European Journal of Operational Research 281 (2020) 642–655

Contents lists available at ScienceDirect

European Journal of Operational Research

journal homepage: www.elsevier.com/locate/ejor

Actualizing business analytics for organizational transformation: A case study of Rovio Entertainment

Yenni Tim[a,*], Petri Hallikainen[b], Shan L Pan[c], Toomas Tamm[d]

[a] School of Information Systems and Technology Management, UNSW Business School, University of New South Wales (UNSW), Room 2085, West Wing, Quadrangle, Sydney 2052, Australia
[b] Business Information Systems, University of Sydney Business School, Rm 4073, Abercrombie Building (H70), NSW 2006, Sydney, Australia
[c] School of Information Systems and Technology Management, UNSW Business School, University of New South Wales (UNSW), Room 2015, West Wing, Quadrangle, Sydney 2052, Australia
[d] School of Information Systems and Technology Management, UNSW Business School, University of New South Wales (UNSW), Room 2111, West Wing, Quadrangle, Sydney 2052, Australia

ARTICLE INFO

Article history:
Received 5 February 2018
Accepted 29 November 2018
Available online 12 December 2018

Keywords:
Business analytics
Technology affordances
Effective use
Value creation
Organizational transformation

ABSTRACT

Increased access to data and affordable technologies today has made business analytics within the reach of most organizations. However, many organizations are unsure of how to translate their analytics use into organizational value. While the area of business analytics value creation has become a popular point of discussion amongst practitioners, much research is needed to provide insights into the effective use of business analytics. The objective of this paper is to deepen understanding in the effective implementation of analytics within organizations. Specifically, we performed an in-depth case study at Rovio Entertainment to investigate how a pioneer in mobile games initiated an analytics-driven transformation. This study contributes to the theory and practice of business analytics in two ways. First, drawing on the perspective of technology affordances, this study sheds light on the varying affordances of business analytics. Second, this study presents empirically-informed insights on how these affordances could be effectively actualized for an analytics-driven transformation in an organization. Collectively, this study opens up the black-box of effective implementation of business analytics for organizational value creation.

1. Introduction

Businesses today are becoming increasingly intrigued by the possibilities of business analytics (hereafter BA) to create value (Chen, Chiang, & Storey, 2012; Ransbotham, Kiron, & Prentice, 2015). While many organizations recognize the power of BA (LaValle, Lesser, Shockley, Hopkins, & Kruschwitz, 2011), many are overwhelmed by the far-reaching changes required to transform into a data-driven organization (Brydon & Gemino, 2008; Ransbotham et al., 2015; Vidgen, Shaw, & Grant, 2017). To date, there is insufficient empirical research about how organizations could translate their BA use into organizational value (Fink, Yogev, & Even, 2017; Hindle & Vidgen, 2018; Vidgen et al., 2017). The objective of this paper is to improve the understanding of how BA can be effectively implemented and actioned in an organization for value creation.

We have performed an in-depth case study of Rovio Entertainment to investigate an organization that has recently completed a BA-driven transformation. As with other industries, a wave of BA adoption is emerging in the gaming industry, driven by the availability of massive user data and analytics technologies, as well as the rise of the freemium business model (Voigt & Hinz, 2016). In response to these environmental changes, Rovio Entertainment, a company that has seen incredible success with its Angry Birds game franchise, initiated a transformation towards becoming a more data-driven organization.

We adopt the technology affordances perspective (Majchrzak & Markus, 2012) as our theoretical lens to uncover the underlying mechanisms of Rovio's successful implementation of BA. The technology affordances perspective serves as a lens for researchers to identify the important potentials of a technology, and to theorize the actions required to effectively actualize those potentials to achieve desirable outcomes (Majchrzak & Markus, 2012; Strong et al., 2014). By conducting an in-depth qualitative exploration

* Corresponding author.
E-mail addresses: yenni.tim@unsw.edu.au (Y. Tim), petri.hallikainen@sydney.edu.au (P. Hallikainen), shan.pan@unsw.edu.au (S.L. Pan), toomas.tamm@unsw.edu.au (T. Tamm).

https://doi.org/10.1016/j.ejor.2018.11.074
0377-2217/

using this theoretical perspective, we are able to develop insights on how the affordances of BA can be effectively actualized for value creation.

Collectively, our findings contribute to both the theory and practice of BA by revealing the mechanisms by which BA are actualized for organizational value creation. Theoretically, our findings open up the black-box of effective implementation of BA through identifying the varying technological and organizational features that drive the actualization of BA affordances. This conceptualization contributes insights to an emerging literature that aims to understand analytics-driven value creation in organizations (Fink et al., 2017; Hindle & Vidgen, 2018; Vidgen et al., 2017). For practitioners, our findings make explicit the goals, expertise and organizational arrangements required to actualize the affordances of BA to create organizational value. These insights provide necessary guidance for practitioners to derive value from their increasing investment in BA (Ransbotham et al., 2015; Ransbotham, Kiron, & Prentice, 2016; Vidgen et al., 2017).

The rest of this paper is organised as follows. In Section 2, we present a review of the literature on BA use for organizational value creation. We then discuss the emerging use of BA in the gaming industry to provide a foundation for this research. In Section 3, we discuss the theoretical underpinnings of this study and outline how the perspective of technology affordances is particularly suited for our investigation. In Section 4, we discuss our research design. In Section 5, we provide a case description of Rovio's analytics-driven transformation. In Section 6, we present the rich description of our analysis, and in Section 7, we discuss our empirically-grounded findings. We conclude with a discussion of the theoretical and practical contributions of the paper in Section 8.

2. Literature review: business analytics for organizational value creation

In this section, we first present a review of the literature on BA-enabled value creation. In this discussion, we outline the specific opportunities and challenges faced by organizations in actualizing value from their uses of business analytics. Second, following from the organizational context of our study, we present a review on BA use in the gaming industry. We focus on a recent shift of the dominant business model in this industry (from premium to freemium games) and discuss the role of BA in this transformation. Taken together, through this literature review, we have identified the need for more empirical research on how BA can be effectively leveraged for organizational value creation. We present a summary of this research gap at the end of this review section.

2.1. BA and organizational value creation

In this paper, we adopt the widely-cited definition of business analytics as "the extensive use of data, statistical and quantitative analysis, explanatory and predictive models, and fact-based management to drive decisions and actions" (Davenport & Harris, 2007, p. 7). Henceforth, we use the abbreviation "BA" and "analytics" interchangeably to refer to "business analytics" as per the above definition. This view of analytics focuses on what BA affords, and how BA can be actualized to inform action and create value (Davenport & Harris, 2007). In today's business environment, data and BA tools have become more available and accessible for organizations (Brydon & Gemino, 2008). The challenge in organizational BA use however, relates to understanding how insights derived from analytics can be translated into actions and organizational value (Fink et al., 2017; George, Haas, & Pentland, 2014; Ransbotham et al., 2015; Vidgen et al., 2017).

Several scholars have highlighted that in addition to having access to BA tools, it is important to consider several organizational aspects that play a role in effective BA use (Brydon & Gemino, 2008; Hindle & Vidgen, 2018; Trieu, 2017; Vidgen et al., 2017). LaValle et al. (2011) highlighted that the biggest barriers to harness value from analytics are often not technological, but managerial and cultural. Davenport and Patil (2012) suggested that data scientists are the "primary gating factor" in determining whether BA will be effective within an organization. Abbasi, Sarker, and Chiang (2016) also pointed out how professionals in varying roles are increasingly expected and required to make use of data and analytics to improve their work. A large-scale survey conducted by Kiron, Ferguson, and Prentice (2013) further suggests that successful analytical companies often have senior managers who embrace and support analytics, and possess a widely shared belief that BA is a core asset that enhances the organization's competitive edge. Pape (2016) also pointed out that the success of an organization's BA strategy requires many considerations ranging from the selection of data and the quantifying of the data items' value. Collectively, cultivating a data-oriented culture is found to be fundamental to the effective use of analytics in organizations (Kiron, Shockley, Kruschwitz, Finch, & Haydock, 2011).

Taken together, insights from existing research reiterate the view that "value is created only when the data is analyzed and acted on" (Watson, 2014, p. 1252, emphasis added). However, to date, only a handful of research focuses on a concrete understanding of how organizations can derive value from analytics. For example, Vidgen et al. (2017) investigated the challenges faced by managers in leveraging BA to create value. Using a mixed method approach, Vidgen et al. (2017) have identified 31 challenges faced by organizations in building the required analytics capabilities. The authors then proposed recommendations and checklists to guide managers through data-driven transformation. More recently, Hindle and Vidgen (2018) proposed a business analytics methodology involving four activities to guide practitioners in drafting analytics initiatives. The proposed methodology focuses on business model building and introduces several techniques for organizations to develop a rich picture of their business practices.

2.2. BA use in the gaming industry

In this paper, we investigate the mechanisms of BA-enabled value creation in the gaming industry. As with other industries, BA has emerged as an important catalyst for competition and innovation amongst companies in the gaming industry (Watson, 2014). Specifically, a few changes in the gaming landscape over the past decade have increased the importance of BA for gaming companies. First, the increasing use of mobile devices has resulted in the explosive growth of mobile games (Chulis, 2012). Second, the popularity of social media platforms has stimulated the growth of social games, which focus on interaction and competition between players (Liu, Li, & Santhanam, 2013). Third, the proliferation of casual gaming, combined with changes in player demographics and preferences, has led to a decline in "pay-to-play" console and computer games and the rise of a freemium business model (Chulis, 2012; Kumar, 2014).

