A Framework of Value Creation from Business Intelligence and Analytics in Competitive Sports

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Abstract

Over the last 10 years, Business Intelligence and Analytics (BI&A) has become a topic of great interest for Information Systems (IS) researchers and practitioners. BI&A initiatives have generated benefits in several organizations across various industries including banking, insurance, entertainment, retail, telecommunications, manufacturing, and more. A relatively new yet insightful domain of application for BI&A is competitive sports, where elite sports organizations, teams and athletes attempt to leverage the use of available data and technology to enhance their performance at many levels. While the use of BI&A tools in competitive sports have recently enjoyed sparks of popularity, academic research remains at a very early stage. In this paper, we provide a conceptual framework of value creation from BI&A use in competitive sports. Based on previous work on the business value of IT and IT-enabled competitive advantage, the framework underlines the multi-level nature of value creation for BI&A in competitive sports, and identifies a set of contextual contingencies that will affect the creation of value at each level of analysis. Finally, because research in BI&A use in competitive sports is still emerging, we identify a set of avenues for future research that, in combination with our proposed framework, will stimulate future studies in sports analytics.

1. Introduction

During the last years, Business Intelligence and Analytics (BI&A) has emerged as an important topic in the discipline of information systems (IS). In their paper published in the 2012 MIS Quarterly special issue on business intelligence and analytics, Chen et al. [7] define BI&A as “the techniques, technologies, systems, practices, methodologies, and applications that analyze critical business data to help an enterprise better understand its business and market and make timely decisions” (page 1166). As the definition suggests, the use of BI&A tools by managers primarily aims at taking advantage of the numerous sources of available data and information to enhance decision making within organizations. Classic BI&A tools and applications include dashboarding, data mining/data warehousing, reporting, ETL (extract-transform-load) process management, key performance indicators, and BI project management [7, 18, 22]. More recent advances in BI&A cover topics such as predictive analytics, mobile BI applications, neural networks, interactive data visualization, web analytics, social network analysis, web intelligence, and cloud-based BI [7, 15].

Managing business intelligence projects and building business intelligence capabilities is critical for a growing number of organizations [38]. For instance, the Gartner Group analysts have consistently ranked BI&A among the top 5 priorities of CIOs during the last years (often identified as the number one priority), and have developed numerous professional reports, toolkits and research papers around the topic of BI&A [16]. As a result, more and more companies implement business intelligence departments and/or competency centers (BICC) whose primary role is to support business functions in their need to identify, organize, analyze, and visually present corporate data to enhance decision making at many levels.

Because one of the key objective of BI&A is to enhance decision making effectiveness, which is relevant to virtually all organizations, the scope of the impacts of BI&A tools have reached across numerous industries. For instances, research have demonstrated the value of BI&A for financial institutions [1, 19, 40], entertainment businesses [33], retail companies [39], in healthcare [22], and other contexts. Various measures of performance have been positively affected by BI&A tools and practices such as customer satisfaction [32], decision making
effectiveness [25, 34, 39] and operational efficiency [37].

The rise of sports analytics and its relevance for IS research

One area where BI&A is beginning to gain more attention is competitive and professional sports. Better known as “sports analytics” or “use of advanced statistics and technologies in sports”, this practice is defined by Benjamin Alamar [2] as « the management of structured historical data, the application of predictive analytic models that utilize that data, and the use of IS to inform decision makers and enable them to help their organizations in gaining a competitive advantage on the field of play ». The sport of professional Baseball is often claimed to be the initial “playground” of sports analytics, where notable visionaries of the concept have used advanced statistics to enhance both player selection and on-the-field strategy. For instance, the publication of Earnshaw Cook’s book in 1964 entitled Percentage Baseball [8] led the way to the development of sabermetrics1, defined by Bill James as “the search for objective knowledge about baseball”. Another example is the acclaimed movie Moneyball2, in which the use of sabermetrics and advance statistics by Oakland Athletics’ general manager Billy Beane and his assistant drove strategic decisions about player selection and game tactics. Overall, the movie Moneyball provided some factual evidence about the overall effectiveness of analytics and advanced statistics in professional Baseball.

