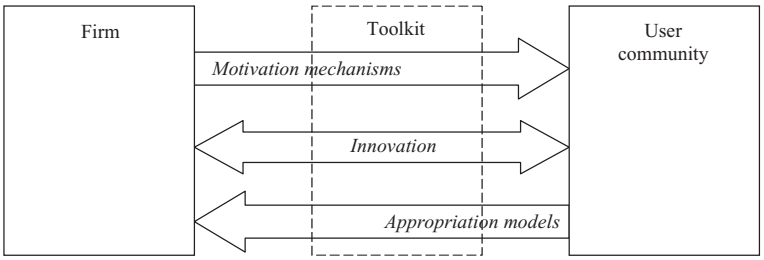

Figure 1. Conceptual Framework

having a strong impact on knowledge creation and the community's innovativeness (Faraj, Jarvenpaa & Majchrzak, 2011; Frey & Lüthje, 2011). In these communities, the users' creations and innovations are discussed, adjusted and renegotiated by means of virtual tools that facilitate a cycle of design by trial and error (Thomke, 1998).

Toolkit use in a community supports innovation and increases the value of users' creations in terms of meeting needs, propensity to pay and intention to buy (Franke, Keinz & Schreier, 2008). A user toolkit in a community helps the firm orient its development to improve its product (Prügl & Schreier, 2006). Thus the toolkit and innovations issuing from a user community form an innovation system based on community and firm cooperation and interaction. To determine the role of the innovation toolkit in this system, we need to examine the users' creative and innovative activities, as well as their relation with the firm's innovation process.

For convenience, we use the term 'user community toolkit' to denote a user toolkit for innovation in user communities. This toolkit has the five characteristics defined by Von Hippel, as well as the principle of direct connection with a user community. Firms propose toolkits to these communities to organize idea contests (Piller & Walcher, 2006; Ebner, Leimeister & Krcmar, 2009; Hutter et al., 2011), to design new products (Füller & Matzler, 2007), or to adapt their products to their clients' particular needs (Berger & Piller, 2003; Piller & Kumar, 2006). Research has focused on the profiles of users of these tools (Jeppesen & Molin, 2003; Jeppesen & Frederiksen, 2006; Prügl & Schreier, 2006), the role of information and support given by users (Franke, Keinz & Schreier, 2008), and the impact of the use of the toolkit on the demand for and value of innovations (Franke & Piller, 2004; Prügl & Schreier, 2006; Franke, Keinz & Schreier, 2008). However, these studies provide little information on the ability of a firm to maintain and develop sustainable innovation with users through toolkit use. Nevertheless, it has been shown that this element facilitates management of a user community. In the same vein as these previous studies, the aim of the present article is to understand how a user community toolkit serves to manage sustainable innovation by users, while at the same time optimizing appropriation and user involvement. Our conceptual framework is synthesized in Figure 1.

In the following sections, based on the longitudinal case study of the game *Trackmania*, we describe the characteristics of this type of toolkit and the way in which the community is structured with a user community toolkit for innovation.

Methodology and Field

Our research is based on a longitudinal single case study (Yin, 1984). The longitudinal study is well suited to understanding the dynamics of an action over time (here, sustainable innovation by a user community), because it can collect data by integrating historical and contextual dimensions (Miles & Huberman, 1994). We chose to study a single firm to explore the issue in depth, by multiplying both internal and external data sources. We present below justification for the case and the method of collecting and analyzing the data.

Case Selection

The game *Trackmania* is published by Nadeo, a small producer of PC games which develops and publishes sports games. The case study lasted for five years, spanning the publication of the first version of the game to the fourth version. *Trackmania* was chosen because the game has benefited from many user innovations issuing from a highly active community (3,000,000 accounts, 45,000 players registered on all official forums, and over 100 websites related to the game). Moreover, since its introduction, the game has had an integrated toolkit with all the characteristics defined by Von Hippel in which players have access to a set of user-friendly tools with a direct transfer

of the users' creation to the game and a vast library of models. Hence, since this is an on-line game with a toolkit, used by a large user community over a long period of time, the case study affords the possibility of studying management of sustainable innovation with a user community toolkit. In this respect, *Trackmania* constitutes a typical case of an active community using a toolkit for innovation, with creations ranging from straightforward customization of cars and tracks, to the creation of completely new tracks that spawn new ways of playing.