The freemium model has rapidly become the dominant pricing model for social network applications and games in the recent decade (Kumar, 2014; Voigt & Hinz, 2016). In the gaming industry, freemium business model is also known as "free-to-play" (F2P). In 2016, 97 percent of mobile gaming revenue came from free-to-play games (Newzoo, 2017). The rise of F2P is significant as it signals a shift from the long-established, product-based business model in the gaming industry towards a highly dynamic, service-based model. As with any new business model, there are challenges to be addressed by gaming companies in this transition. For example,

the monetization mechanisms between the two models are drastically different (Chulis, 2012). Historically, games are developed as a product and monetized through either a one-off payment or an ongoing subscription. In the F2P paradigm however, monetization relies on in-game micro-purchases, such as the sale of virtual goods, as well as in-game advertising. In other words, in the new model, value is created by both developers and users through constant engagement (Oestreicher-Singer & Zalmanson, 2013). It is therefore becoming increasingly important for freemium companies to better understand player behavior in order to make strategic adjustments to optimize profitability (Voigt & Hinz, 2016).

Triggered by these shifting requirements, gaming companies have started to adopt analytics to secure a stake in the fast-growing gaming industry, which is estimated to reach $65 billion in revenue by 2020 (Newzoo, 2017). BA affords the opportunity to analyze player data for effective marketing and data-driven monetization (Chulis, 2012), ultimately allowing gaming companies to become more flexible when developing customer-driven products and services (Watson, 2014). Because BA use in the gaming industry has only emerged recently, research on game analytics is still in its initial phases, with related publications stemming from the early 2010s, primarily in the form of conference papers and workshop proposals (e.g., Andersen, Liu, Snider, Szeto, & Popović, 2011; Deterding, Björk, Nacke, Dixon, & Lawley, 2013; Nacke & Drachen, 2011). These studies, as well as two recent books on the topic (i.e. El-Nasr, Drachen, & Canossa, 2016; Loh, Sheng, & Ifenthaler, 2015), primarily focus on defining the technicalities related to how analytics can be used to inform a better design of game features and experience. These discussions have revealed several important game-play and player metrics that could be used by game companies to measure the performance of their games.

However, there appears to have been little attention to date on the organizational implementation of game analytics. This lack of research might be attributed to a misconception that effective implementation of analytics is simply about having access to appropriate analytics technologies (Vidgen et al., 2017). As recent research has pointed out, value creation from BA is in fact a process of complicated organizational changes, such as business model alignment (Hindle & Vidgen, 2018) and changes in organizational processes and strategies (Vidgen et al., 2017). Against this backdrop, we argue that investigating the effective actualization of BA in the gaming industry is important for two reasons. First, the gaming industry is evolving rapidly today with a new focus on BA-driven value creation. Many game companies have, or are in the process of, adopting game analytics today but there is little information and guidance available for how gaming companies can leverage BA for value creation. Second, and broadly, a study of effective BA implementation could provide valuable insights for other organizations looking to embark on a BA-driven transformation in response to changing environment. An understanding of BA-driven transformation is relevant and insightful for most of today's organizations; notwithstanding, lessons learned from the gaming industry will be particularly relevant for organizations operating in a similar industry environment, such as internet start-ups offering digital products.

3. Theoretical background: technology affordances and actualization

In this study, we adopt the perspective of technology affordances to theorize the organizational uses and implications of BA in the game industry. The concept of *affordances* originates from Gibson (1979) work in the field of ecological psychology. Gibson (1979) first developed the concept of affordances to explain the possibilities an object affords for action. The concept of *technology affordances* was then introduced by scholars in the recent decade to capture the action potentials of technological objects (Majchrzak & Markus, 2012; Majchrzak, Faraj, Kane, & Azad, 2013). Specifically, technology affordances refer to "what an individual or organization with a particular purpose can do with a technology" (Majchrzak & Markus, 2012, p. 1).

Technology affordances is a relational concept (Strong et al., 2014; Vaast, Safadi, Lapointe, & Negoita, 2017). It focuses not only on technological features, but also takes into account how actors perceive and interact with the technology (Markus & Silver, 2008; Vaast et al., 2017). Adopting this perspective is vital for scholars in considering how organizational features, including "expertise, organizational processes and procedures, controls, boundary-spanning approaches, and other social capacities present in the organization" (Zammuto, Griffith, Majchrzak, Dougherty, & Faraj, 2007, p. 752) interact with features of a technology, and how this interaction influences the use of the technology (Burton-Jones & Volkoff, 2017; Hasan, Henry Linger, Choy, & Schlagwein, 2016).

Scholars previously have adopted the perspective of technology affordances to identify action potentials of technological artifacts in facilitating the attainment of organizational goals. Most of these existing studies focus on proposing higher-order categorization for technological affordances or introduce different types of affordances (see, for example, Leonardi, 2013; Treem & Leonardi, 2013). Nevertheless, given the relational property of this concept, technology affordance is a "potentiality that only exists when leveraged within a specific domain and set of actions" (Majchrzak et al., 2013, p. 39). The same technology could then support different affordances and lead to different organizational outcomes when leveraged within different domains and sets of actions (Rice et al., 2017; Strong et al., 2014; Vaast et al., 2017).

Accordingly, scholars have begun to call for a theorization on affordance-actualization (see, for example, Burton-Jones & Volkoff, 2017; Strong et al., 2014; and Tim, Pan, Bahri, & Fauzi, 2018). Affordance-actualization captures the process where actors realize a specific action potential afforded by a technological artifact to facilitate a specific goal-oriented action (Strong et al., 2014). Conceptualizing affordance-actualization allows scholars to capture the process where a technological potentiality is discovered and articulated to support a certain task, as well as aids their understanding of the concrete outcomes of actualization (Burton-Jones & Volkoff, 2017). To date, a handful of existing research has provided conceptualizations for affordance-actualization to understand the various ways in which actors adopt and appropriate a technology, and how the actualization process leads to the achievement of certain organizational outcomes. Appendix A summarizes some of these existing studies. These studies have inspired our theorization as they provide an example into how attending to the importance of affordance-actualization could lead to a better understanding of digitally-enabled organizational change (Anderson & Robey, 2017).

As such, we argue that the technology affordances perspective is well-suited to address our research objective. Firstly, this perspective allows an investigation into how technological potentials could be actualized in a particular organizational context to facilitate a specific goal-oriented action (Strong et al., 2014). Secondly, this perspective not only describes the characteristics of a technology, but provides scholars with an opportunity to understand how organizational features play a part in leveraging technological potentials to enable a particular change or outcome (Bygstad, Munkvold, & Volkoff, 2016; Strong et al., 2014; Zammuto et al., 2007). This perspective serves as an important sensitizing device in this study because it is not obvious what effective organizational BA use involves. Using this perspective, we conceptualize the effective actualization of BA in organizations as an entanglement of technology features, organizational processes and goals. A conceptualization of affordance-actualization allows us to answer the question of how BA use could translate into organizational value.

4. Research method

4.1. Research design and case selection

We started this research with an aim to understand how organizations adopt BA to create value. Given the exploratory nature of our research topic, we chose the qualitative case study (Pan & Tan, 2011; Walsham, 1995) and an interpretive approach (Klein & Myers, 1999; Walsham, 1995) to develop a rich theoretical understanding of the phenomenon and to answer our research question. We provide a summary of our research design and key methodological considerations in Table 1.

4.2. Data collection

Interviews were our primary data source. Prior to our onsite visit, we collected and reviewed publicly available data from Rovio's official channels, press releases, and news articles to develop a basic understanding of the case organization and its transformation initiative. Our site visit and interviews took place in June 2016 at Rovio's headquarters located in Espoo, Finland. In total, we conducted more than 12 hours of interviews with Rovio's employees in a broad variety of roles and at different levels (see Appendix B for a full list of interviewees). Our interviews were semi-structured with a primary focus on open-ended questions. We first asked our interviewees to provide an overview of Rovio's transformation initiative, and then to elaborate in detail on the relevant facts and key events (see Appendix C for the interview guide). Questions were adapted along the way to gather more data, depending on the interviewees' role in the transformation. Our understanding of prior research on BA adoption and affordance-actualization sensitized us to more questions to ask. Nevertheless, we maintained flexibility during the interview process, having non-leading conversations when necessary (Myers & Newman, 2007). We also cross-checked information gathered from interviewees against publicly available materials to control for retrospective bias.

We complemented this data with a range of published materials surrounding the case to capture contextual complexity and for triangulation. We first reviewed articles and reports available on Rovio's official website to reconstruct details of its transformation journey. One of the key sources of published data that complemented and confirmed our analysis was the official Offering Circular document released by Rovio in line with its initial public offering (Rovio, 2017). This 444-page official document provided an unprecedented view of Rovio's internal processes. It details how analytics provides Rovio with a strong competitive advantage in the market. This emphasis signals the importance of analytics at Rovio, which confirms the significance of the focus of this study. The specific analytics examples provided in the document are also consistent with our interview data and analysis, which reaffirms the reliability of our findings. We also reviewed all official social media channels of Rovio and captured all relevant information to complement our interviews. Overall, data collected from different sources enabled a triangulated understanding of Rovio's BA-enabled transformation. Our data sources and their role in the data analysis is summarized in Table 2.

4.3. Data analysis

We approached our analysis from an interpretive perspective and adopted the theoretical lens of technology affordances as our "sensitizing device" (Klein & Myers, 1999, p. 75) to guide our sense-making of the rich data. In interpretive research, data analysis is started as soon as data collection commences. In the first phase of our data analysis, we focused on developing narratives to delineate the transformation journey at Rovio. At this stage, we made use of data from a variety of sources to reconstruct the key stages and events of the transformation. This initial understanding allowed us to organize detailed stories from our data into four stages of transformation (i.e., Establish, Enhance, Engage, and Embrace, as illustrated in our theoretical framework) to account for the different types of activities and BA use over time. This narrative serves as the main source of our analysis.

The next step of our data analysis involved working back and forth between our data, literature and emerging insights to construct a deeper understanding of the phenomenon. At this stage, we mapped out our data into broad thematic categories to present the different types of BA use. The theoretical lens of technology affordances provided us with the theoretical sensitivity to perform this mapping. Following guidance from existing studies (e.g., Tim et al., 2018; Volkoff & Strong, 2013), we asked questions such as "what did BA enable Rovio to do?" and "what did Rovio use BA for?" when analyzing our data. This process allowed us to identify four affordances (i.e., foundational, functional, formative and formalizing affordances) as salient affordances that emerged as core to the attainment of Rovio's transformation goals.