Since then, the diversity of statistical techniques and technologies aimed at enhancing data collection and decision making in competitive sports have continued to expand, mostly in professional sports organizations such as in Major League Soccer [11] or the National Basketball Association [3]. Athletes participating in individual sports such as running, cycling, athletics, or weightlifting also rely on a wide variety of software and hardware to enhance their training, nutritive habits, analyze their performance or their opponents’ tactics. In sum, competitive sports organizations and athletes, just like typical organizations and managers from other industries, are prone to the adoption of BI&A tools and remain eager to create value from their usage.

With that in mind, we believe that understanding the creation of value from BI&A tools in competitive sports can be of great interest to IS academics, and that for the following reasons. First, at the professional level, the sports business is a growing industry in which a large amount of financial resources exist. In the 2014 edition of Pricewaterhouse Coopers’ Sports Outlook [21], analysts predicted that the North America sports market will grow at a compound annual rate of 4.5 percent across four core segments (gate revenues, media rights, sponsorship and merchandising), from $56.9 billion in 2013 to $70.7 billion in 2018.

Second, we have recently witnessed a series of partnerships and professional affiliations between technology and statistical software vendors and professional sports leagues and clubs, two important pillars of sports analytics. Notable examples include SAP as a key partner of the National Hockey League (NHL) and the National Basketball Association (NBA), SAS as a business partner with the Toronto Maple Leafs, Hawk-eye ball-tracking technology for professional tennis, cricket and football (soccer), and the interactive data visualization provided by SportVision during NFL games, Baseball games, and Nascar races. While different in their nature and functionalities, all these initiatives are designed to offer timely and relevant information to support some form of decision making in competitive sports.

Third, we believe the context of competitive sports offers a unique research setting for IS academics interested in the use of BI&A tools. For instance, there is a lot of heterogeneity among competitive sports organizations in terms of financial and human resources, type of tasks, and data sources relevant for decision making. As reported by Davenport [9], professional sports organizations are relatively small in size (in terms of number of employees) but possess large amount of resources and extreme visibility. In opposition, amateur athletes and non-professional organizations have much less visibility and clearly fewer resources, but the use of BI&A tools have virtually the same value from a decision making standpoint. These disparities are likely to affect the way investments in BI&A tools will be assessed in terms of potential value, thereby creating interesting challenges for managers of sports organizations and athletes as well. We believe that IS researchers could provide new insights on how to manage such complex implementation dynamics and demonstrate the value created from investments in BI&A technologies.

Fourth, interesting parallels can be drawn between the use of BI&A in competitive sports and their use in more conventional business settings. For

1 Sabermetrics is a Society for American baseball research.
2 The movie Moneyball is based on Michael Lewis’ book entitled Moneyball: The art of winning an unfair game (2004).
professional sports organizations, financial performance is as equally important as for conventional businesses. Instead of selling professional services, professional sports organizations gain revenues from selling game tickets, physical products (ex: team shirts and other artifacts, collectible items, etc.) or through sponsorship. Another parallel can be made by looking at key value creating processes. In competitive sports, just like in conventional organizations, effective decision making is a key process that can be linked to several performance measures such as success during games and competitions, individual and collective learning by athletes, or fan satisfaction (which could be seen as customers).

While the use of BI&A in competitive sports is growing in sports organizations, research on the topic remains at a very early stage, especially in the IS discipline. To date, most academic research on BI&A in sports comes from the disciplines of mathematics, statistics, economics, or marketing. For instance, an overwhelming proportion of articles published on sports analytics focus on the development of metrics (ratios, indexes) that offer an objective assessment of players’ effectiveness and productivity. These indexes are useful to describe and assess the performance of competitive athletes using secondary/public data, but it is unclear how they are actually used by competitive sports organizations and athletes. However, since BI&A tools are clearly technology artifacts that aim at creating value for organizations and decision makers, we believe that more studies using theories and concepts developed within the IS discipline should be used to study sports analytics. Example include (but are not limited to) studying BI&A implementation projects in sports organizations, managing resistance to change during sports analytics projects, assessing the impacts of BI&A tools on decision making by coaches and athletes, crowdsourcing data analyses using fans and online communities, and using BI&A technologies for knowledge creation and transfer among competitive athletes.

