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Kauppi, Katri, Moxham, Claire and Bamford, David

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Original Citation

Kauppi, Katri, Moxham, Claire and Bamford, David (2013) Should we try out for the major leagues? A call for research in sports operations management. *International Journal of Operations & Production Management*, 33 (10). pp. 1368-1399. ISSN 0144-3577

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SHOULD WE TRY OUT FOR THE MAJOR LEAGUES? A CALL FOR RESEARCH IN SPORT OPERATIONS MANAGEMENT

1. INTRODUCTION

The history of sport is richer than any other form of human activity; it has developed across the world as a ceremony, celebration, physical pursuit, leisure activity and now, increasingly, as a business (Chadwick, 2009). With multi-million dollar payrolls, facilities and television contracts, sport is now big business (Shannon, 1999). Professional leagues involve millions of fans and significant investment in players, merchandizing, and advertising (Kendall *et al.* 2010). Estimates of the total annual market size for sports and event tickets vary from \$7 billion to \$60 billion (Sainam *et al.* 2010). In contrast, amateur leagues do not usually have access to such large sums of money, but the number of tournaments and venues can be very large and require significant coordination and management. The last decade has also seen an unprecedented demand from countries and cities battling for the rights to organize major events such as the Olympic Games and the FIFA World Cup, which can bring thousands of jobs and economic opportunities to their hosts (Kendall *et al.* 2010; Emery, 2010). With such events the huge figures are not limited to revenues: the Olympic Games is considered by experts to be the greatest, non-defense related, world-wide logistics event (Minis *et al.* 2006). In the 16 days of the Athens 2004 Olympic Games over 2,000 athletes from 28 different sports took part in 300 events across 36 venues (Beis *et al.* 2006). Recent Games have typically attracted 20,000 members of the media, are supported by 150,000 staff members and volunteers, host over 5.5 million ticketed spectators and are watched by billions of television viewers (Minis *et al.* 2006).

The sport industry is not limited to leagues and competitions but includes the sporting facilities sector, which incorporates gyms and pools that are offered for public usage. In the US, the total fitness club industry revenue is sizable and is estimated to be \$15 billion per annum (Health Club Industry Stats, 2005). In addition to revenue, other benefits of sports facilities usage include lower health care requirements, lower crime rates, better quality of life, and contributions to social redevelopment (Taylor and Godfrey, 2003).

The many facets of the sport industry constitute major business, economic and social activity, with various operations occurring at different levels and often in parallel. The highly distinctive characteristics of the sports industry necessitate specialist research in the field (Chadwick, 2011). It is therefore unsurprising that sport has become a focus of research in the management literature. Wolfe *et al.* (2005) list the following topics as being studied within sport: loyalty, pay equity and structure, motivation and performance, the relationship of managerial succession to organizational performance, new product development, human resources strategy and the resource-based view of the firm. Baade and Mattheson (2006) have looked at public financing in building sport stadiums, whilst other studies in the finance area have included gambling (e.g. Sauer, 2005; Forrest and McHale, 2007). Studies in marketing cover sponsorship issues (Olson, 2010), effects of attitude importance (Pritchard and Funk, 2010), ticket pricing and consumer options (Sainam *et al.* 2010). The management discipline with possibly the deepest roots in sport studies research is operations research (OR), with Wright (2009) providing a recent review of 50 years of activity in OR as applied to different sports. The main areas of study identified were the analysis of tactics and strategy, scheduling, forecasting and analysis of policy issues (Wright, 2009)¹.