As is typical for interpretive research, we analyze our data, the literature and the emerging insights to construct and refine our understanding of the phenomenon. Upon identification of the affordances of BA, we cross-checked this with the data to identify statements describing different actions relating to each affordance.

Table 1
Research design and key methodological consideration.

Methodological consideration	Outcome
Case study approach and case selection	The case of Rovio was selected because the company has recently undergone a hugely successful analytics-driven transformation
• Research aim was to investigate the effective actualization of BA for organizational value creation	• Rovio embraced BA to transform from a premium pay-to-play model to a free-to-play model
• Theoretical sampling to select a revelatory case to study this phenomenon of interest	• The use of BA has enabled value creation at Rovio, as evident from the developed capabilities including *in-house analytics and a proven user acquisition process, expertise in game development and monetization, substantial cross-promotion capability* (Rovio, 2017, p. 145)
Interviews as primary data source	
• Snowballing technique (Myers & Newman, 2007) to recruit suitable interviewees	• The interviews at Rovio provided a deep understanding of the transformation process, especially the use of BA in supporting the process
• Principles of openness, flexibility and improvisation to make necessary adjustments during the data collection process (Myers & Newman, 2007)	• The insights gained allowed us to establish meaningful understanding of the underlying mechanisms and also to capture the contextual richness
Multiple data sources for triangulation	• Rovio provided us with an unprecedented view of specific analytics metrics and measures used internally in the organization to guide decision making
• A rich set of data sources (see Table X) for triangulation to add breadth and depth to our analysis (Flick, von Kardoff, & Steinke, 2004)	• A range of published data used as supporting pieces of evidence for triangulation

Table 2
Description of data sources and their role in analysis.

Data sources	Description	Role in analysis
Onsite, semi-structured interviews	12 hours and 15 minutes of interview recordings	Insights into key events related to the transformation journey Deep understanding of meaningful and contextual richness behind the process
Analytics metrics and measures	Specific analytics metrics and measures used by Rovio, including a snapshot of analytics dashboard, specific measures and illustrative examples	Insights into the exact use of analytics Deep understanding of the changes enabled by analytical insights
Official channels	Offering Circular document, articles, posts and reports published on Rovio's website and official social media channels (Facebook, LinkedIn, Instagram and Twitter)	Insights into timeline and detailed information of key events and decision points Understanding of the key events and developments from the company's perspective
Published materials	Publicly available reports, articles and case studies	Insights into key events and developments

This allowed us to better appreciate the importance of organizational arrangements in enabling effective actualization of the affordances. Multiple readings of the data and the literature further affirmed that an effective actualization of affordances depends upon a combination of technological features and organizational arrangements. For example, our interviewees repeatedly noted that having access to BA does not immediately generate value for the organization. In many cases, multiple rounds of adjustments in processes and structures were needed to effectively realize the value potential of BA.

Further consultation of the literature and our emerging interpretations (for example, by asking questions such as: How were the affordances of BA actualized? What are the enablers of affordance-actualization? What are the outcomes?) allowed us to conceptualize the mechanisms of affordance-actualization, and how these actualizations lead to the attainment of varying organizational goals (i.e., different value created). When performing these analyses, our rich data allowed us to verify salience of the emerging concepts and to refine our interpretations. We also retained "a considerable degree of openness to the field data, and a willingness to modify initial assumptions and theories" (Walsham, 1995, p. 76), and remained open to identifying additional new concepts from our data. As we continued to analyze the emerging conceptualization, data and related literature, we were able to map the various mechanisms of affordance-actualization to different transformation stages. This final step resulted in a deep conceptual interpretation of the phenomenon, which we organized into a theoretical framework discussed later in the paper. During the analysis process, we also cross-checked our interpretations and theoretical framework with our interviewees at Rovio. Involving our interviewees in the analysis process enabled a critical reflection that adds to the validity of our interpretations (Flick, 1998).

5. Case description: envisioning a BA-enabled transformation at Rovio Entertainment corporation

Rovio Entertainment is a Finnish entertainment company founded in 2003 as a mobile game development studio by three students – Niklas Hed, Jarno Väkeväinen, and Kim Dikert. In the 15 years since, Rovio has grown to more than 430 employees, close to €200 million in annual revenue, and created some of the most successful mobile games of all time. The company is best known for its Angry Birds game franchise. The original title in the series, released as Rovio's 52nd game in 2009, has been downloaded more than 3 billion times and led the paid iOS app rankings for longer than any other game.

Despite the phenomenal success of Angry Birds, Rovio has already had to reinvent itself in response to disruptive industry forces. By 2012, the "pay-to-play" (also referred to as "premium") games business model underpinning Rovio's original Angry Birds success was becoming unviable. The more profitable titles in the gaming industry, such as the Candy Crush Saga and Clash of Clans, were moving to a "free-to-play" (F2P) business model. As the name suggests, this new model allowed customers to download a game and access a significant part of its functionality for free. The F2P model is dependent on keeping users continuously engaged in the game, and earning revenue from in-game micro-transactions that either enrich or simplify the user experience. The rise of F2P games has signalled a shift in the gaming industry towards a highly accessible, connected and dynamic gaming model:

> *[The move to F2P business] has been the biggest transformation, not only for Rovio, but for the whole games industry…I would actually argue that the biggest changes in the whole games industry are related to … App Store and Android markets opening to us…and the F2P business being enabled by the fact that those app stores actually allowed in-app purchases… In 2015 just the mobile gaming market was 34 billion (USD)… that's huge…[it's] a really crowded place…200 new iOS games per day.* Head of Studio

Rovio's management team soon realized that they could not afford to ignore the F2P business model as F2P games have become the dominant revenue model in the market:

> *With the proliferation of the free-to-play model, barriers to downloading games have decreased, and an increasing share of the population and of mobile phone users are playing mobile games. In the United States, 69% of mobile phone users played mobile games at least once per month in 2016, and it is estimated that this percentage will increase to 77% by 2020.* (Rovio, 2017, *p. 8*)

In responding to the shift in the environment, Rovio embarked on its first F2P game project in the summer of 2012. Initially, some of the premium games were converted to F2P games but this was considered only partially successful as fundamental changes in game design were still needed to fully embrace the F2P model. As such, Rovio decided to solely focus on F2P games going forward:

> *One of the biggest decision points was actually the company come out and say that we are only doing free to play games. That was a big change because before that if there was even a chance that someone could do premium games they would like to grab that chance. But when it was explicitly said that no, we don't do premium games any more at all, that was a big, big change.* Senior Product Manager

However, Rovio was also well aware that the transformation required to adopt this new business model was complicated. There were several challenges which Rovio needed to overcome. First, F2P games have historically been of low quality compared to premium games. As Rovio's staff prided themselves on creating top quality products, this stereotype presented an initial hurdle in their pursuit of the F2P model. Second, creating a successful F2P game required a deep understanding of players' preferences and the use of behavioral economics. While Rovio had one of the strongest

Table 3
Actualizing BA for organizational transformation.

Organizational goal	Technological features	Organizational features	Affordance-Actualization (AA)	Organizational outcomes
Improved understanding	• Aggregation of user behavioral data, public feedback and comments	• Analysts with expertise in analyzing big data	**AA1**: Curate relevant data	• Comprehensive data awareness (where it is, what we need and how we use it)
	• Dashboards and reports	• Designers tasked to review analytical insights	**AA2**: Perform basic analysis	• Improved understanding of the potential of analytics in enabling transition to new model
Improved core operational processes	• Customizable data acquisition (e.g., return on paid user acquisition investment, retention and monetization rate)	• Individuals with optimism towards analytics	**AA3**: Incorporate analytics into existing processes	• Increased strategic use of analytics
		• Analysts tasked to provide constant guidance	**AA4**: Use analytics to make constant adjustments to products	• Formulation of more concrete analytics strategies and plans
Integrated use of analytics	• Real-time, integrated dashboard	• Individuals with confidence in the potential of analytics	**AA5**: Set visible statements about the importance and expected use of analytics	• A change in organizational structure and individual responsibilities in enacting analytics
	• Easily accessible reports and *ad hoc* analytics queries	• Managers with clear expectations about the use of analytics	**AA6**: A hybrid team structure to promote the use of BA	• Broadened use of analytics in different areas
Analytics-driven culture	• Real-time, integrated dashboards	• Individuals with trust in analytics	**AA7**: Formalize analytics as an essential part of the organization	• Tolerance for trial and error and an openness to data-driven orientation
	• Regular feedback, consolidated analysis and interim reports	• A culture that respects reliance on data and analytics	**AA8**: Proactively enact analytics to maximize impact and value	• Appreciation of the power of analytics as a source of competitive advantage for the organization

pools of premium game talent, there was very little know-how within the company on how to create successful F2P games.

BA was identified as a key enabler for this transformation. Firstly, BA afforded several new possibilities for Rovio to create customer-centric games to compete in the F2P market. For example, data about players' in-game behaviors and the economic performance of a game could be analyzed to generate insights into player preferences. These data improved the games' retention and monetization, which are the key performance indicators (KPIs) for F2P games. Secondly, Rovio embedded analytics in many of its operations, and introduced a change in organizational structure to accommodate for more effective BA use. This BA adoption enabled Rovio to transform into a data-driven organization, as summarized succinctly by a Head of Studio:

> *Now everybody is somehow exposed to the data. When I joined Rovio the only data we basically had and we were looking at were the app store downloads. Now we have a lot of data. We look at how the players actually play the game, where are the pain points possibly, where are the opportunities…The usage of data has basically entered every area, even the work of artists. They see that if I do this kind of icon, we can immediately see that ok, when the possible customers go to the app store page this icon actually works this much better in actually converting people to download the game. All the disciplines now are using the data in their work.*

Today, Rovio is thriving in the industry as a customer-driven, service-based entertainment company. "By 2016, the Company's games were almost fully transformed to the free-to-play model as opposed to 2011, when 63% of the Company's Games gross bookings was generated from paid apps." (Rovio, 2017, p. 139) This transformation journey of Rovio serves as a revelatory case to investigate the actualization of BA for value creation. We present our analysis of this analytics-driven transformation in the following section.