Given the aforementioned gaps, the goal of this paper is to develop a new conceptual framework of value creation from BI&A in competitive sports. Since academic and peer-reviewed research on the topic is characterized by a very low level of maturity, a secondary objective is to identify areas for future research on BI&A in competitive sports for IS academics. The remaining of the paper is structured as follows. In the next section, we provide a broad picture of the extant research on sports analytics and BI&A in competitive sports. Then, we revisit some prior studies on the business value of IT that served as the main foundations for this research, and use their key premises to develop a new conceptual framework of value creation from BI&A in competitive sports. The paper concludes by a discussion in which key contributions and avenues for future research are presented.

2. A brief overview of the current research on sports analytics

Insofar, we can claim that most definitions, concepts and body of knowledge on sports analytics and BI&A in competitive sports emanate from the professional literature or directly from the sports industry. In his book entitled “Sports Analytics: A Guide for Coaches, Managers, and Other Decision Makers” [2], Benjamin Alamar defines the topic as « the management of structured historical data, the application of predictive analytic models that utilize that data, and the use of IS to inform decision makers and enable them to help their organizations in gaining a competitive advantage on the field of play ». Using similar ideas, other books on the topics have been published during the last five years, such as “Sport Strategist” by Rein et al. [36] and “Scorecasting: the hidden influences behind how sports are played and games are won” by Moscovitz and Wertheim [31]. Together, these books provide general guidelines for professional sports organizations and managers who seek to rely on sports analytics to improve the performance of their organization and athletes through better decision making.

In between the worlds of professional sports and academia, the MIT Sloan Sports Analytics Conference has been established as one of the most important events for the creation and dissemination of knowledge about sports analytics. Celebrating its 9th edition in February 2015, the conference is mainly based on specialized panels during which the most dominant figures of sports analytics from professional sports organizations share their beliefs and experiences about sports analytics initiatives. Research papers and posters are also presented during the conference, most often by faculty members or graduate students from universities in North America. As for peer-reviewed articles published in scholarly journals, the number remains very low in general, and virtually null in IS academic journal. In fact, at the time of writing the present article, a search in ABI-INFORMS/Proquest using “sports analytics” in the abstract or title fields yielded only 12 results in peer-reviewed journals. Most of the published journal articles came from other disciplines such as computer

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science, marketing, mathematics, economics, and statistics. In general, researchers have attempted to craft indexes and key performance indicators that can quantify the productivity of an athlete or a team in a given situation. In one of the rare research article linked to the BI&A in competitive sports by an IS researcher, Thomas Davenport [9] identifies a series of potential benefits associated with the use of analytics in professional sports. He also provides interesting examples of current applications of analytics by professional sports teams, and discusses future trends on the topic. On a complementary note, we also found an academic journal fully devoted to the use of mathematical models, simulations and statistical analyses in sports, namely the Journal of Quantitative Analysis in Sports. First released in 2005, this quarterly journal has published more 39 issues overall.

3. A Conceptual framework of value creation from BI&A in competitive sports

In this section, we develop a conceptual framework of value creation for BI&A in competitive sports. At the most general level, the purpose of this framework is to demonstrate how and where BI&A can create value for competitive sports organizations and athletes. Based on prior studies on the business value of IT [10, 12, 33], the framework rests on three overarching premises. The first premise suggests that the potential value of BI&A applications can be observed at several levels of analysis (from macro to micro levels). In line with the first premise, the second highlights the importance of using appropriate value creation measures (called locus of value) for each level of analysis investigated. Third, we argue that for each level of analysis, contextual contingencies moderate the impact of BI&A on value creation.

3.1 Key concepts, definitions and assumptions of the framework

Explaining the business value of IT investments has been, and continue to be, an important task for IS academics and practitioners. From prior studies on the productivity paradox [5] to more recent work on IT-enabled sustained competitive advantage [33], researchers have devoted substantive efforts to explain how investments in IT projects can be beneficial for organizations. While the purpose of this study is not to provide a comprehensive review of the literature on business value of IT, we intend to rely on the extant literature to understand how BI&A can create value for competitive sports organizations. We base our framework mainly on the work of Davern and Kauffman’s [10] who offer conceptual foundations for explaining how and where value can be created from investments in IT (see Figure 1).