Data Collection

We focus on monitoring the life of the community, on the users' creative and innovative activities, and on the evolution of the game and of its innovation toolkit. As regards longitudinality, all changes to the game have been monitored between 2004 and 2008. The director of Nadeo was interviewed three times (2005, 2006, 2008) on his strategy and his relations with players. Furthermore, 18 players who were heavily involved in the community were interviewed between 2006 and 2007 concerning their motivations and practices in and around the game. We selected those players who were most deeply involved on the advice of the Chief Executive Officer (CEO) who who was in constant contact with the community via the forum, and by selecting those who contributed most on the game's official forum (i.e., had the highest number of posts). Finally, each player recommended other players to interview. The collection of data through interviews ceased when the respondents had no new input.

To complement the interview data, a longitudinal documentary research was conducted on the communities' websites and in the specialized press. The website TMX Track provided statistics of its deposits (uploads) in the circuits. The researcher participated as a game player in the *Trackmania* community to ensure that the data collection reflected direct experience and helped limit bias or over-interpretations by the respondents. All statements were systematically verified, based on corresponding discussions on the official forum or by talking to several players. The traces left on forums and websites thus allowed for a triangulation of data and more certainty as to their level of reliability. The data were collected over a period of three years, using a historical reconstruction of the period prior to the collection. With these data, a chronological case history was written. This document was submitted to the managers of the community Internet sites for *Trackmania*. Their comments and remarks helped complete the chronological case history.

Data Analysis

Data from the interviews were processed using the ATLAS.ti software to group together the conversation contents by category: creation practices, innovation practices, game practices, practices around the game, relations with the other players, relations with the firm, opinions on changes in the game. For theoretical purposes, the coding was based on operations of categorization and interpretation of the qualitative data (Miles & Huberman, 1994). The first categories for analysis were taken from the theoretical framework. Using these categories, information was compiled into a chronological case study, focused on user activities in the innovation process and on the history of the community (i.e., birth and evolution). This chronological case was then analysed to find theoretical patterns. Relations were identified between the users' innovation activities and the characteristics of the innovation toolkit. These were then discussed with the general manager of the firm and the leader of the community. Their comments and additional information enabled us to strengthen our analysis.

Trackmania's User Toolkit to Manage Sustainable Innovation

We present the *Trackmania* case study in three parts. First, we present the game *Trackmania* in a descriptive manner. Then, we present the game evolution, tools and user community in a chronological manner. We conclude with a discussion of the role of the toolkit on the creative and innovative activities of users.

The Game Trackmania

Different versions of the game were released between 2003 and 2008,[1] the first without add-ons, and then with regular updates offering new racing environments, new tools, new functionalities and improved graphics. In 2006 *Trackmania* sales for all versions together topped the 500,000 mark. In May 2007, close to three million player accounts had been opened (although not necessarily used). A free Internet version of *Trackmania* was also published: *Trackmania* Nations. This version attracted over a million new players. The game consists of small car circuits and of tools for editing circuits, cars and videos. The driving is very simple and each player can put his machine into server mode and organize games at will. In the game, the producer Nadeo[2] directly proposed the list of active servers, with the

number of players on each server. In 2006, *Trackmania United* brought together in a single game the seven environments used in the preceding games (desert, rally, snow, island, coast, bay and stadium).

Evolution of the Game and the Trackmania *Community*

The game was progressively enriched through different versions of new environments of races. The toolkit was originally limited to the functionality of creating circuits and networking the races. It had been improved throughout the observation period by creating new tools that greatly contributed to the development of creative activities in the *Trackmania* community. Data deposit (upload) circuits on the main site, content sharing TMX Tracks and the number of registrations on the main *Trackmania* forum showed continued growth in the number of active players in creative activities and in the life of the community. We summarize in Table 1 the evolution of the toolkit and its impact on the creative activity of the players and the development of the community.

Functionalities that Stimulate Users' Creativity and Social Relations

Tools for Creating and Opening to External Tools

Creative activities in and around the game are numerous. With the toolkit, users can create circuits, express and develop graphic talents, personalize cars and make videos. Editing tools consist of a circuit builder, a painting workshop to personalize cars, and a replay editor. With the replay editor, the player records the race and can export it to a video file. *Trackmania* does not, however, provide all the tools required for creation. To go further, one has to use graphic software to create textures and 3D modelling software to model cars: as Starbuck explains '*I do the mapping, I remodel all the UV on Photoshop . . . This is my pleasure making cars because . . . I always want to drive cars that I like*.'

The game has integrated the openness – accessible sources, minimalist creative tools and generation of videos – needed for the most creative players to take advantage of the wide range of possibilities afforded by the Internet and content creation software. Experienced players offer tutorials to guide novices, while the general *Trackmania* forum serves as after-sales service to help creators. Since 2006, Nadeo has improved the possibility of car and circuit importation and the design tools to make them more accessible to beginner creators. Additions of new blocks, new environments, new game modes and new possibilities of import and export content in the successive versions have helped develop creative activities in the *Trackmania* community over time.