6. Case analysis

Based on the technology affordances perspective, we uncovered four salient affordances of BA that were core to the attainment of Rovio's transformation goals: (1) foundational affordances for improved understanding, (2) functional affordances to improve core operational processes, (3) formative affordances to foster an integrated use of BA, and (4) formalizing affordances to cultivate a data-driven culture. For each affordance, our analysis unveiled the specific technological features of BA, as well as the organizational arrangements that are essential for organizational actors to actualize the affordance. We then described the organizational outcomes achieved through affordance-actualization. These findings are summarized in Table 3 and discussed in detail in this section.

6.1. Actualizing foundational affordances for improved understanding

Rovio first adopted BA to better understand its new business model as well as its current performance and opportunities in an emerging market. At this stage, Rovio actualized several foundational affordances of BA, including accessibility and visibility, to establish a strong foundation for its analytics-driven transformation.

6.1.1. Curate relevant data (AA1)

BA was first adopted by Rovio as an experimental move to gain a greater understanding of the F2P model. Moving from a premium-game business model to a F2P model was a significant transformation for Rovio. F2P games need to be designed in a way that keeps users continuously engaged and willing to make purchases within the game. This is fundamentally different from the premium game model, as highlighted by a Head of Studio at Rovio:

> *This is what has fundamentally changed with the F2P business…you need to be able to think where does the monetization of the game sit…things like target audience size as well as things like long term retention.*

Rovio knew that it needed to have an in-depth understanding of the F2P model to develop successful games in this new space. BA was adopted to achieve this purpose. At this stage, BA was utilized mainly to inform Rovio's understanding on the current trends of the F2P mobile gaming market, and subsequently on users' needs and behaviors:

> *Data on the mobile gaming market, competitors and users is utilized more strongly in generating, designing and prototyping new*

game ideas whereas quantitative user data is utilized to a larger extent when games are opened for wider distribution. – (Rovio, 2017, p. 162)

As Rovio developed an initial understanding of the changes required, they set out to hire people with expertise in game analytics and the F2P model. A handpicked transformation leadership team – CorePM was established to lead Rovio in harnessing BA in the transformation. The team consisted of four people - Senior Vice President, Games, a Head of Studio and two Senior Product Managers with strong expertise in F2P. This team was in charge of coaching and familiarizing existing employees with the F2P design logic and the uses of BA in the process. For example, they would run one-day workshops that involved a competitor's successful premium game as a point of discussion and working through what is needed to be done in order to transform it into a successful F2P game. BA played an essential role in these workshops as it afforded visibility into the progress of all activities involved, and allowed the team to stay on the right track:

At some point we were getting more money from the in-app purchases than from the paid downloads, so that's already one place when we knew that ok, we are on the right track. Vice President, Game Development

6.1.2. Perform basic analysis (AA2)

Based on this understanding of the F2P model and support from analytics experts, Rovio started to develop its first F2P game from the ground-up. The use of BA grew considerably starting from this trial:

When we had our first real free to play games…that was the place when we started really digging into that, what happens when players spend money, when do they spend money, in which things they spend money, is it energy, is it power ups, is it speeding up things. Also, the journey—what happens before they spend and what happens after they spend. And do they spend multiple times, how much do they spend in one go. We started testing that ok if you offer let's say this starter bundle with this price point, that price point or this price point, which of these performs better money-wise, which brings the most revenue. Vice President, Game Development

At the time, the F2P mobile gaming market was highly competitive. The cost of user acquisition was high and only a small portion of F2P mobile games could reach significant scale. As a new entrant in this market, *Rovio employs analytics to understand content and the campaigns that work best, often combined with embedded A/B content testing and refinement. (Rovio, 2017, p. 163).* As highlighted by the Senior Product Manager, the use of BA has provided a detailed view of user expectations and game performance, something which has been historically unattainable:

Everything can be measured since it's a service-based thing and that's a huge change. You don't rely on your gut or your thinking, but rather rely on numbers, which is quite a drastic change of thinking.

This visibility has reassured Rovio that their transition to F2P model was necessary and possible. This improved awareness and allowed Rovio to establish a strong foundation and momentum for its analytics-driven transformation.

6.2. Actualizing functional affordances to improve core operational processes

Having established an understanding of the power of analytics and the F2P model, Rovio began to expand their BA use to improve existing processes and to guide its transition to the F2P model. Several functional affordances of BA have been actualized at this stage to improve existing business and game development processes, as well as to inform new products and services design.

6.2.1. Incorporating analytics into existing processes (AA3)

The F2P market is highly dynamic and requires companies to continually anticipate and respond to changing trends and demand. Rovio's use of BA has afforded visibility into market changes and crucially, allowed informed decisions to be made in response to these changes. One specific example of this is how Rovio incorporated BA in its game development process. As part of the transformation into a F2P model, Rovio has introduced a game development process called "Flightpath". This process takes game ideas through the phases of (1) Idea and Concepting, (2) Market Research and Prototyping, (3) Pre-production, (4) Production and Soft Launch. BA is used in all phases of a game's Flightpath to achieve informed decision-making. For example, BA was used to identify potential new game designs in the Idea and Concepting phase:

Rovio has accumulated significant understanding of user behavior, and Rovio uses this knowledge to develop its games based on data-driven analysis and user feedback. (Rovio, 2017, p. 141)

The Senior Vice President, Games has provided a specific example of how BA was used to identify a need for adjustments to a game prototype (see also Fig. 1):

A game team working on a new game prototype noticed from analytics that players were not using their free boosters as expected in the very early part of the game. Especially the share of players using zero free boosters per level was alarmingly high (70%). Using free boosters will give better feeling of control to the player and make the experience more fun, so those that do not use free boosters are more likely to churn out from the game.

After gaining this insight, the team has spent two days implementing a series of User Experience (UX) improvements to remind players to use their free boosters. With BA, the team was able to continuously monitor the impact of changes and make any necessary adjustments.

To ensure highly available and reliable BA services, Rovio has also invested extensively in an in-house cloud-based platform to collect data and perform analytics on all Rovio games. This platform allows everyone at Rovio to have full visibility and control over user data and analytics services. *Currently [in 2017], Rovio's 24/7 platform handles up to 4 billion analytics events on a daily basis and on peak times more than 45,000 API requests per second* (Rovio, 2017, p. 161). Rovio has provided us with an unprecedented look of the platform. Fig. 2 shows one of the dashboards which describes several measurement areas of a game that were actively used by game developers at Rovio. As explained by the Senior Vice President, Games, *there are altogether 55 dashboards. All of them are used actively by developers. The platform has various graphical and spreadsheet data and it's possible to export data* e.g., *to Excel for further analysis.* This in-house analytics platform has been repeatedly highlighted by Rovio as one of the key support for its transition into the new model:

Rovio relies on its network infrastructure, including the cloud-based services, to manage its operations, to develop its games and to provide Rovio with the data needed to analyze the performance of its business and to accurately report its operational and financial performance. (Rovio, 2017, p. 90)

6.2.2. Use analytics to make constant adjustments to products (AA4)

The use of BA has enabled an unparalleled understanding on the performance of each games. As elaborated by the Vice President, Game Development, *back in the premium times we didn't re-*

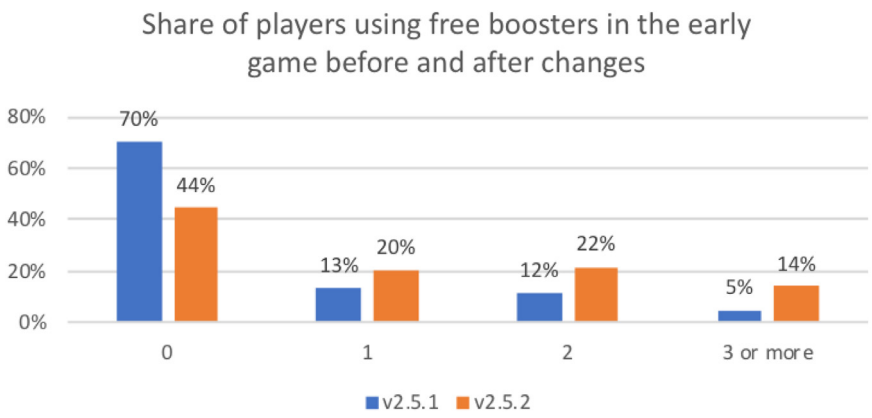

Fig. 1. Analytics used by Rovio team to monitor the use of free boosters and improvements once changes were made to the game's UX design (confidential information including the game's name have been removed).