The one area of management research that has given limited attention to the sport industry is operations management (OM), although there have been recent efforts to broaden OM research into previously unchartered industries. The need for further research in sport has also been highlighted by Machuca *et al.* (2007) who argue that not enough attention is paid in operations management journals to research in significant sectors found in developed countries, such as tourism, leisure, culture and sport. As a result, most of the major sport operations management research is narrow in focus and coverage. This is surprising given the consequences of OM failure in sport, particularly when this failure is highly visible to a global audience. The 2010 Commonwealth Games, for example, was criticised for empty stands, collapsing

¹ Wright's review relates to studies that look at sport as a competitive and physical activity and how OR has been used to assist individual decision makers such as coaches, managers, leagues or gamblers. We focus on the operations and business aspects within the sport industry and examine the potential for the application of operations management topics, including capacity management, layout, supply chain management, quality management, strategy and process design, to the sporting context.

scoreboards and strike threats by judges due to poor transportation arrangements and failing technology (Gilmour, 2010). Such instances of failure were operationally predictable and preventable for a sporting event that cost an estimated \$6.8 billion (Kaushik, 2010). There are many other examples of situations that although not instances of OM failure, provide opportunities for improved performance. Improved layout, queuing methods, process and job design can increase customer throughput and sales during half-time breaks, while some capacity management principles are useful in improving both utilization and customer satisfaction at sporting facilities. Naturally, we do not suggest that sport operations management is non-existent in practice. Most likely, many organizations are already implementing some service OM strategies and practices. Of equal importance, therefore, is the identification of best practices within the sport industry and the dissemination of knowledge so that managers and academics alike can understand which OM practices work best in certain types of environments.

In this paper we argue for operations management scholars to get into the game (pun intended) and to consider the structured application of operations management theories, tools and techniques to sport management. For a research field in its infancy, a research agenda grounded in literature is needed to synthesize the limited, disparate research that has been published to date, to construct a basic framework to identify unexplored topics and to propose the most fruitful directions for research and theory testing and development (Angell and Klassen, 1999, Youngdahl *et al.*, 2010). Therefore, the primary aim and contribution of this paper is to provide a comprehensive understanding of the research that has been conducted in the area of sport operations management so far, and from that to derive and develop an extended and integrated perspective to guide future research efforts. This paper provides a detailed synthesis of the sport operations management issues that have been studied based on a systematic literature review. We classify our findings and discussion based on earlier categorizations of operations management topic areas (Pannirselvam *et al.* 1999; Prasad and Babbar 2000). We then identify potential avenues for future research and propose research questions. The purpose of this paper is to develop a research agenda for sport OM and to prompt further debate and investigation into this neglected field of study.

This paper also provides a brief discussion on methodology in which we will argue that investigating operations management in a sport context not only provides a new setting in which to apply and test OM theories and offers interesting new research questions around established topics, but that it can also help OM as a field to learn more from and develop further the existing theories and techniques we have. This is because sporting events provide unique opportunities for experimental research in OM, which has been much called for in recent OM publications (Craighead and Meredith, 2008; Bendoly *et al.* 2006). League games taking place in stadiums on a weekly basis or members visiting a gym in a specified time frame provide for a unique laboratory like setting - without the artificiality created by using a laboratory - for conducting experiments where certain variables can be controlled for and others changed to see their impact on queues, capacity utilization, service quality and other outcomes.

When defining the sport industry, this paper takes a broad scope in order to capture the full range of studies conducted on the topic. We include all three categories of industrial activities in the sport industry value chain as defined by Smith (2008). The first category includes activities associated with the government and public sector as well as institutions that are involved in the development of sport, determining government sport policy, bolstering competitive performance or health promotion. The second category comprises activities by the nonprofit or voluntary sector, e.g. local clubs and international federations, where the focus is on the development of sport through organized competition and participation, with a heavy emphasis on the regulation and management of sport. The final category encompasses the professional sport sector which is commercially focused and comprises professional clubs, leagues and major events. Any organization whose primary purpose is to make a profit from an association with sport can be placed in this category (Smith, 2008), thus commercial sports facilities offered to the public are included here. Sports equipment manufacturing and retail are excluded from the scope of this paper as they are seen as a separate industry related more closely to retail than to sport. This paper does not consider the potential application of OM to on-field sport performance, however this context is recognized as another possible outlet for research as certain tools such as Statistical Process Control (SPC) and Six Sigma have the potential to be used in improving athlete performance (Antony, 2000, Linderman *et al.*, 2003).