Tools for Creating Activities Within and Outside the Game

Activities associated with the game are even more numerous. For example, thousands of races are organized daily if a player-creator of content wants to play alone or with others using his or her content. Originally no system for exchanging circuits was provided for in the game, apart from putting them on a server to organize races. Very quickly, however, websites were created for players to exchange circuits, thus adding to the *Trackmania* toolkit. As Tom says, '*In Trackmania Sunrise, they have implemented the import of vehicles into the game, so we think of it as site for easy access and sharing with everyone. This site is still online after a year and a half*.'

In this way activities have developed outside the game. In the beginning, players invented and launched the first contests, forming racing teams to participate in competitions and managing their own servers, and this practice continues today. Each member of a team has a precise function. A manager selects leagues, distributes tasks, plans training matches, and follows the games under way. A creator makes original maps which will be proposed on the team's server or designs cars with the team's colours. Finally, there are racers who participate in competitions. Tools for creating activities are therefore indispensable for the development of team activities. Initially, the functions of the server and game network had a strong impact on getting the community going. Since that time, racing activities and contests have fostered dense social relations, cemented by the creation of teams. Moreover, the launch of the free game *Trackmania Nations* has strengthened the role of competition in community animation, as explains Carl: '*with Trackmania Nations, it's true that there are plenty of new players and new teams which arrive, because the game is free. We were familiar with the principle involved so we immediately had tournaments there*'. In 2006, the version of the game *Trackmania United*, as well as Manialinks and Maniazones[3] added still further innovations, reinforcing the community aspect.

A Community that Groups Together Interdependent Users on a Multi-Sided Platform

The *Trackmania* community consists of four groups that contribute to the overall value of

Table 1. Evolution of the Game and Trackmania Community

Year	Game Version	Evolution of the User Toolkit	Creative Activity of Players[a]	Evolution of the Community
2004	*Trackmania Original*	Circuit construction tools Organization of multiplayer races	1,417	Startup community. Development of websites dedicated to the exchange of circuits and cars Launch of the first league competition
2005	Add-on eXtreme	New blocks of circuit construction and circuit functionalities	2,777	Stimulation of the creation dynamic of players Development of teams and managers
2005	*Trackmania Sunrise*	Race screenwriting tools Car customization tools Tools to capture and export race videos Introduction of a virtual currency (coppers) Ability to import 3D car models New game modes and environments		Expansion of creative possibilities with the use of external 3D software Development of designers focused on creating video posted on YouTube
2006	*Trackmania Nations (free)*	Top players by country Environment dedicated to competition	5,206 (11,650)	Massive influx of competitors Emergence of new competition leagues Presence of *Trackmania* at World Cup games
2006	*Trackmania United*	Manialink: downloading of circuits, cars and mini-websites directly to the game Maniazone: regionalization rankings and news Modification of the system of virtual currency		Official recognition of the creative activity of players with the coop system Moderating the impact of competitors with regional ranking system Opening the game to less experienced designers
2007			7,362 (16,000)	
2008	*Trackmania United Forever*	New building blocks of circuits Adding simplified publishing tools New sound control functionalities	10,164 (22,150)	Stimulation of the player creation dynamic Easier handling for less experienced designers

[a] Average number of deposit (upload) circuits on the TMX Tracks website; in brackets: number of registered members in the main *Trackmania* forum.

the game. First, 'consumers' participate occasionally in races and fill the game servers. A network game requires a minimum of around-the-clock gaming if it is to be appealing. Second, creative players have a key role in the game. Without the content diversity of over 110,000 available circuits and cars, all the races would be alike and interest in the game would quickly wane. As stated by Sam the Pirate: '*I create almost all the cars for my team. I've done 60–70 2D or 3D visuals, and for the team, for the TDS, (our cars) are only done using our colours, black, white and pink, with a predominance of pink*.' Third, the contestants, whose aim is above all to win, are essential for increasing interest in the races by adding to the intensity of the game. Fourth, the managers organize online races by putting their machines in server mode. Their presence is indispensable if there is to be a steady flow of race proposals. They choose the tracks, animate the races, and manage the competitors' teams. In this way the player/managers support both game and community liveliness. Among these categories of players, certain users have a highly active role in the constitution and vibrancy of the community. At the game's beginning, the developer had created a forum on his site but had not developed a specific site for competition, exchanging circuits, distributing videos and other activities. This forum was added to by Benz, creator of the first league competition, Tom, creator of the first community website, and Starbuck, creator of the video competition 'funclip'. These creations are emblematic examples of highly creative players who have individually structured activities in and around the game. As Benz explains, their role was crucial at the beginning of the game: '*What's funny is that it's still me who invents the rules of the TrackMania competitions. We started on a particular basis, and four years later, it's still the same*'. These three players have lead user characteristics; they are innovators who anticipate players' emerging needs.