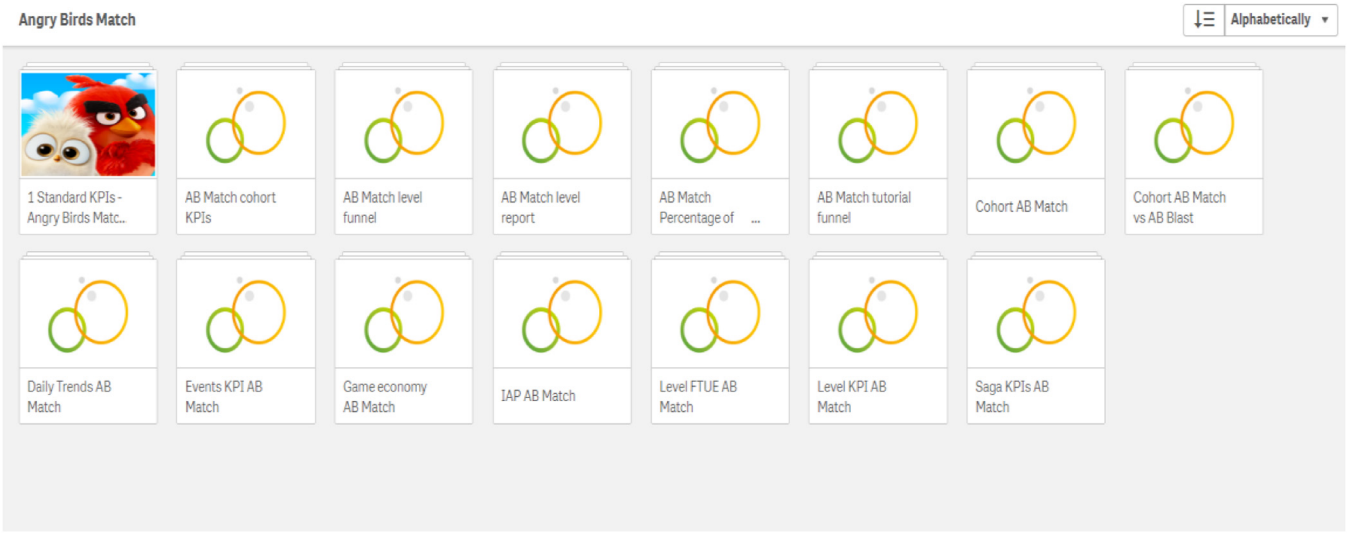

Fig. 2. A high level view of a dashboard showing several measurement areas of a game, which are reviewed actively by game developers. (Non-public information on the original dashboard has been removed).

ally care about KPIs, we didn't have retention KPIs, no one was talking about that. The use of BA has now enabled the teams to keep track of multiple Key Performance Indicators (KPIs) of F2P games, including:

> *We have retention, we have average revenue per daily active user… how many views there are per daily active users, what's the average revenue per paying user over a certain period of time, your activity how many minutes per day you are playing and how many sessions per day you are playing. Those are the main KPIs.*

This visibility enables Rovio to continuously improve on its game design. For example, Fig. 3 shows a screenshot of specific analytics for one of Rovio's games. The development team uses the data on Level Funnel (i.e. how many players who have started playing the game are still left on a level x) and the Fail Rate (i.e. the number of failed attempts at each level) to identify which levels of the game are either too easy or too challenging for its players.

With this insight into how each game performs, the development team was able to continuously make improvements to the game to maximize user experience. As highlighted by the Product Lead at Rovio, *basically there are a lot of things that hour-by-hour you are able to change in the game*. Rovio has also made sure to design their games in a way that made accumulation of meaningful data points possible:

> *The game is responsible for actually sending the data events to our system and then the big data system crunches that data and makes it available both for the data analysts, but also in the form of different dashboards and reports to everybody who is working with the games.* – Head of Studio

Beyond improving the games, incorporation of BA also aided Rovio in optimizing the game development process. As discussed above, BA was used to monitor a game's performance in each Flightpath. Games with retention issues can be abandoned early in the Pre-production phase. This allowed Rovio to focus its resources on games that were more likely to generate revenue, which is difficult to do in the past:

> *People were previously not willing to publish unfinished, or not unfinished, but not optimal game. Now we can go soft launch with not quite the full game and get initial learning and develop based on the feedback or the results. That was unheard of in the premium era when we just wanted to make a superpolished game. That's a huge design thinking change*. Senior Product Manager

A Senior Producer has provided a detailed description on how BA was integrated to inform various decisions in the game development process:

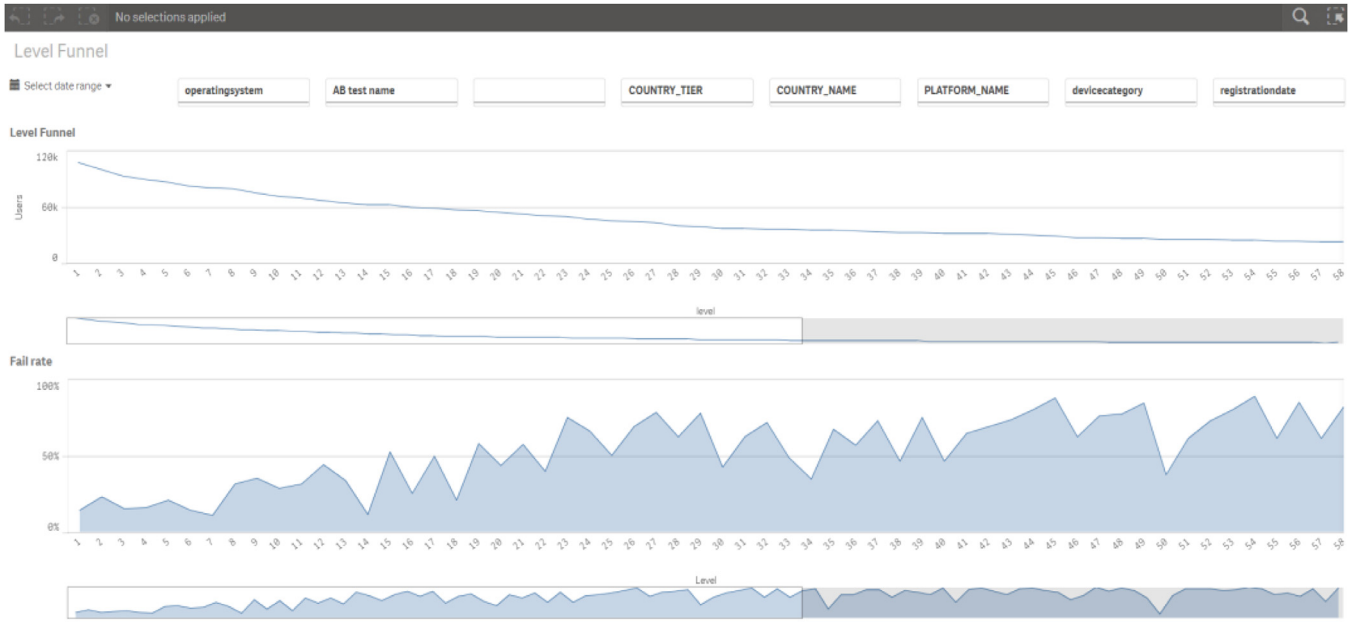

Fig. 3. Dashboard to keep track of level funnel and fail rate of a game.

> *It is much more data-driven and the loop-back of getting feedback and reacting to changes is much faster… You have to think how you can analyze all of this when the game is live. So, you have to put all the analytics events in and to make sure that the analytics pipeline is there, so that you can get the events, you can aggregate them, you can analyze. And then you need to have some dashboards, some analytics tools, all of that. So, there's a big shift [from] having a premium game to free to play—similar to boxed software.*

When discussing how BA often unveils surprising insights into users' preferences, a Senior Game Artist also highlighted an interesting example:

> *Since our game is called Angry Birds, we long thought that we have to picture them always angry…but then we noticed through this data that it works best if they are, for example, smiling and really happy…this doesn't really perfectly fit our title [Angry Birds] but it just looks best for the people.*

6.3. Actualizing formative affordances to foster an integrated use of BA

The positive impact of BA cultivated an optimism towards Rovio's transition into the F2P model. With increased experience in analytics, "*Rovio aims to connect the data, insights and knowledge gained from its analytics and monetization techniques to every element of its business – from marketing to merchandizing*" (Rovio, 2017, p. 162). To foster a more integrated use of BA, Rovio started to define clear expectations about BA use and introduced changes to the organizational structure to accommodate these expectations.

6.3.1. Set visible statements about the importance and expected use of analytics (AA5)

To better harness the affordances of BA, Rovio has started to embrace BA as part of its strategic priorities. For Rovio, this transformation was at times challenging because it involved both a change of processes and a shift in mindset and organizational structure to accommodate the changes. Based on our analysis, we found that the positive uses of BA have played a part in cultivating a much-needed confidence towards the transformation. Initially, some employees at Rovio were unsure of the potentials of F2P games and were intimidated by the need to transform the old premium model. These concerns were soon addressed as the use of BA afforded transparency in the process. Employees were able to monitor the status of all ongoing activities, including their performance and the company's transformation progress. The use of BA has also allowed better communication internally and fostered continuous improvement of processes and products. For example, the Senior Vice President, Games explained how BA enabled transparency into the progression of different teams. This insight allows certain changes to be made to foster collaboration:

> *If you use a lot of market data, you can find a lot earlier that hey, there seems to be a studio that has something much better than anyone else in that area, and something that you need.*

The transparency of BA was also actualized to foster communication and exchanges of ideas. The Vice President, Game Development highlighted that the open sharing of analytical evidence sparked new conversations and stimulated healthy competition:

> *We have all kinds of QlikView dashboards that pretty much anyone can access about all the KPIs of the games. Then we have a weekly report that is sent out to every single employee in the games unit. That shows weekly KPIs, weekly statistics, it has a ranking of games, which games are performing the best at the moment, so some kind of internal competition about that.*

As the use of BA continues to cultivate transparency, Rovio has shifted towards a more open culture. This is demonstrated through Rovio making its games analytics reports available to all employees. Where previously in the premium model era, only managers had the access to the analytics. Now, the use of BA has become more widespread and well-acknowledged, employees have been given access to key data and reports. This seemingly small change was deemed essential to foster a sense of openness and collective learning. As elaborated by a Senior Game Artist, the company's new priority in transparency was very different from the old model where individuals worked in silos:

> *Our common goal now is to share information. I would say that's the keyword here. For example, we have this new event once a month where we have to share what we have been doing in this*

game for everybody who is interested. We have to present and have this presentation ready to show efficiently what is different in the game and what we are going to push forward. That's a thing which we were not accustomed to before, because we were just working privately and doing our everyday stuff.