The paper is structured as follows: First, a brief description of the context of the study and consideration of the features of the sport industry that make it an interesting area of study is provided. Second, the systematic literature review methodology is described in detail. Third, the main findings from the review are presented by synthesizing the literature on sport operations management. Fourth, a research agenda is developed and finally the paper concludes by considering the opportunities for OM theory development through experimental research in sport industry settings.

2. THE CONTEXT: SPECIAL FEATURES OF THE SPORT INDUSTRY

Sport and business share a common concern for value creation yet sport is significantly more concerned with beating rivals, winning trophies and channeling the passions of players and fans (Smith and Stewart, 2010). There is a tension between sport as a business and sport as a game-centered and social institution due to the recognition that failure to consider sport as a business will produce poor performance both on and off the field (Smith and Stewart, 2010). To produce optimal performance off the field will require that the special features of the sports industry are acknowledged in management practices.

We also note that the sport industry is part of the service industry and shares many of the characteristics typical of services, such as perishability, intangibility, inseparability and heterogeneity (for a more detailed discussion the reader is referred to Lee, 1989; Bitran and Lojo, 1993; Karmarkar and Pitbladdo, 1995 and Prajogo, 2006). Additionally, as Machuca *et al.* (2007) suggest, sport is part of a subsector (sport, leisure, culture and tourism) that has certain specific management characteristics that are not as typical to other service sectors. Some of the management challenges caused by the characteristics of services are amplified within the sport industry, especially for operations related to one-off and league events. An example is the fluctuating demand which aggravates the problem of perishability in services. This is universally perceived to be the most troublesome characteristic for service firms as it complicates synchronizing supply and demand (Lee, 1989). Demand for sport events is limited to weekly, fortnightly or possibly only annual events which results in peaks of a very short duration, thus making it difficult to

utilize many of the traditional capacity management strategies such as incentives to arrive at off-peak times, informing customers of demand patterns or determining prearranged schedules (Bitran and Lojo, 1993).

Sporting clubs and competitions are restricted by a fixed short-run supply, or a highly inelastic production curve (Smith and Stewart, 2010). Therefore on-field performance cannot be increased in the same way that a manufactured good can; the sport product cannot be stored and re-sold which therefore limits its distribution (this does not apply to the same extent in other cultural events such as concerts and theatre, which are played several times). Overall, it is a product-led industry: the competitive contest drives the industrial activity, as opposed to market or customer led industries (Chadwick, 2011). Organizations also have limited control over the product: sport is subject to local, national and international laws and external operating criteria not present in other industries (Chadwick, 2011), e.g. product specifications such as competition duration and format are not within the control of the organization, limiting decision making control and opportunities for differentiation.

In sport events, the core product usually consists of a network of resources and competencies, such as team performance, quality of opponents, rivalry rank and star players, that interact to create value and determine customers' perceptions of the quality of the game (Basole and Rouse, 2008, Vargo *et al.*, 2008). Customer experience is essential to create value (Vargo and Lusch, 2006). One of the primary reasons that spectators attend sporting events is to be part of the atmosphere, which is akin to co-creating the sporting experience (Basole and Rouse, 2008, Vargo *et al.*, 2008). Spectators engage in this co-creation for the pure enjoyment experienced through the uncertain outcome of the sporting event (Lusch *et al.*, 2007, Chadwick, 2011).

In participating in creating the sporting atmosphere, spectators can be viewed as operant resources, they are a collaborative partner who co-creates value (Lusch *et al.*, 2007). The atmosphere co-created by spectators may have an influence on the sporting outcome, as evidenced by the 'home advantage' phenomenon (Wolfson *et al.*, 2005). This characteristic distinguishes sport from other cultural events whereby the activity is scripted with a predictable outcome, even if some variability in performance exists every time (for example with theatrical productions or musical

events). Spectators may therefore be seen in some respects as both the customers and the suppliers of the sporting experience as they demand and supply the intensity, atmosphere and rivalry which strengthen the core product itself (Sampson and Froehle, 2006, Chadwick, 2011).