The structure of the community thus resembles a multi-sided platform, which allows for the simultaneous participation of several categories of users in the creation of value. It is based on network externalities in so far as the utility of the product or service for one user category depends on the existence of another user category (Rochet & Tirole, 2006; Evans & Schmalensee, 2007). The *Trackmania* toolkit is indispensable for this multi-sided platform. Toolkits are designed primarily for a particular type of user, creator and manager with a lead user profile, who is prepared to invest time in designing a product suited to his or her needs. Connected to a user community, the toolkit makes this conception accessible to other users, especially those who are less eager to invest in design. The contribution of the first group, the deeply involved users, impacts on the overall utility of the product and favours its use by the second group, the consumers and competitors. Consumers, by playing on the circuits created by other players, and competitors, by participating in the competition leagues, justify and give value to the creators' and managers' actions. The four groups are therefore interdependent and all contribute to enhancing the game via their interactions with it (see Table 2). The *Trackmania* game, with its community of users' toolkit for innovation, makes it possible to valorize the contribution of all the categories of users and thus increase the value of the game for all players over the long term.

Results

This study shows that the user community toolkit for innovation has a significant effect on the sustainable firm's innovation activity. Three reasons explain this phenomenon. First, the toolkit favours innovative behaviour of users through motivation mechanisms for creations that are constantly improved by the firm (new versions of the game, add-ons and updates). Second, the toolkit provides clear roles and responsibilities for users, according to their ability, thus guaranteeing their sustainable involvement. Third, firm-led toolkit development provides users with an environment ripe for skills development and thus promotes innovation in return. The user community innovation toolkit enables the community to structure itself as a multi-sided platform, and this has important consequences, namely a direct impact on the innovation process, on the firm's business model, and on the nature of the products proposed. The firm is called upon to manage sustainable user innovation and they do so by using four modalities conducive to firm-community alignment. These include creation and appropriation of value, and increasing returns to adoption. The following section describes the four management modalities identified in the case study (synthesized in Table 3).

Managing Openness

The characteristics of the *Trackmania* user toolkit and the partial opening of graphic sources to users made it possible to extend the solution space outside the game. The simplest tools enabled users to create new tracks, while the openness of sources facilitated creation and innovation with more advanced users. The game rapidly captured lead users who formed

Table 2. Contribution of Each User Category

Category	Activity	Added Value	Tools
Creator Presence of lead users	Creation of circuits, cars and videos	Richness of content Richness of gameplay	Tools for creating content Graphics software Website for sharing content
Manager Presence of lead users	Manager of races, competitions and teams Creation of team website and sharing of content	Animation of game Animation and management of the community Animation and management of teams	Tools for creating activities Software for developing the website
Competitor	Participation in races and competitions	Increases race difficulty Increases the stakes in the races	Team management website Regional and international classifications List of available races
Consumer	Participation in races	Presence on the servers of races around-the-clock	List of available races

a community via the networking functions of the toolkit. These lead users developed activities that were not included in the first version of the game by using the server and content creation functionalities. The firm designers then carefully monitored player innovations and integrated those functionalities that facilitate innovation adoption by all players into new versions of the game. The partial opening of sources by means of a toolkit made it possible to limit the solution space while maintaining the possibility of innovating with the lead users. The firm's designers thus maintained control over development while reaping the benefits of the players' creativeness.

The firm also adopted a partially open position. This openness is concretized by ongoing interaction between the director and users in the forum, the financing of community activities such as competitions and website hosting, and invitations to the most active players to talk to the official game designers. However, part of the platform's evolution is out of the designer's hands, being reliant on how the user community appropriates the product. Designers therefore have to closely monitor the innovations developed by the community and design new versions that facilitate diffusion of those innovations to all users, all the while encouraging their appropriation.

Managing the Business Model

In our case study, introduction of a toolkit linked to a user community directly impacted the firm's business model.[4] The toolkit is a way of obtaining additional resources which create value for the firm and, as a result, for the community. The community thus becomes one of the firm's most valuable resources. Production of 110,000 new tracks would have required the firm to recruit over 100 additional graphic artists. Instead, it recruited a Community Manager through whom it interacts directly with the community. Some highly active players have also been incorporated into the development team. The game producer does not hesitate to use a free-of-charge version to attract and renew players, but makes money by selling players an upgraded version of the game. The Nadeo economic model is thus based on users' 'community work', with the gradual construction of an offer that alternates between free distribution (add-ons and a complete, free-of-charge version) and multiple sales of the different versions of the game (with changes of functionalities). This way of managing the business model reduces the tension between the necessity to charge for income generating services, and the necessity to involve the most active players, in part via free services, to continue obtaining additional resources.