6.3.2. A hybrid team structure to promote the use of BA (AA6)

With an increased confidence in BA, management at Rovio has started to initiate changes to the organizational structure. A significant move involved the integration of analytics experts into Rovio's game studios (i.e. game development teams). Analytics experts used to work in separate units and served the game development teams only when the need arose. From our case study, we can see how Rovio creatively assigned analytics and technology experts to work closely with artists, designers and developers. With this structural change, Rovio transitioned from a centralized model, to a *hybrid model, that we are part of BA, but 'rented' to the game teams so to speak* (Senior Data Analyst). Analysts and game experts were now empowered to work together to make the best use of data and insights:

*Rovio develops and produces its own titles using a development process in which a group of creative, production, and technical professionals – including designers, producers, programmers, artists, and sound engineers – in cooperation with marketing, finance, analytics, sales, and other professionals – collaborate in an agile (*i.e. *iterative and incremental) manner* (Rovio, 2017, p. 156)

6.4. Actualizing formalizing affordances to cultivate a data-driven culture

Lastly, Rovio actualized the formalizing affordances of BA to cultivate a data-driven culture. At this stage, BA has been integrated into Rovio's new model and processes, and teams at Rovio have started to proactively adopt BA in their day-to-day operations.

6.4.1. Formalizing analytics as an essential part of the organization (AA7)

Fundamentally, the positive impacts generated from BA use have led to a strong reliance on data and analytics at Rovio. As BA became a part of the company's DNA, most key decisions made at Rovio are now data-driven. For example, Rovio now *develop[s] its games based on data-driven analysis and user feedback* (Rovio, 2017, p. 141), *prioritizes games based on the ROI they deliver* (Rovio, 2017, p. 158), and *improve[s] its monetization through data-driven feature development* (Rovio, 2017, p. 142).

The persistence affordance of BA also plays a crucial role at this stage. BA technologies allowed all communication, decisions and progress to be stored and remain accessible over time. This persistence allowed teams at Rovio to keep track of all analytics activities and review the progress and learning when any needs arise. Together, the transparency and persistence of BA were actualized to support constant reflection and improvement. As summarized by the Vice President, Game Development, these features are vital in promoting a data-driven mindset:

If you wanted to have everyone to be interested about the money and about making a business we had to change that mindset. That everyone can access the data. That everyone can see that how your game did yesterday. Did the change that we made actually have an impact on KPIs of the game? That was a big thing, we had to convince the whole company that yes, we can share data of every game to every employee

6.4.2. Proactively enact analytics to maximize impact and value (AA8)

Once a majority of employees recognized the value of analytics and made it a high priority, it triggered a shift in the fundamental attitudes and culture within Rovio. The continuing BA use stimulated and reinforced a trial-and-error mindset and a commitment to data-driven decision-making. An analytical culture thrives through a company-wide change in attitudes and value. A Senior Product Manager provided an example of this mindset shift:

[*The design process] has changed so much more into this model of systematic thinking and definitely data-based decisions. Everything can be measured as it's a service-based thing and that's a huge step change. That don't rely on your gut or your creative thinking, but rather rely on the numbers, which is quite a drastic change of thinking.*

As employees were now well equipped with skills and confidence to embrace analytics in their work, BA use has become normalized in all areas of work at Rovio. Employees are now proactively embracing analytics to improve their work. A Senior Product Manager summarized the proactiveness succinctly:

The whole analytic mentality has definitely come through the company. It's a very big win. Level designers are posting results of how did their level perform and why. […] Rather than someone telling them to do that, they actually want to share.

6.5. Actualizing the affordances of BA for organizational transformation

In 2015, Rovio launched Angry Birds 2, the first sequel to the original Angry Birds game. Angry Birds 2 is an interactive F2P game with a focus on engagement, social interactions and monetization. Creating F2P games allows Rovio to add more flexibility and depth into the games. In Angry Birds 2, for example, Rovio introduced daily reward mechanics that make use of player behavior analysis (see Appendix D for illustrations), and deploy dynamic, content enhancements to maximize user retention. The game was launched in July 2015 and has reached 10 million downloads within just the first three days of launch. The success of Angry Birds 2 was a strong encouragement and an acknowledgment of Rovio's transition into the F2P model. As described by the Lead Game Designer of Angry Birds 2, F2P games are no longer seen as "shallow games", but meaningful games that can be more scalable and engaging as long as a solid support system is in place:

When you're creating your game, you should design for it to live for years, that means you have to have smart systems in place that can scale and engage players for a long time. In support of that I would not look too much in the past way of making casual games where the core game was 90% of the experience. (Tandom, 2017)

Today, Rovio's titles have been downloaded 4 billion times (Rovio, 2018). Rovio's original Angry Birds' premium game now has several F2P spinoffs, all of which have been highly successful and ranked among the most downloaded games. The revenue of Rovio's gaming business has increased by 40% year-to-year, with most of this increase attributable to the improved monetization of the company's top F2P games (Rovio, 2017). These improvements have clearly demonstrated the organizational value created by BA and served as valuable data points for analysis and discussion.

7. Discussion

We developed Fig. 4 as a synthesis of our analysis to illustrate how affordances of BA were actualized to enable value creation. This model proposes four categories of affordances, organized into four stages of analytics-driven transformation. For each affordance, the model highlights three salient dimensions (i.e., technological potentials, organizational actors, and specific organizational arrangements) that are key to effective affordance-actualization.

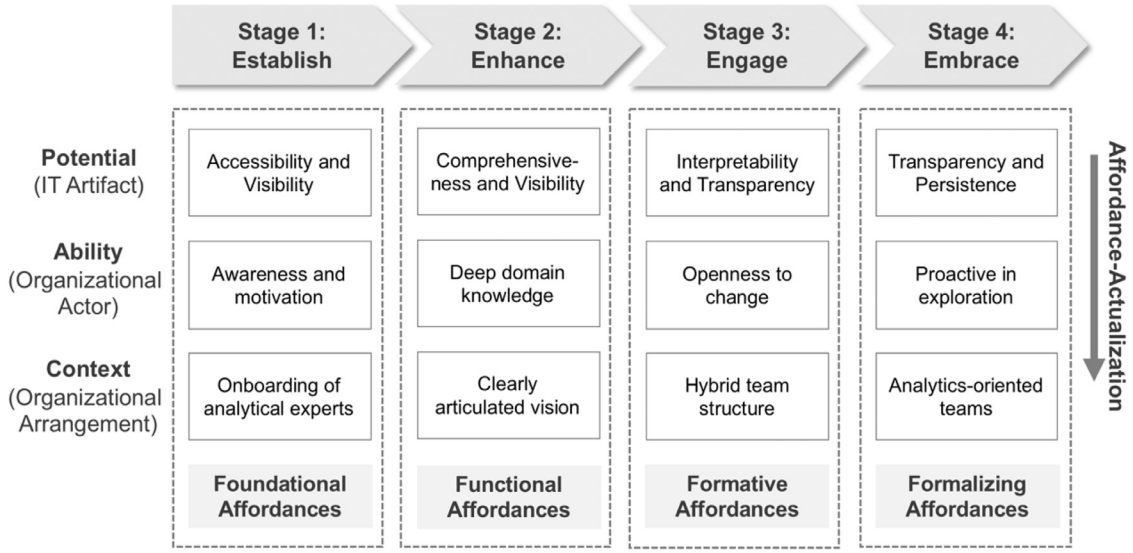

Fig. 4. Actualizing the affordances of BA for organizational value creation.

The purpose of conceptualizing affordance-actualization is to provide a practical understanding for organizations to derive value from BA. Overall, our findings suggest that the same action potential when leveraged within different contexts and sets of actions would lead to different organizational outcomes. For example, the visibility affordance of BA was actualized to establish awareness and understanding in the initial stage of Rovio's transformation, but was also actualized in later stages to communicate a sense of progress of the transformation. Conceptualizing the varying affordance-actualization mechanisms is therefore important to allow organizations to consider the nuances involved in effective use of BA for value creation. We now discuss in further detail how the different affordances of BA can be actualized to obtain four main analytics-driven transformation goals.

7.1. Establish an initial understanding

In Stage 1, several foundational affordances of BA were actualized to establish an initial understanding. Today, many firms are approaching BA-related transformation with little prior knowledge and expertise (Ransbotham et al., 2015). Similarly, in our case study, Rovio ventured into the analytics space following a shift in the gaming industry, with little understanding of how data and analytics would translate into practical value. At this stage, organizations such as Rovio need to focus on assessing the feasibility of the transformation. BA were actualized to answer questions such as: *What has happened in our industry? How can we understand our business better? What are the possibilities?*.

In our case study, BA afforded access to large, fast-moving data, ranging from environmental trends to competitor performance, which provided Rovio with answers to the above questions. BA also afforded visibility, i.e., the possibility to identify important information within a large pool of data across multiple sources. Both types of action potentials provided Rovio an opportunity to quickly establish an initial understanding about the changing environment and to perform an initial self-assessment.

Our analysis also highlighted several organizational arrangements that needed to be put in place for organizations to successfully actualize the foundational affordances of BA. At Rovio, one of the key organizational attributes that drove effective BA use at this stage was the onboarding of analytics talent. Analytics experts brought in the capabilities required to enact BA value and helped drive initial exploration. For example, analysts helped to actualize the visibility of BA by integrating a large amount of data from multiple sources, and by presenting insights in the form of dashboards easily accessible to the designers and developers.

7.2. Enhance analytical capability

In Stage 2, several functional affordances of BA were actualized to enrich existing knowledge of analytics to drive further value creation. This transformation stage involved actualizing the functional affordances of BA to support core operational processes. At Rovio, this is the stage when BA use expanded, as teams started to ask questions such as *What can we do to improve this task, this activity*? and began to look to BA for the solution. BA affords several action potentials at this stage, including comprehensiveness, i.e. the possibility to locate and document all necessary information, and visibility, i.e. the possibility to consolidate and present useful insights in an easy-to-access manner.