Two pervasive claims about the sport product are that its quality is variable, and its level of performance is unpredictable (Smith and Stewart, 2010). Performance improvements on the field are outside of the scope of this paper. It is important to note, however that as on-field performance has a real influence on customer satisfaction, its variability creates additional pressure for exceptional performance from front and back office operations. Uncertainty in on-field performance can also create additional operational challenges. For example operations planning for cup competitions can be difficult if future game locations are based on current and future performance as this information is often only available at short notice, thus creating real difficulties for operations management. Furthermore, in the sports industry collaboration and coordination are enforced rather than chosen strategically, therefore groups of organizations need to work together to create competitions (Kale and Singh, 2007).

Sporting events provide examples of service value networks (SVN) (Basole and Rouse, 2008, Agarwal and Selen, 2009) whereby an 'elevated service offering' can be achieved through the collaborative efforts of network partners (Agarwal and Selen, 2011). Organizing any major sporting event is a typical project: time-constrained (with an absolute and non-negotiable delivery date), resource-constrained (budget and number of employees), goal oriented, highly complex and cross-functional (Lowendahl, 1995). Sporting events differ from standard projects due to five important event characteristics that impact operations management. These characteristics have been considered in the context of the Olympic Games (Minis *et al.*, 2006) and it is worth noting that many of these characteristics are relevant to other major events such as the World Cup, Super Bowl and Formula 1.

Firstly, the Games have a transient nature: a short duration with a long planning period. Secondly, the size of the event is massive: typical numbers include more than 6,000 containers imported in the host country, about 100,000m² of warehousing space

utilized, and about 1,000 logistics staff employed. Thirdly, there is considerable diversity in terms of items managed combined with uncertainty in quantities and in the arrival and departure times. Fourth, the event has a firm schedule with immovable deadlines. There are no second chances to correct mistakes. Fifth, the staff is a mix of hired and volunteer labor, most newly hired and inexperienced. Beis *et al.* (2006) point out that the organizational backdrop is also unique; the organizing committee has a limited lifetime and no organizational memory therefore any learning disappears with it and therefore positive alliance learning processes and dynamic capability building are crucial (Kale and Singh, 2007, Agarwal and Selen, 2009). This facet in particular differentiates many sporting events from the construction industry, which does share some of the same characteristics of size and schedule.

In addition to the above characteristics, the host country environment (the location, logistics infrastructure and know-how) may have an impact on event operations as well (Minis *et al.* 2006). Beis *et al.* (2006) further describe venue operations as unique in that they are characterized by an extraordinary volume of demand for services to be provided in a very short period of time and require a variety of services to support the many customer groups and their specific requirements.

All the characteristics discussed above add complexity to standard operations management tasks such as capacity planning (Buxley, 2005), service quality and quality control (Parasuraman *et al.*, 1985), supply chain management (SCM) (Christopher and Towill, 2000), and process design (Lu and Wood, 2006) when compared to the more stable and continuous operating environment often observed in manufacturing or most other service operations. Such a context therefore provides a wealth of opportunities for OM researchers.

Opportunities within the sport context exist also to broaden the methodologies utilized in OM research. We propose that sport offers a unique context for conducting experimental studies on OM topics and could thus act as a catalyst to increase this underutilized methodology in future theory testing and development (see Craighead and Meredith; 2008, Taylor and Taylor, 2009). To develop rather than to test theory, OM scholars must directly observe the reality they wish to study (Craighead and Meredith, 2008). Experiments are especially well suited to provide evidence of causal

relationships (Greenberg and Tomlinson, 2004). Already Wolfe *et al.* (2005) have suggested that sport contexts mimic laboratory research as hypotheses can be tested in relatively controlled field environments. They, however, refer to the actual on-field sport performance, whereas we put forward the argument that the off-field operations in sports can also be used as a setting for experimental OM research.