Managing the Community

Using the toolkit has fostered relations between players, who have gradually organized themselves into highly active communities. The number and variety of on-line races organized by the players ensures intense encounters on a permanent and ongoing basis. This activity creates affinities and relationships

Table 3. Firm Innovation Management with User Community Toolkit

Type of Management	Toolkit Characteristic and Other Management Activities	Effects on the Firm's Innovation
Management of openness	• Tools used to create new content • Limitation of solution space • Openness of content sources • Direct integration of players' contributions • Direct interaction between designers and forum participants	Innovation process: • Permanent adaptation of content to users' usage and needs • Introduction of user innovations in new versions Strategy: alignment between the firm and the user community
Management of the economic model	• Tools used to create value for users and for the firm • Publishing of free add-ons • Alternation between free-of-charge and pay versions	Value creation: significant increase in product value with limited investment Appropriation of value: allows for partial appropriation of the value created by users via pay versions
Management of the community	• Tools for event organization • Networking tools in the game (chat, local forum) and outside the game (general forum, website for players and teams) • Networking of various categories of players	Invigorating the community Increasing returns to adoption: once the community has been launched, it is self-fed with the contributions of complementary categories Development of involvement by users over a long period
Management of virtuality	• Product that is both physical (game box) and virtual (online game) • Organization of meetings with users at the firm • Organization of events in the physical world (LANs, video game World Cup)	Materialization of the online service by means of a physical object Increasing the strength of ties between the most involved users Increasing the strength of ties between users and the firm

between players. They group together to form teams and interact extensively on the forums. The community leaders, administrators, forum moderators, organizers of competitions and creator contests, and the game's producers are easily accessible via the forums or directly in the games. The tools for creation and organization provided by the toolkit have attracted lead users who have innovated technically and socially around the game, with the creation of sites, competitions, races and yet other tools. The game producer has not simply followed the innovations proposed by the lead users, however. It has reacted to the innovations by offering prizes for contests, entering *Trackmania* in the video game World Cup, and by partially integrating transformations into the games via manialinks and maniazones. The user community toolkit has thus made tools available resulting in development of an active community of users, involving users with differing skills and motivations, and encouraging them to contribute to the innovation process. These devices provide the firm with a means to indirectly manage their user community. The firm does not need to appeal to users to contribute nor to gather together in a community, they have done so of their own initiative, over long periods, and the firm has both fostered and benefited from this enthusiasm.

Managing Virtuality

The *Trackmania* innovation toolkit allows the maintenance of a strong community around a product and 'virtual' service. *Trackmania* is a virtual sport game where simulated races bear

little relation to real car racing, and relations between players are mediated by computer tools. The game therefore allows for creation of a unique virtual space which affords users a large degree of freedom and integrates tools needed for animating the community. Paradoxically, it is by sliding towards virtuality that this firm has created strong, lasting relations with its customers. Simulation of activities and use of communication technologies has made it possible to partially eliminate physical and temporal 'real' world constraints. *Trackmania* is, however, also one of the games in the video game World Cup, an event that brings together a thousand gamers in a single venue. Here, virtuality enters the physical world. The racing teams regularly organize local area networks (LANs) between their members in the physical world. The user community recognizes the value of regular gatherings in the physical world to strengthen its existence and assure its continuation. Physical encounters also reinforce ties between the most active users and the firm, and foster them over the long term.

Discussion

In the case of *Trackmania*, the existence of a user community toolkit enabled the creation of a large community of players and has been conducive to sustainable innovation in and around the game, by lead users and all other categories of users. The creation of a user community toolkit enables a firm to manage openness, its economic model, the community and the virtuality of its new products and services. These different types of management reduce problems of appropriation and of maintaining sustainable user involvement in innovative activities.