Similarly, our analysis shows that actualizing these action potentials requires the support of specific organizational arrangements. Firstly, managers play a role in encouraging the incorporation of analytics into existing models and processes. At Rovio, this support was evident as the senior executives championed the use of analytics in game development and introduced new models and processes to accommodate the change. Secondly, analytics experts continued to play a big role in driving the strategic incorporation of BA. They were in charge of leading the teams to explore new use cases for analytics and provided support in actualizing the value of BA. When the value of BA became increasingly apparent, individuals became more proactive in incorporating BA in their work and were more open in seeking advice from analytics experts. The aspiration to becoming more analytics-driven continued to develop as the list of uses for BA expanded. This optimism helped to foster further actualization of BA in the organization.

7.3. Engage in analytical decision-making

In Stage 3, several formative affordances of BA were actualized to drive strategic decisions. Employees at all levels started to engage in analytical activities and BA was now deemed as an important driver of performance across the entire organization. Questions such as *How can we use analytics to create value and to drive decisions?* started to emerge. Two action potentials were key to building this confidence in BA. First, BA affords interpretability,

which is the possibility for users to understand information obtained, and to present insights in a form that is meaningful for different users. Second, BA also affords transparency, which is the possibility for users to not only freely share insights, but to also have visibility over status of ongoing activities and changes unfolding in the organization.

Similarly, our analysis unveiled the specific organizational arrangements put in place by Rovio to facilitate increasing engagement in analytics. Firstly, teams were restructured to promote cross-learning and capability-sharing. Groups of creative, production, and analytics experts were assembled into hybrid teams to cultivate knowledge exchange and generation of new ideas. The synergy between game experts with deep domain knowledge and analysts with strong analytical capabilities helped to derive value from BA. Secondly, management also started to define BA priorities for the organization, and challenge employees in every functional area to incorporate BA into their operations and decision-making. Teams were encouraged, and to some extent required, to use BA for performance assessment and to regularly share lessons learned with others. This deep engagement allowed Rovio to continually learn from its implementation of BA.

7.4. Embrace analytics in organizational culture

In Stage 4, several formalizing affordances of BA were actualized to embed analytics into the organization's DNA. This was the stage when Rovio embraced analytics as part of its culture and identity, and began regularly asking analytics-centric questions, such as *How do we use analytics to innovate, differentiate and stay ahead? What's possible?*. Two action potentials of BA found salient at this stage are, firstly, transparency – which helps to facilitate collaborative learning, and secondly, persistence – which is the possibility for conversations, activities and knowledge to remain visible and available over time.

Specific organizational arrangements play an essential role in actualizing these action potentials. At Rovio, teams developed a data-driven orientation as they gradually became adept at using analytics to investigate an issue or inform a decision. The possibility to freely exchange analytical insights fostered more appreciation for BA and helped cultivate an analytical orientation. At this stage, it was clear to everyone that the organization had made significant progress towards becoming data-driven. Overall, BA is enabling data-driven insights that inform strategic decisions (Kunc & O'Brien, 2018). The transparency and persistence of BA were also actualized to help foster a sense of openness and to create a common ground for communication. When knowledge is easily accessible and communication is clear, analytical capabilities become institutionalized and a data-driven orientation pervades the organizational culture.

8. Implications and conclusion

Based on an in-depth case study of Rovio, this paper has developed empirically-grounded insights into the actualization of BA affordances for organizational value creation. First, our analysis uncovered four classes of affordances in supporting the attainment of four value creation goals. Second, for each affordance, we have provided a conceptualization on how the affordance was actualized to achieve the specific goal. Guided by our theoretical lens, our conceptualization highlights both the technological and organizational features that are central to affordance-actualization. Understanding how affordances of BA can be effectively actualized to support organizational goals contributes to both the theory and practice of BA in the following ways.

8.1. Finding 1: affordances of BA for organizational value creation

We address the call for research on how BA could be adopted for organizational value creation (Vidgen et al., 2017). Based on a revelatory case study, this paper proposes a model of affordance-actualization and discusses how varying affordances of BA can be actualized to achieve value creation goals at different stages. A benefit of discussing affordances, instead of other relevant concepts such as capabilities, is that affordances extend beyond the properties of a technology and allow a comprehensive understanding of how the properties or potentials of a technology can be actualized in a particular context (Majchrzak & Markus, 2012; Strong et al., 2014). This relational concept offers a rich approach to study an emerging technology-in-use because it allows us to not only conceptualize the opportunities, but also the different use patterns that arise when a technology is actualized to achieve specific organizational goals (Strong et al., 2014).

Our conceptualization of affordance-actualization shows that creating value through BA requires a rearrangement of organizational processes and structure. Leveraging BA to create organizational value is more than just obtaining access to big data and analytics tools (Watson, 2014). To actualize the potentials of BA requires integrating BA into existing organizational arrangements (Fink et al., 2017; Trieu, 2017), or transforming specific organizational features to align with the new, analytics-driven model. This conceptualization is important as it emphasizes that "analytics is not simply a technical matter" (Vidgen et al., 2017, p. 628)—the mere existence of analytics resources and technologies will not lead to successful value creation unless appropriate organizational features that support its actualization are in place.

Our findings challenge an existing misconception of viewing BA as an isolated "IT department" issue (Vidgen et al., 2017). As suggested by our findings, the biggest barriers companies face in extracting value from BA are often, in fact, organizational. Many companies struggle to incorporate analytical insights into day-to-day organizational processes and are unsure how to best adapt the technologies to create organizational value (Ransbotham et al., 2016). By highlighting both technological and organizational features that are essential for effective BA use, we hope that our research opens new paths of inquiry in investigating the varying affordances of BA, and how the affordances can be actualized to achieve value creation.

8.2. Finding 2: effective actualization of BA affordances

In recent years, there has been much investment into developing organizational analytical capability. However, there has been limited guidance for practitioners on deriving value from their investment in BA (Ransbotham et al., 2016; Vidgen et al., 2017). In this research, we make a practical contribution by providing actionable insights for practitioners to derive value from BA use. We summarize these insights in Table 4. Specifically, Table 4 highlights four salient affordances of BA, which could be actualized to achieve different transformation goals in four stages. From a practitioner's perspective, it also outlines the technological features of BA and the organizational arrangements (including actors' goals and expertise, as well as key analytical activities) which are required to actualize the affordances for value creation.

The analytical activities highlighted in our findings are broadly consistent with Hindle and Vidgen (2018) recently proposed Business Analytics Methodology (BAM), which highlights four activities involved in gaining value from BA: (1) problem situation structuring, (2) business model mapping, (3) business analytics leverage and (4) analytics implementation. While the BAM has an emphasis on the business model, which is different from our focus on BA affordances and actualization, our findings have

Table 4
Actualizing BA affordances for organizational value creation.

Goals	Affordance-Actualization (AA)		
	BA features	Key actors	Key analytical activities
Stage 1: Establish an initial understanding (actualizing accessibility and visibility affordances)			
What has happened in our industry?	• Exploratory data (e.g. market research, user data) • Descriptive analysis to understand trends and behaviors	• Employees to have intrinsic and extrinsic motivation to adopt analytics • Analytics experts to provide guidance in data collection and analysis	• *Organize*: Consolidate data from multiple sources • *Describe*: Analyze data to identify opportunities and challenges in the environment
Stage 2: Enhance Analytical Capability (Actualizing Visibility and Comprehensiveness Affordances)			
What can we do to improve this task/activity?	• Diagnostic data (e.g. performance data)	• Decision makers to promote the incorporation of analytics into existing processes	• *Implement*: Incorporate analytics to improve existing processes
	• Visualization and dashboards to develop performance metrics	• Analytics experts to lead the exploration of new analytics use cases	• *Diagnose*: Use analytics to make informed adjustments
Stage 3: Engage in Analytical Decision-making (Actualizing Interpretability and Transparency Affordances)			
How can we use analytics to create new value?	• Predictive data (e.g. consolidated dataset)	• Decision makers to modify organizational structure (e.g. hybrid team) to promote collaboration and cross-learning	• *Decide*: Use analytics to inform strategic decisions
	• Query and guided analysis to discern patterns and relationships	• Decision makers to define strategic priorities for analytics	• *Share*: Sharing of analytics tools and results to promote collective learning
Stage 4: Embrace analytics into organizational culture (actualizing transparency and persistence affordances)			
What is possible?	• Prescriptive data (e.g. a big dataset of internal, external and historical data) • Integrated analytics and customized reporting to perform forecasting	• Decision makers to encourage a data-driven orientation • Employees to embrace an analytics-driven culture	• *Integrate*: Formalize analytics as an essential part of the organization • *Prescribe*: Proactively create new use cases for analytics to maximize value

captured a similar set of analytics activities in the same logical precedence. For example, in stage 1, the key activities identified from our findings involved a consolidation of market and user data to develop an initial understanding of the environment. This activity is aligned with "problem situation structuring" in the BAM.

The organizational arrangements highlighted in our findings also align with Vidgen et al. (2017). In this study, the authors advocated the importance of considering organizational features when embarking on an analytics-driven transformation. Our findings extend Vidgen et al. (2017)'s discussion on the organizational reconfiguration by presenting a staged model that outlines specific organizational arrangements that are critical in each stage. As informed by our analysis from a technology affordance perspective, our findings are able to distil specific organizational features that fundamentally drive effective implementation of BA. These findings could serve as a useful guide for managers to overcome many of the BA value creation challenges identified in Vidgen et al. (2017) and generally to make more informed decisions in every transformation stage. It is also worth noting that while our findings were developed from our research in the gaming industry, the proposed insights on the actualization of BA affordances, which are organized into four maturity stages, will be relevant to organizations in other industries looking to embrace an analytics-driven transformation.

In closing, we hope that this research inspires further investigation of how analytics can be actualized to create value for organizations. While many companies today are beginning to utilize data and analytics to address tactical and strategic issues, there is still a lack of guidance for businesses to effectively leverage BA for value creation (Brydon & Gemino, 2008; George et al., 2014; Ransbotham et al., 2016; Vidgen et al., 2017). We hope that through our thought-provoking findings, we are able to inspire more research to explore the opportunities and challenges associated with organizational BA use. Future research could also expand on our findings to uncover new affordances of BA in different organizational contexts, and examine how the affordances of BA can be actualized to facilitate the attainment of organizational goals.