The majority of OM publications with experimental methods have utilized laboratory experiments (Bendoly *et al.* 2006), and while they are appreciated due to the opportunity to control variables of interest, their artificiality and lack of generalizability limits their usefulness (Greenberg and Tomlinson, 2004; Boyer and Swink, 2008). As field experiments are conducted in naturalistic settings, they are not subject to the same criticisms (Greenberg and Tomlinson, 2004). Sport events and facilities offer the opportunities for field experiments, providing potential to manipulate certain variables in naturally controlled settings. Most stadiums host weekly games where, for example, certain sections are always occupied by the same visitors i.e. season ticket holders and most sport facilities only provide access to members. This differentiates the sport industry from many other service settings as a context for experiments; the human inputs to the process remain the same while the operational variables can be changed. By controlling some factors and modifying others in these settings – such as number of servers or options offered during half-time, queuing systems, layout, process design aspects or back-office operating systems - the impact on factors such as throughput, waiting times, perceived service quality and system costs can be estimated. These findings can lead to both development and refinement of theories, optimal strategies and managerial practices in OM - not just within the sport context.

Bendoly *et al.* (2006) and Boyer and Swink (2008) particularly encourage the use of experiments in behavioural OM. We want to expand the argument and suggest that within the context of sport, OM researchers have access to settings that allow for experimental research outside the scope of behavioural issues to topics such as capacity management, process design and queue management.

3. METHODOLOGY: SYSTEMATIC LITERATURE REVIEW

PROCESS

To ensure that we would include all relevant past publications in our consolidation of previous research we employed a three-pronged systematic methodology to build a database of relevant publications for our literature review. It is essential that a systematic review reports the search strategy in detail to ensure that it can be replicated by other scholars (Tranfield *et al.* 2003). The completed literature review only includes studies that meet pre-specified inclusion criteria and do not contain any of the exclusion criteria decided upon. Sources deemed as possibly relevant are evaluated thoroughly to decide on the final selection. The systematic literature review method used in this study is based on Pittaway *et al.* (2004). Our review had three different approaches to ensure maximum coverage. Firstly, a full-text search using sport keywords was conducted in fifteen academic journals that focus on the operations and/or supply chain management field. Secondly, a full-text search using OM keywords was conducted in five sport management journals. Finally, a more restricted² search using a combination of sport and OM keywords was conducted in three databases (Proquest, ScienceDirect and ISI Web of Science). The keywords were identified based on OM textbooks, review articles of the OM field (Prasad and Babbar, 2000; Pannirselvam *et al.* 1999), prior experience and reviews of sport related material. Each author individually provided a list of keywords and these were combined to develop the final lists. The search strings and journals used in each of the three search methods are included in Appendix 1, and a flow diagram of the review process in Figure 1.

INSERT FIGURE 1 ABOUT HERE

The 12451 articles (including some duplications) found through these three approaches were reviewed by one of the three authors (based on title and/or abstract

² The use of the search strings differed somewhat given the characteristics of the databases. Typically either a search for both words in the abstract or within a limited amount of words of each other in the full text was conducted. This is because for many of the search strings a full text search provided thousands of hits that on inspection proved irrelevant to the topic. An example of such a combination is “tournament + distribution”, which provided articles dealing with e.g. different types of probability distributions in various tournament-like environments such as auctions.

and if necessary full text) in line with the pre-specified criteria. Exclusion criteria included the following: low journal quality (in the general database search), article not containing sport operations management, and publication type (e.g. book reviews and anonymous publications were excluded). Additionally, articles dealing with operations management in sport retailing were excluded, as these are outside the scope of the study. Based on these criteria, 121 articles were carried forward to the next step in the systematic process where the three authors independently reviewed all articles. Each author coded the articles as either green (definitely accept, contains OM and in a sport context), yellow (possibly accept, OM viewpoint or industry focus unclear) and red (no OM or sport industry focus). After each author individually implemented the coding, the codings were compared to check for inconsistencies. Articles with all yellow coding or inconsistent coding among the researchers were discussed in order to reach a conclusion on whether to include or exclude it. Finally, 34 articles were selected for the literature review.