Figure 1. The IT value creation process (adapted from Davern and Kauffman 2000)

According to Davern and Kauffman [10], the first step is for managers to develop an initial perception towards the potential value of IT investments projects. This phase has a strategic component in the sense that is provides initial value expectations, and if the perceived potential value is high, it is more likely that people will invest in the technology. Then, the extent to which investments in an IT project leads the desired impacts will be affected by the presence of conversion contingencies. Essentially, conversion contingencies are internal and external contextual factors that, during the implementation process, are likely to influence the conversion of IT expenditures into outcomes. Examples include the extent of top management support, effective training, users’ technology literacy, and competitors’ actions. Obviously, some of these contingencies can be dealt more easily by IT managers and staff (e.g. training, top management support, IT infrastructure characteristics) while others are more difficult to control or act upon (e.g. economic instability, competitors’ investments in similar technologies, others).

Another important concept of Davern and Kauffman’s [18] model is the notion of locus of value. Initially introduced by Kauffman and Weill [23], the concept of locus of values refers to the primary level of analysis at which flows of IT value become discernible for the investing firm [10, p. 126]. In other words, “where” the realized value from IT investments can be assessed. Examples of different levels of analysis where value can accrue include individual user, teams and work groups,
business processes, firm level, and even the market/industry level. Finally, only after assessing the realized value at different levels of analysis can managers make a judgment about the actual return on IT investments.

In the next section, we rely on these concepts and ideas to develop a framework of value creation for BI&A in the competitive sports context. Here, competitive sports include professional sports organizations as well as amateur athletes who compete in organized sports federations and leagues (e.g. regional level, College/University level, Olympics).

3.2. A framework of value creation from BI&A for competitive sports

Competitive sports, just like other more conventional industries, is composed of several key stakeholders who either use directly BI&A tools, sponsor BI&A initiatives, or act as consumers of the outputs of BI&A. Moreover, consistent with Davern and Kauffman’s [10] model, these stakeholders will be found at several levels of analysis, thereby calling for the assessment of value creation at each level. Here, we propose three levels of analysis where value can be created from BI&A tools. We also identify a fourth category of stakeholders, called external actors, who interact with a focal entity where value is created.

3.2.1. Institutional level. Several competitive sports are managed by professional leagues and provincial, national, and even international sports federations. These macro-level entities are the ones who provide rules and regulations about a given sport and create the overall structure into which most sports teams and individual athletes will perform. In professional sports, league owners and managers often dictate the contextual opportunities and constraints [20] which teams and athletes will have to operate (ex. financial and legal boundaries). At the amateur level, international sports federations can determine the standards of performance that are required to qualify to major national or international competitions. On a complementary note, leagues and sports federations are often responsible for player safety issues, the image and reputation of their sports, drug control policies, and other issues relevant for the practice of their sports from a global perspective.

3.2.2. Organizational level. We call the organization level the intermediary category of stakeholders which involves sports teams and sub-teams who are part of the same formal entity. Examples on the professional side includes NFL/MLB/NBA teams (e.g. the Boston Celtics), their management team (general managers and ownership), coaching staff, and other support staff such as doctors, fitness managers, statisticians, and sports psychologists. For amateur organizations, we might think of a local figure skating team in which several athletes either perform in couple or on an individual basis, benefitting from the same coaching structure and support staff. Several tasks fall under the responsibility of organizational level stakeholders. For instance, team owners and general managers worry about the financial success of their organization (ticket sales, salaries paid to athletes, other revenues and costs), members of the coaching staff develop game tactics, and scouting staff need reliable data to produce reports and video analyses used for player evaluation and recruitment.

3.2.3. Individual level. At the individual level, we found the athletes who actually turn tactical information and physical actions into sport accomplishment, whether it happens in team or individual sports. Of course, on many occasions, individual athletes are embedded within the previous levels, namely the organizational (sports organizations/teams) and/or the institutional levels (an athlete performing an individual sport might belong to a national sport federation, even if he/she is not part of a team).

3.2.4. External actors. External actors designate those people, groups and entities that are not directly concerned with the transformation of potential value into realized value creation of a sports entity, yet interact with this same focal entity in the creation of value. Key external actors include sports fans, technology vendors, academics, media, influential sports bloggers, and specialized data analysis firms. In terms of BI&A, these external actors are either intensive consumers of data and information related to athletes and sports teams, or resource providers for the acquisition and use of BI&A tools.
In figure 2, we provide an integrative framework in which the potential value from BI&A project is tight to the actual locus of value where these investments are expected to happen. While this framework provides a very high-level representation of how and where BI&A projects generate value in competitive sports, we also offer more accurate examples of value creation at each level of analysis (institutional, organizational, and individual levels), respectively depicted in Figure 3, 4 et 5. Within each “sub-model”, specific detail about the nature of BI&A initiatives are provided, along with specific conversion contingencies and measures of value created from those same BI&A initiatives.