Our first main finding concerns the role of a user toolkit in the construction, control and maintenance of a sustainable innovative approach with a user community. From the innovation perspective, the toolkit can be considered as a means of managing the boundary between the firm and the user community. In the case of *Trackmania*, the boundary is positioned where motivation mechanisms, appropriation models and innovation activity work effectively within the community. The more these mechanisms are efficient (and therefore motivation is higher, with a significant level of appropriation and innovation), the more the boundary becomes clear. Over time, the user community becomes autonomous thanks to the toolkit. From the moment the toolkit provides roles and responsibilities to users (Prügl & Schreier, 2006), it provides a means to innovate and energize the game (Von Hippel & Katz, 2002). In our study, we observed the creation of a form of management and a learning mode in the game initiated by the users themselves. This resulted in a circle of sustainable innovation, maintained by the community, that the firm was able to control and appropriate through the toolkit. The performance of these mechanisms and the level of user contributions vary over time, and as a result change the boundary. From this perspective, the toolkit can help rebalance the boundary during a performance deficit (e.g., via the launch of a new game version or by improving the functionality of the toolkit to motivate users and stimulate innovation). Finally, the boundary between the firm and the community becomes dynamic, insofar as the community grows (thus modifying the boundary through the use of the toolkit) and leads the company to act in return (via the toolkit) to balance, adjust and develop this boundary. This boundary dynamism (Bogers, Afuah & Bastian, 2010) makes it possible to consider the toolkit as a strategic asset in the development and maintenance of a sustainable business model, centred on the user as innovator.

Our second main finding is that a user community with an innovation toolkit is structured as a multi-sided platform catering to different types of users: lead users, creators, managers and consumers. The openness of sources and existence of elaborate tools attracts lead users when the community is first set up. These lead users are indispensable because they facilitate adaption of the game and toolkit to reflect user needs. Our research also points out that lead users are at the origin of increasing returns to adoption when a community is a multi-sided platform. As these lead users are often early adopters and opinion leaders (Morrison, Roberts & Midgley, 2004), they adopt the innovations of other lead users when the community is created, and strongly encourage all users to adopt the innovations as well. In addition, our research supports the need to provide different tools for each category of user, not just in terms of their level of expertise (Prügl & Schreier, 2006), but also depending on the nature of the user's expertise (creation, management, competition, etc.). The multi-sided platform structure shows us the importance of linking these tools so that each user category creates value for itself and simultaneously creates value for the other users. The openness of sources further attracts users who belong to multiple communities – something that has been identified as indispensable for fostering user innovation (Dahlander & Frederiksen, forthcoming).

The third major finding is that a user community toolkit serves to manage the openness

of the innovation process by avoiding problems of appropriation. In this revealing type of situation of openness, Dahlander identifies capturing the value creation produced by users as a main problem (Dahlander & Gann, 2010). With the user community toolkit, openness is partial: only the content is accessible and alterable; the source code of the toolkit and of the game remain inaccessible to users. This solution enables opening certain select aspects of the innovation process to optimize capturing value (Gassmann, 2006; Laursen & Salter, 2006). But the openness described above is not enough. In an active community hosted by the firm, users are more interested in recognition by the firm than by their peers (Jeppesen & Frederiksen, 2006). Alternating between pay and free-of-charge versions is a solution, in this case, to directly reward users for their work, while continuing to generate revenue. Our reflections correspond to an emergent theme identified by Dahlander on how to articulate open innovation and a business model (Dahlander & Gann, 2010). The user community toolkit is a response to this situation. Because it is structured as a multisided platform, it optimizes value creation and makes it possible to optimize the capture of value by means of a free-of-charge/pay business model.

Finally, a fourth important result points to the necessity to manage links between the virtual online aspects of a product and its materialization in the physical world. This imperative helps us understand how the user community toolkit can also be applied to physical mass consumer products in the framework of mass customization. The virtualization of design, facilitated by new innovation technologies (Dogson, Gann & Salter, 2005) opens wider possibilities for involving users in design, especially if they are enrolled in an active community. Supply and community should not, however, be exclusively virtual. Encounters in the physical world foster strong ties and collaboration on new projects and can facilitate the crossing of community borders by users who prefer physical to virtual contact. The concretization of a virtual product as a physical artefact gives it a tangible form, and is thus more likely to favour sustainable brand loyalty.

Conclusion

This study is based on a single but noteworthy case of a producer which attained success by designing a game integrating a user community toolkit for innovation. The *Trackmania* case study contributes to a theoretical understanding of how a user community toolkit for innovation can facilitate the sustainable development both of innovations and of user communities. The results of our research show that the toolkit is not a simple lever for innovation; it is an intermediary object that dynamically manages the boundaries between the firm and the user community. Sustainable innovation is possible when the toolkit facilitates the structuration of the user community as a multisided platform, in which users can innovate, interact and organize themselves in terms of their roles and responsibilities. From a managerial point of view, a user community toolkit makes it possible to manage the openness of the innovation process, the business model, the community and the virtuality of the product, to further foster user innovation. Further research should spread to other industrial sectors and study the differences between digital product and physical product innovative user communities. Additional studies should attempt to identify hindrances to the innovation process, while also determining factors that can encourage development of innovations with a user community toolkit. From a managerial point of view, further research should examine the key role of Community Manager, the individual responsible for managing the boundaries and animating the user community via toolkits.