Inter-rater agreement among the three researchers in their coding was tested by the R_{wg} coefficients according to the ratio method (James *et al.*, 1984). Inter-rater agreement refers to the interchangeability among raters and addresses the extent to which raters make the same ratings (Shah and Ward, 2006). In the calculation, more weighting was put on rater differences between a red and a green code than on a difference between a yellow and red or green code. The inter-rater agreement index can range between 0 and 1, with 1 representing perfect agreement (Koste *et al.* 2004). Although James *et al.* (1984) do not provide a definitive cut off point, values of 0.71 or higher have been suggested (Koste *et al.* 2004), and values as low as 0.6 and 0.65 have been deemed acceptable in previous empirical OM research (e.g. Papke-Shields *et al.* 2006; Shah and Ward 2006). These studies have typically focused on inter-rater agreement of two survey responses from the same organization on survey items, whereas here the rater agreement is calculated for three raters and for each of the 121 articles coded. On 81% of the articles coded, the R_{wg} coefficient was very high, either 1 or 0.875. In only 14% of the cases the value was below figures accepted in previous research, and in these cases it was at least 0.5. Furthermore, all such cases were discussed among all authors before the final inclusion/exclusion decision was made. These results indicate an acceptable level of agreement between the researchers.

4. LITERATURE REVIEW: OPERATIONS MANAGEMENT IN SPORT

In this section, the findings from the systematic literature review are presented. Only papers that were identified as part of the review process are considered here. The systematic literature review found a variety of operations management topics applied to the sporting context. Studies ranged from an analysis of the Olympic Games to more localised studies of fitness clubs and football leagues. Table 1 contains information on units of analysis, method, topic area and sampling in each of the reviewed papers. After a review of the selected papers was conducted, the papers were categorized into nine operations management topics derived from Pannirselvam *et al.* (1999) and Prasad and Babbar (2000). Specifically, the following categories are adopted from these studies and are used to structure the findings of the review: Capacity, Layout, Forecasting, Purchasing and Supply Chain Management, Distribution, Quality, Project Management, Process Design and Strategy.

INSERT TABLE 1 ABOUT HERE

4.1. Capacity

A variety of studies focused on capacity in a sports context. Two studies simulated the operations of a ski resort in order to examine an environment characterised by multiple facilities (ski lifts and restaurants) and their corresponding queues (Pullman and Moore, 1999; Pullman and Thompson, 2003). Results showed how demand smoothing led to a reduction in profit and that the replacement of ski lifts to alleviate bottlenecks simply shifted the bottleneck to another location. Both studies proposed better utilization of existing capacity through queue information systems as a solution prior to considering capacity expansion. Misener and Doherty (2009) considered capacity under the umbrella term ‘organizational capacity’, which comprised five constructs of human resources, financial, relationship/network, infrastructure and process as well as planning and development capacity. Organizational capacity was defined as an organization’s potential to achieve its mission and objectives and was applied to a community gymnastics club. The study found that human resources

capacity and planning and development capacity were perceived as having the greatest impact on goal attainment. Operations growth was found to be especially limited due to a combination of a shortage of facilities and poor planning. No capacity management tools as they exist in the OM literature were discussed as potential solutions.

In contrast, a study of ice hockey spectators defined capacity in terms of number of seats in an ice hockey arena; a more traditional OM input approach. In attempting to understand the relationship between the physical facility and the service experience, the study found however that area seating had little impact on customer satisfaction (Greenwell *et al*, 2002). Facilities were also considered by Taylor and Godfrey (2003) who looked at the utilization of sports halls and swimming pools in a UK benchmarking study. Whilst not examined in any detail, indicators of floor space were used to provide a comparative basis for income and cost performance based on size of facility. In considering capacity in terms of availability and utilization of labour, Sampson (2006) compared volunteer labour with traditional labour assignment and provides examples from the Olympics and community youth soccer. The study finds that the availability of volunteer labour is limited by the number of volunteers that can be recruited and that volunteers that were not utilized had a reduced propensity to volunteer in the future.