Acknowledgement

This work was funded by the National Natural Science Foundation of China, Grant/Award Numbers: 71529001 and 71632003.

Supplementary material

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.ejor.2018.11.074.

References

Abbasi, A., Sarker, S., & Chiang, R. H. (2016). Big data research in information systems: Toward an inclusive research agenda. *Journal of the Association for Information Systems, 17*(2), i–xxxii.
Andersen, E., Liu, Y.-E., Snider, R., Szeto, R., & Popović, Z. (2011). Placing a value on aesthetics in online casual games. In *Proceedings of the SIGCHI conference on human factors in computing systems*.
Anderson, C., & Robey, D. (2017). Affordance potency: Explaining the actualization of technology affordances. *Information and Organization, 27*(2), 100–115.
Brydon, M., & Gemino, A. (2008). You've data mined. Now what. *Communications of the Association for Information Systems, 22*(1), 603–616.
Burton-Jones, A., & Volkoff, O. (2017). How can we develop contextualized theories of effective use? A demonstration in the context of community-care Electronic Health Records. *Information Systems Research, 28*(3), 468–489.
Bygstad, B., Munkvold, B. E., & Volkoff, O. (2016). Identifying generative mechanisms through affordances: A framework for critical realist data analysis. *Journal of Information Technology, 31*(1), 83–96.
Chen, H., Chiang, R. H., & Storey, V. C. (2012). Business intelligence and analytics: From big data to big impact. *MIS Quarterly, 36*(4), 1165–1188.
Choy, K., & Schlagwein, D. (2016). Crowdsourcing for a bet-ter world: On the relation between IT affordances and donor motivations in charitable crowdfunding. *Information Technology & People, 29*(1), 221–247.
Chulis, K. (2012). Big data analytics for video, mobile, and social game monetization: Understand and influence profitable consumer behavior. *IBM Corporation*. https://www.ibm.com/developerworks/library/ba-big-data-gaming/. Accessed 04 November 2017.
Davenport, T. H., & Harris, J. G. (2007). *Competing on analytics: The new science of winning*. Harvard Business Press.
Davenport, T. H., & Patil, D. (2012). Data scientist: The sexiest job of the 21st century. Harvard Business Review.
Deterding, S., Björk, S. L., Nacke, L. E., Dixon, D., & Lawley, E. (2013). Designing gamification: Creating gameful and playful experiences. In *Proceedings of the CHI'13 Extended Abstracts on Human Factors in Computing Systems*.
El-Nasr, M. S., Drachen, A., & Canossa, A. (2016). *Game analytics*. Springer.

Fink, L., Yogev, N., & Even, A. (2017). Business intelligence and organizational learning: An empirical investigation of value creation processes. *Information & Management, 54*(1), 38–56.
Flick, U. (1998). *An introduction to qualitative research*. SAGE.
Flick, U., von Kardoff, E., & Steinke, I. (2004). *A companion to qualitative research*. SAGE.
George, G., Haas, M. R., & Pentland, A. (2014). Big data and management. *Academy of Management Journal, 57*(2), 321–326.
Gibson, J. J. (1979). *The ecological approach to visual perception*. New York, N.Y.: Psychology Press.
Hindle, G. A., & Vidgen, R. (2018). Developing a business analytics methodology: A case study in the foodbank sector. *European Journal of Operational Research, 268*(3), 836–851.
Kiron, D., Shockley, R., Kruschwitz, N., Finch, G., & Haydock, M. (2011). Analytics: The widening divide. *MIT Sloan Management Review, 53*(3), 1–22.
Kiron, D., Ferguson, R. B., & Prentice, P. K. (2013). From value to vision: Reimagining the possible with data analytics. *MIT Sloan Management Review, 54*(3), 1–19.
Klein, H. K., & Myers, M. D. (1999). A set of principles for conducting and evaluating interpretive field studies in Information Systems. *MIS Quarterly, 23*(1), 67–93.
Kumar, V. (2014). Making 'Freemium' work. Harvard Business Review.
Kunc, M., & O'Brien, F. A. (2018). The role of business analytics in supporting strategy processes: Opportunities and limitations. *Journal of the Operational Research Society* Published Online. doi:10.1080/01605682.2018.1475104.
LaValle, S., Lesser, E., Shockley, R., Hopkins, M. S., & Kruschwitz, N. (2011). Big data, analytics and the path from insights to value. *MIT Sloan Management Review, 52*(2), 21. https://sloanreview.mit.edu/article/big-data-analytics-and-the-path-from-insights-to-value/.
Leonardi, P. M. (2013). When does technology use enable network change in organizations? A comparative study of feature use and shared affordances. *MIS Quarterly, 37*(3), 749–776.
Liu, D., Li, X., & Santhanam, R. (2013). Digital games and beyond: What happens when players compete. *MIS Quarterly, 37*(1), 111–124.
Loh, C. S., Sheng, Y., & Ifenthaler, D. (2015). *Serious games analytics: Methodologies for performance measurement, assessment, and improvement*. Springer.
Majchrzak, A., Faraj, S., Kane, G. C., & Azad, B. (2013). The contradictory influence of social media affordances on online communal knowledge sharing. *Journal of Computer-Mediated Communication, 19*(1), 38–55.
Majchrzak, A., & Markus, M. L. (2012). Technology affordances and constraints in Management Information Systems (MIS). *Encyclopedia of management theory*. Thousand Oaks: Sage Publications.
Markus, M. L., & Silver, M. S. (2008). A foundation for the study of IT effects: A new look at DeSanctis and Poole's concepts of structural features and spirit. *Journal of the Association for Information Systems, 9*(10), 609–632.
Myers, M. D., & Newman, M. (2007). The qualitative interview in IS research: Examining the craft. *Information and Organization, 17*(1), 2–26.
Nacke, L., & Drachen, A. (2011). Towards a framework of player experience research. In *Proceedings of the second international workshop on evaluating player experience in games at FDG*.
Newzoo. The global games market will reach $108.9 billion in 2017 with mobile taking 42%. (2017). https://newzoo.com/insights/articles/the-global-games-market-will-reach-108-9-billion-in-2017-with-mobile-taking-42/ Accessed 03 January 2018.
Oestreicher-Singer, G., & Zalmanson, L. (2013). Content or community? A digital business strategy for content providers in the social age. *MIS Quarterly, 37*(2), 591–616.
Pan, S. L., & Tan, B. (2011). Demystifying case research: A structured-pragmatic-situational (SPS) approach to conducting case studies. *Information and Organization, 21*(3), 161–176.
Pape, T. (2016). Prioritising data items for business analytics: Framework and application to human resources. *European Journal of Operational Research, 252*(2), 687–698.
Ransbotham, S., Kiron, D., & Prentice, P. K. (2015). Minding the analytics gap. *MIT Sloan Management Review, 56*(3), 63–68.
Ransbotham, S., Kiron, D., & Prentice, P. K. (2016). Beyond the hype: The hard work behind analytics success. *MIT Sloan Management Review, 57*(3), 2–16.
Rice, R. E., Evans, S. K., Pearce, K. E., Sivunen, A., Vitak, J., & Treem, J. W. (2017). Organizational media affordances: Operationalization and associations with media use. *Journal of Communication, 67*(1), 106–130.
Rovio. Offering Circular. (2017). https://assets-production.rovio.com/s3fs-public/0ffering-circular-eng3.pdf.
Rovio. 4 billion downloads across all games. (2018). https://www.facebook.com/RovioEntertainment/posts/1650622161665196.
Strong, D. M., Johnson, S. A., Tulu, B., Trudel, J., Volkoff, O., Pelletier, L. R., & Garber, L. (2014). A theory of organization-EHR affordance actualization. *Journal of the Association for Information Systems, 15*(2), 53–85.
Tandom, O. Are casual games maturing? Lessons from Angry Birds 2. (2017). https://www.linkedin.com/pulse/casual-games-maturing-lessons-from-angry-birds-2-om-tandon/ Accessed 03 January 2018.
Tim, Y., Pan, S. L., Bahri, S., & Fauzi, A. (2018). Digitally enabled affordances for community-driven environmental movement in rural Malaysia. *Information Systems Journal, 28*(1), 48–75.
Treem, J. W., & Leonardi, P. M. (2013). Social media use in organizations: Exploring the affordances of visibility, editability, persistence, and association. *Annals of the International Communication Association, 36*(1), 143–189.
Trieu, V.-H. (2017). Getting value from business intelligence systems: A review and research agenda. *Decision Support Systems, 93*, 111–124.
Vaast, E., Safadi, H., Lapointe, L., & Negoita, B. (2017). Social media affordances for connective action: An examination of microblogging use during the gulf of Mexico oil spill. *MIS Quarterly, 41*(4), 1179–1205.
Vidgen, R., Shaw, S., & Grant, D. B. (2017). Management challenges in creating value from business analytics. *European Journal of Operational Research, 261*(2), 626–639.
Voigt, S., & Hinz, O. (2016). Making digital freemium business models a success: Predicting customers' lifetime value via initial purchase information. *Business & Information Systems Engineering, 58*(2), 107–118.
Volkoff, O., & Strong, D. M. (2013). Critical realism and affordances: Theorizing IT-associated organizational change processes. *MIS Quarterly, 37*(3), 819–834.
Walsham, G. (1995). Interpretive case studies in IS research: Nature and method. *European Journal of Information Systems, 4*(2), 74–81.
Watson, H. J. (2014). Tutorial: Big data analytics: Concepts, technologies, and applications. *Communications of the AIS, 34*(1), 1247–1268.
Zammuto, R. F., Griffith, T. L., Majchrzak, A., Dougherty, D. J., & Faraj, S. (2007). Information technology and the changing fabric of organization. *Organization Science, 18*(5), 749–762.