Notes

1. *Trackmania Original* end-2003, *Trackmania Sunrise* mid-2005, *Trackmania Nations* early 2006, *Trackmania United* end-2006, and *Trackmania United Forever* early 2008.
2. In 2010, Nadeo was bought out by the international publisher Ubisoft, for an amount in excess of €10 million, thus confirming the producer's financial success.
3. Manialinks enable users to directly visualize players' websites while in the game and to download the proposed content. Maniazones make it possible to regionalize classifications and to publish news and a local forum.
4. A business model defines the way a firm acquires and exploits resources to generate income in relation to the firm's organizational structure and means available to it.

References

Berger, C. and Piller, F.T. (2003) Customers as Co-Designers. *Manufacturing Engineer*, 82, 42–45.

Bogers, M., Afuah, A. and Bastian, B. (2010) Users as Innovators: A Review, Critique, and Future Research Directions. *Journal of Management*, 36, 857–75.

Dahlander, L. and Frederiksen, L. (forthcoming) The Core and Cosmopolitans: A Relational View

of Innovation in Users Communities. *Organization Science*, doi: 10.1287/orsc.1110.0673.
Dahlander, L. and Gann, D.M. (2010) How Open Is Innovation? *Research Policy*, 39, 699–709.
Dahlander, L. and Magnusson, M.G. (2005) Relationships between Open Source Software Companies and Communities: Observations from Nordic Firms. *Research Policy*, 34, 481–93.
Dahlander, L. and Magnusson, M.G. (2008) How do Firms Make Use of Open Source Communities? *Long Range Planning*, 41, 629–49.
Dogson, M., Gann, D. and Salter, A. (2005) *Think, Play, Do: Markets, Technology and Organization*. Oxford University Press, Oxford.
Ebner, W., Leimeister, J.M. and Krcmar, H. (2009) Community Engineering for Innovations: The Ideas Competition as a Method to Nurture a Virtual Community for Innovations. *R&D Management*, 39, 342–56.
Evans, D.S. and Schmalensee, R. (2007) The Industrial Organization of Markets with Two-Sided Platforms. *Competition Policy International*, 3, 151–79.
Faraj, S., Jarvenpaa, S. and Majchrzak, A. (2011) Knowledge Collaboration in Online Communities. *Organization Science*, 22, 1224–39.
Franke, N. and Piller, F. (2004) Value Creation by Toolkits for User Innovation and Design: The Case of the Watch Market. *Journal of Product Innovation Management*, 21, 401–15.
Franke, N. and Shah, S. (2003) How Communities Support Innovative Activities: An Exploration of Assistance and Sharing among End-Users. *Research Policy*, 32, 157–78.
Franke, N. and von Hippel, E. (2003) Satisfying Heterogeneous User Needs via Innovation Toolkits: The Case of Apache Security Software. *Research Policy*, 32, 1199–215.
Franke, N., Keinz, P. and Schreier, M. (2008) Complementing Mass Customization Toolkits with User Communities: How Peer Input Improves Customer Self-Design. *Journal of Product Innovation Management*, 25, 546–59.
Frey, K. and Lüthje, C. (2011) Antecedents and Consequences of Interaction Quality in Virtual End-User Communities. *Creativity and Innovation Management*, 20, 22–35.
Füller, J. and Matzler, K. (2007) Virtual Product Experience and Customer Participation: A Chance for Customer-Centred, Really New Products. *Technovation*, 27, 378–87.
Gassmann, O. (2006) Opening Up the Innovation Process: Towards an Agenda. *R&D Management*, 36, 223–8.
Hertel, G., Niedner, S. and Herrmann, S. (2003) Motivation of Software Developers in Open Source Projects: An Internet-Based Survey of Contributors to the Linux Kernel. *Research Policy*, 32, 1159–77.
Hienerth, C. (2006) The Commercialization of User Innovations: The Development of the Rodeo Kayak Industry. *R&D Management*, 36, 273–94.
Hienerth, C., Von Hippel, E., Jensen, A. and Berg, M. (2012) Efficiency of Consumer (Household Sector) vs. Producer Innovation. MIT Sloan Working Paper, 4926–11.
Hutter, K., Hautz, J., Füller, J., Mueller, J. and Matzler, K. (2011) Communitition: The Tension between Competition and Collaboration in Community-Based Design Contests. *Creativity and Innovation Management*, 20, 3–21.
Jeppesen, L.B. (2005) User Toolkits for Innovation: Consumers Support Each Other. *Journal of Product Innovation Management*, 22, 347–62.
Jeppesen, L.B. and Frederiksen, L. (2006) Why Do Users Contribute to Firm-Hosted User Communities? The Case of Computer-Controlled Music Instruments. *Organization Science*, 17, 45–63.
Jeppesen, L.B. and Molin, M. (2003) Consumers as Co-Developers: Learning and Innovation Outside the Firm. *Technology Analysis & Strategic Management*, 15, 363–83.
Lakhani, K.R. and von Hippel, E. (2003) How Open Source Software Works: 'Free' User-to-User Assistance. *Research Policy*, 32, 923–43.
Laursen, K. and Salter, A. (2006) Open for Innovation: The Role of Openness in Explaining Innovation Performance among UK Manufacturing Firms. *Strategic Management Journal*, 27, 131–50.
Miles, M.B. and Huberman, A.M. (1994) *Qualitative Data Analysis: An Expanded Sourcebook*. Sage Publications, Thousand Oaks, CA.
Morrison, P.D., Roberts, J.H. and von Hippel, E. (2000) Determinants of User Innovation and Innovation Sharing in a Local Market. *Management Science*, 46, 1513–27.
Morrison, P.D., Roberts, J.H. and Midgley, D.F. (2004) The Nature of Lead Users and Measurement of Leading Edge Status. *Research Policy*, 33, 351–62.
Nov, O., Naaman, M. and Chen, Y. (2010) Analysis of Participation in an Online Photo-Sharing Community: A Multidimensional Perspective. *Journal of the American Society for Information Science & Technology*, 61, 555–66.
Piller, F. and Kumar, A. (2006) For Each, Their Own. *Industrial Engineer: IE*, 38, 40–45.
Piller, F.T. and Walcher, D. (2006) Toolkits for Idea Competitions: A Novel Method to Integrate Users in New Product Development. *R&D Management*, 36, 307–18.
Pisano, G.P. and Teece, D.J. (2007) How to Capture Value from Innovation: Shaping Intellectual Property and Industry Architecture. *California Management Review*, 50, 278–96.
Prügl, R. and Schreier, M. (2006) Learning from Leading-Edge Customers at The Sims: Opening Up the Innovation Process using Toolkits. *R&D Management*, 36, 237–50.
Rochet, J.-C. and Tirole, J. (2006) Two-Sided Markets: A Progress Report. *RAND Journal of Economics*, 37, 645–67.
Sawhney, M. and Prandelli, E. (2000) Communities of Creation: Managing Distributed Innovation in Turbulent Markets. *California Management Review*, 42, 24–54.
Schau, H.J., Muniz, A.M. and Arnould, E.J. (2009) How Brand Community Practices Create Value. *Journal of Marketing*, 73, 30–51.
Shah, S. (2006) Motivation, Governance, and the Viability of Hybrid Forms in Open Source Software Development. *Management Science*, 52, 1000–14.