4.2. Layout

The application of layout principles was not well represented within the literature. In a study of the design and use of skateboard parks, Kellett and Russell (2009) discuss how layout is related to the customer experience and is altered to suit the target audience. Layout principles which are specific to skateboarding are presented, however their generalizability to other sports is not discussed. In a study of top Texas golf courses, Heim and Ketzberg (2011) discuss the challenges of redesign linked to the potential negative impact on the customer experience (examples of turf conditioning, dry or dead spots and drainage issues are given). The study finds that top private golf courses are active in learning from experience to improve their layout, and thus their course rankings, whereas public and resort courses are less focused on

major course redesign, presumably due to the associated costs and upheaval that may result in a negative impact on perceived quality.

Tesone *et al.* (2009) present a process to develop visual representations of production systems within golf clubs in North America. By inference layout is an important element, but the study focuses more on the process design aspect. The findings of the study reinforce the point that the concepts of production processes are often perceived as ambiguous in the minds of many practicing managers. The practical implications of managers being held accountable for productivity enhancement yet not understanding the importance of production systems, productivity and flow are highlighted.

4.3. Forecasting

Forecasting in sports in this paper is limited to forecasting demand for operational planning purposes. (We refer the reader to Wright *et al.* (2009) for a review of OR type sport forecasting with a focus on gambling and predicting match, game, tournament and race results). Beis *et al.* (2006) present a comprehensive analysis of venue operations in the context of the Athens 2004 Olympic Games. To effectively and efficiently organize the support systems for venue operations, the organizers must be able to predict and anticipate demand. The Athens 2004 Olympic Games organizing committee developed the Process Logistics Advanced Technical Optimization (PLATO) approach. This was a systematic process for planning and designing venue operations which incorporated aspects and elements of predictive operational forecasting. The direct financial benefit of this system was reported as a reduction in venue operations costs of over \$69.7 million. The legacy of the PLATO approach was suggested as enabling future organizing committees to reduce the financial burden of the Olympic Games on both governments and society.

4.4. Purchasing and supply chain management

Two studies (Lonsdale, 2004 and Cross and Henderson, 2003) have looked at supply chain management within the context of the English Premier Football League. Lonsdale (2004) provides a detailed description of the value and relationships in the football supply networks. He identifies four main sets of suppliers that the

Premiership clubs manage: the players, the coaches, the merchandise suppliers and the construction suppliers. According to Lonsdale (2004), a major supply management problem concerns the acquisition and retention of the players. Although the Premiership football clubs have received an enormous increase in revenue over the years this has not been translated into higher or possibly any profits because their key suppliers, the players, have been appropriating the major share of value. The recent record-breaking 5-year contract between Manchester United and star-striker Wayne Rooney, promising him a \$282,000 a week salary, is a case in point (Businessweek, 2010). Lonsdale (2004) describes the relationship between the players and the clubs as one of Supplier-Skewed Adversarial Collaboration and as a “talent supply network”. Cross and Henderson (2003) also study the supply of players within the Premier League by applying a resource-based view. They suggest that the skills of the workforce are the main source of superior rents. Specifically, they argue that players are not homogeneous and only partially interdependent; this combined with their limited transferability, replicability, durability and the relatively weak powers of club against player have created a situation where clubs cannot cover the costs of players from gate receipts. Neither of the papers gives managerial recommendations for these issues, with the focus of both being largely descriptive.

Burden and Li (2009) focused on outsourcing sport marketing. They suggest that outsourcing is a recent phenomenon in the sport industry. The study examined which clubs are most likely to utilize outsourcing and for which marketing operations. Their survey suggests that a well-developed strategic plan by the outsourcing organization, as well as the development of a cooperative partnership, are the keys to a successful outsourcing program and point out that in some instances professional sport organizations have created their own third-party service providers. The study is largely exploratory in nature and not conducted from an OM viewpoint or by utilizing the literature in the field. Minis *et al.* (2006), in their study of logistics in the Olympics, point out that outsourcing has entered the Olympic Games as well; it was seen as a differentiating feature of the Sydney Olympics. Major functions that were outsourced were the provision of experienced personnel in freight forwarding and customs clearance, technological support in the form of an inventory tracking and material planning system and a scheduling software for deliveries (Minis *et al.* 2006).