3.3. Institutional level value creation from BI&A

Most competitive sports, especially at the professional level, have a strong entertaining purpose and compete against each other to capture the interest of sports fans. This is why one of the primary goals of sports leagues and federations is to develop and maintain an entertaining image among the public in order to attract and retain fans and sponsors, and develop positive relationships with them. Tight with these objectives, sports leagues and federations also seek financial success.

We believe that two specific BI&A initiatives can facilitate such objectives. First, interactive data visualization technologies can be used to enrich fans’ experience during the diffusion of sports events.

Most of the time, these technologies are developed by external technology vendors who provide the necessary technological expertise as part of an official partnership. Other important actors involved in the creation of value are television networks and media, who own the infrastructure and legal rights to display enriched data visualization as part of the video feed they transmit to fans. A good example of such interaction is SportVision, a company who displays enriched data and informational content during live sports events (ex. interactive strike zone in Baseball, drive charts analyses in professional Football, virtual lane markers during Olympic Games, and live information about pilots and cars during Nascar races).
Second, sports leagues and federations can also create value from the use of social media, web portals and social media metrics. They do so by providing their fans with relevant and up-to-date data, statistical analyses, and other information about the performance of athletes. For instance, the NHL has made a step toward more open sharing of advanced statistics for its fans. In a new section of its website devoted to advanced statistics, several performance metrics developed over the years to evaluate some facets of the game are made available for teams and fans on a day-to-day basis. Similarly, the National Basketball association provides NBA teams and fans with several web pages, customizable reports, and data representation tools for assessing the performance of NBA players and teams. An interactive tracking technology called SportsVU also provides precise geolocation of the ball and all players from both teams, with 25 data coordinates captured every second.

Here, the main conversion contingency that is likely to influence the impact of these BI&A initiatives on value creation has to do with the development of a strong strategic position towards the value of BI&A at the institutional level. Clearly, before making any partnership with technology vendors for interactive data visualization, a league has to first develop its own vision about the potential role of BI&A. Only once leagues and federations develop a positive view towards data analytics and open sharing of information will resources be allocated to BI&A projects and value created to the fans. The Major League Baseball and the National Basketball Association are considered to be the most proactive sports leagues in terms of analytics adoption. Examples of professional teams in which top management strongly supports BI&A include the Houston Rockets [26], the Dallas Mavericks and the San Antonio Spurs in Basketball, the Oakland Athletics [27], the Chicago Cubs, the St-Louis Cards, and the Houston Astros in Baseball [4], and more recently the Toronto Maple Leafs in professional hockey [30].

3.4. Organizational level value creation from BI&A

BI&A tools can be used in professional and amateur sports organizations to create value in numerous ways. One of the most important has to do with improved decision making, game tactics and player preparation by coaches and staff of a given sports organization. In fact, numerous specialized software are available in the market to help coaches and staff (from various sports) collect, store, analyze and visually represent game data about their athletes and/or their opponents. The type of data being collected highly depends on the sport itself and the amount of effort and resources a given sports organization possesses. Also, because of the differences across sports in terms of rules, objectives, and athletic actions required, most specialized software are considered “niche applications” and are hardly transferable into other sports. Here again, technology vendors and specialized sports consultants are most often those who develop the BI&A tools and sell them to professional teams.

For professional sports organizations, increasing revenues and making decisions to improve their general financial performance is also a priority. For such purpose, advanced statistics and algorithms for establishing dynamic pricing models for ticket sales and other sports-related products (e.g.: official jerseys, collectible items, etc.) can prove extremely valuable. Usually, these pricing models attempt to optimize the overall revenues from sales activities by adapting prices according to changing market demands. Classic BI&A tools such as key performance indicators, dashboards and OLAP cubes can also be useful to assess the effectiveness of sales activities across the whole range of products that sports organizations offer to its customers. Baseball teams have been shown to be quite active in terms of using dynamic pricing strategies, especially due to the decrease in attendance in the last years [9].