Shah, S. and Tripsas, M. (2004) When Do User-Innovators Start Firms? Towards a Theory of User Entrepreneurship. Working Paper 04-0106, University of Illinois at Urbana-Champaign.

Thomke, S.H. (1998) Managing Experimentation in the Design of New Products. *Management Science*, 44, 743–62.

Von Hippel, E. (2001) Perspective: User toolkits for Innovation. *Journal of Product Innovation Management*, 18, 247–57.

Von Hippel, E. and Katz, R. (2002) Shifting Innovation to Users via Toolkits. *Management Science*, 48, 821–33.

Von Krogh, G., Spaeth, S. and Lakhani, K.R. (2003) Community, Joining, and Specialization in Open Source Software Innovation: A Case Study. *Research Policy*, 32, 1217–41.

West, J. and Gallagher, S. (2006) Challenges of Open Innovation: The Paradox of Firm Investment in Open-Source Software. *R&D Management*, 36, 319–31.

Wiertz, C. and de Ruyter, K. (2007) Beyond the Call of Duty: Why Customers Contribute to Firm-hosted Commercial Online Communities. *Organization Studies*, 28, 347–76.

Yin, K.R. (1984) *Case Study Research: Design and Methods*. Sage Publications, London.

Guy Parmentier (guy.parmentier@iae-grenoble.fr) is associate professor at the University of Grenoble in the department of the *'Institut d'Administration des Entreprises'* and CERAG research team. He specializes in management of user innovation and management of creativity, with a particular focus on the creative and tourist industries.

Romain Gandia (rgandia@inseec.com) is associate professor at the INSEEC Business School where he teaches strategy and innovation management. His research in the *Research Institute of Management and Economics* focuses on cultural industries and new strategies, and organizational forms of innovation.