Figure 4. Organizational level model of value creation from BI&A in competitive sports

At the organizational level, three conversion contingencies appear relevant here to ensure that value will be created from BI&A investments. First, it is clear that coaches and staff need to develop an open mind toward business intelligence and analytics in general, and embrace a mindset that is prone to data-driven decision making. Although their intuition
will still be critical for crafting game tactics, the variety and volume of data that is available to coaches can reveal interesting patterns from which specific game decisions might be optimized. Notable example are Houston Rockets’ General Manager Daryl Morey, Toronto Maple Leafs’ coach Mike Babcock and assistant general manager Kyle Dubas, and Boston Celtics’ coach Brad Stevens, who are all known to rely on BI&A to establish their respective team strategy and support their decision making processes [26]. Second, sports organizations need to rely upon people who are experts in statistics, analytics and information technology in order to fully exploit the potential of the BI&A tools they acquire. Most BI&A tools and technologies, especially those that enable linkages between numeric and video data, require a great deal of technology literacy and of course some knowledge in statistics and database management. More and more professional sports teams are known to have developed an analytics group/department, including the Toronto Maple Leafs [30], the Houston Astros [17], and the Chicago Cubs [35]. In other instances, sports organizations often establish partnerships with third party vendors who are already experts in data modeling, statistics, and advanced analytics. For instance, the New York Islanders have hired PowerScout Hockey for gathering and analyzing game video data [14]. In basketball, several teams (e.g. Chicago Bulls, Miami Heat) and individual athletes (e.g. Kevin Durant) have hired the former college basketball manager and statistical expert Justin Zormelo [6], who act as a special consultant in advanced statistics in basketball. Finally, because most BI&A tools used to collect and analyze game-relevant data require an extensive amount of coding and data entry, the quality and security of the data collection process is of paramount importance in order to support decision makers effectively. If for instance errors are made during the data-entry phase, any decision that results from the analyses of such flawed data will be of poor quality. The following quote from Benjamin Alamar [3] highlights the inherent complexity of managing and using data for NBA teams, as well as the importance of relying on a solid expertise in data analysis and statistics.

Today, teams are overwhelmed by the avalanche of data produced by SportVU cameras -- palm-sized devices that hang above the court in all 29 NBA arenas, constantly capturing the position of everything that moves below -- and they have little idea what to do with it. Most teams don’t even have any idea how to hire the right people who would know what to do with it.

3.5. Individual level value creation from BI&A

BI&A tools can serve individual athletes well in their pursuit for successful physical accomplishments. Two primary areas of value creation are identified here, along with the same number of BI&A initiatives and conversion contingencies.

First, it is obvious that individual athletes are eager to improve their athletic performance in their respective sport. Stated otherwise, they seek to be better at what their sport demands in terms of physical and sport accomplishments. Second, athletes also need to improve their overall health on a day-to-day basis and during training. This is why better injury prevention and effective health management can be seen as important for athletes in general.

To serve these two goals, two relevant sets of BI&A tools are proposed here. First, athletes can rely on personal analytics, defined as “the use of data by an individual to help achieve objectives across a range of domains” [15] to help athletes track personal accomplishments and physical performance during training session. If used in a reliable and consistent manner, these technologies can help them improve their performance, prevent injuries, and maintain healthy and responsible day-to-day habits. A notable example of personal analytics usage is the sensor-based portable device named Catapult. Used by a vast number of amateur and professional athletes, Catapult is a wearable technology that can capture biometric data and geographic positioning during training sessions and games. The data collected can be used to monitor the intensity of physical effort, the strength of physical impacts, the position and speed of athletes during training, and more. Another example is the Hexoskin wearable body metrics system used by Canadian Olympics athletes for gathering athletic performance data, which is then interpreted and used to optimize training programs [13].

The second set of BI&A tools relevant for the creation of value at the individual level is the use of contextualized reports and data visualization tools with which coaches and other staff members share game tactics, opponents’ patterns of play, and personalized feedback to athletes. In most cases, these reports and visual representations are the outputs of the specialized BI&A tools we discussed previously. For instance, several volleyball teams from the French professional league use the specialized software “Mercury” for linking video data to play action statistics. One of the functionalities of Mercury allows coaches to export
specific video sequences about any given player’s actions on an external drive (USB key, portable hard drive). For instance, a coach can select all videos where an athlete is blocked by an opponent once the game score reaches a certain value (e.g. after both teams have scored 15 points). Using a portable viewer, a player can then review his personalized set of post-game video and statistics, which enhances the relevance and timeliness of the feedback given to the athlete.

In order to ensure that investments in BI&A will create value at the individual level, we see two important contextual contingencies to take into account. First, because athletes are the ones who convert game tactics into physical action during sports events, they need to develop positive perceptions towards the usefulness of BI&A in general. In fact, a lack of perceived usefulness might result in poor usage of personal analytics technologies, resulting in sub-optimal data gathering from such devices. Second, we also think that athletes’ desire to learn and act upon the information they obtain from specialized BI&A tools is very much likely to influence the value they can get from them. The case of Shane Battier is one of the most salient examples of such desire to apply advanced statistics for his personal account during games. Playing as a forward for the Houston Rockets, he was known to process detailed data about his direct opponent’s playing patterns prior to a game in order to reduce the performance impact of that opponent [28].

**Figure 5. Individual level model of value creation from BI&A in competitive sports**

4. Discussion and avenues for future research

The goal of this paper was to develop a framework highlighting the value of BI&A for competitive sports, otherwise known as “sports analytics”. The proposed framework, based on previous studies on business value of IT and IT-enabled competitive advantage, delineates the main levels of analysis at which BI&A tools can have impacts. At each level, it also identifies a set of conversion contingencies that affect the impact of BI&A on value creation. Overall, we believe that the framework is useful in explaining how and where BI&A can affect the creation of value for competitive sports organizations and athletes.

We are also confident that the framework offers an initial structure that can guide future research on sports analytics and BI&A use in sports. Team owners, institutional sports entities (leagues and federations), athletes, coaches, and managers of sports organizations can use the framework by first identifying the type of value they seek to create with BI&A tools and then take into account the conversion contingencies that need to be managed in order to transform potential value into realized value. We also hope the framework will stimulate an interest within the IS community and guide researchers in their attempt to conduct empirical studies on the adoption and use of BI&A tools by competitive sports organizations and athletes.

At this stage, we feel important to highlight a few avenues for future research. First, we see great potential in the study of BI&A adoption and use by non-professional sports organizations. Heavily biased toward professional teams and athletes, research on sports analytics need to broaden its coverage to include implementation contexts in which financial resources and players’ athletic capabilities are below the level of professional sports organizations. The non-professional context, we believe, might lead to more variability in the nature and scope of the impacts of BI&A on some locus of value, especially in terms of player performance in the field and athletes’ learning. Also, even if some BI&A technologies are fairly expensive and more suited for professional organizations, customized and inexpensive BI tools can be used by non-professionals to support their decision making processes as they seek to enhance their performance.

Another avenue for future research would be to study the whole process of value creation in sports contexts, from initial perceptions towards the potential of BI&A investments to the realized value created from such investments. Of course, that would...
require a longitudinal design and probably more time and efforts at collecting stakeholders’ perceptions toward the value of BI&A. However, it is worth noting that a lot of suspicion still exists in competitive sports organizations about the real value of BI&A tools, and some argue that analytics in sports are made by those who actually know a lot about statistics/analytics but very little about competitive sports. But studying IT adoption, appropriation, usage and explaining the creation of value from IT investments are topics about which IS researchers have developed a rich body of knowledge over decades.

5. From sports analytics to sports intelligence

One thing that emerges from past studies on sports analytics by Davenport [9] and transpires from the present framework is that competitive sports organizations who seek to take advantage of BI&A tools need to embrace a new mindset about the way of competing. As research in IS has informed us for decades, technology is often seen as a trigger for organizational change and this is surely the case for the context of competitive sports. Increasingly overwhelmed by the amount of data they can use, athletes, coaches, and sports managers will need to define best practices to leverage their use and deal effectively with the issue of data quality. Thus, who will really win? Those who only rely on the talent and skills of their athletes and resist using BI&A tools? Or those who take a step forward by adopting BI&A tools as key elements of their strategy? While we clearly believe that competitive sports organizations and athletes can improve their performance by adopting BI&A tools, more empirical studies are needed to develop accurate representations of the real value created from investments in BI&A.

6. References