Both studies on outsourcing lack a theoretical background such as the resource based view or transaction cost economics.

4.5. Distribution

Minis *et al.* (2006) provide the most comprehensive study of distribution and logistics in the sporting context by discussing the logistics challenges in the Athens Olympics 2004. The main contribution of the paper is a systematic methodology for designing the strategic and tactical aspects of Olympic logistics, which takes into consideration characteristics of the Games and the host country logistics environment as well as learning from previous Games. They divide the design into major tasks (freight forwarding and customs clearance, warehousing and distribution, venue logistics, delivery coordination, asset tracking and reverse logistics), activities within the tasks and the major operations involved in each task (planning, coordination, service delivery and control) and discuss outsourcing options for each task. Finally, recommendations for designing logistics operations for future Olympics and other major events with similar characteristics are given. The study thus provides a generalizable framework for managerial purposes. Theoretically, the main contribution is the detailed discussion of event characteristics.

As mentioned above, a special characteristic in the sport industry is the fixed short-run supply. Smith and Stewart (2010) however suggest that technology can be used to increase product supply. Several mechanisms such as blogs, social networking sites, email, podcasts, websites, mobile phones, PDAs and gaming devices can offer ways to redistribute the sporting product to new and existing customers. These innovations may offer new areas for research where an interdisciplinary approach between marketing, OM and technology management is needed.

4.6. Quality

The questions of what and how to measure in terms of quality were pervasive across the sport quality management literature (Tsitskari *et al.*, 2006). Studies found on the topic of evaluating quality in a sporting context focused on fitness clubs (Alexandris *et al.*, 2001, Chang and Chelladurai, 2003, Bodet, 2006, Moxham and Wiseman,

2009), surfing events (de Knop *et al.*, 2004), basketball games (Kelley and Turley, 2001) and public sports halls and swimming pools (Taylor and Godfrey, 2003). The positive relationship between revenue and service quality were key drivers for the majority of the studies in this area, with Alexandris *et al.* (2001) finding a strong correlation between high levels of service quality and repeat purchase intentions and Bodet (2006) concluding that staff behavior is a key determinant of perceived quality.

Specifically, Chelladurai and Chang (2000) propose a framework for understanding quality in 'sport services' (a definition which includes fitness services, leisure services and recreation services) in terms of developing quality targets, quality standards and mechanisms to evaluate quality. This targets-standards-evaluation framework is utilized by Moxham and Wiseman (2009), who report on its usefulness in developing quality policy and for measuring service quality in a UK fitness club. Also with a focus on fitness clubs, Chang and Chelladurai (2003) take a systems perspective to examining quality. The resultant Scale of Quality in Fitness Services (SQFS) framework is developed through the consideration of nine dimensions of quality specifically for fitness clubs, which are related to inputs, throughputs and outputs.

Taylor and Godfrey (2003) also develop indicators of service quality and report on the development of twenty-eight attributes for measuring service quality in public access sports halls and swimming pools. Unlike Chang and Chelladurai (2003), all of these attributes are quantitative in nature and feed into a national benchmarking programme. The study reports on the positive reaction from participants involved in the benchmarking exercise and on the opportunities for continuous improvement, which concurs with Mawson's (1993) study on the applicability of Total Quality Management to sport managers. Dimensions of service quality are also considered by Kelley and Turley (2001) in attempting to understand the importance of thirty-five service attributes to basketball fans. Whilst the importance weightings assigned to each attribute varied across the sample of fans, the game experience was identified as the most important. This finding has interesting implications for operations managers as the ability of the team to win may be a difficult one to manage.

Focusing more explicitly on internal processes, de Knop *et al.* (2004) report on the development of a computer information system aimed at improving the quality of

management systems in sports clubs in Belgium. Seven dimensions of quality are evaluated by using a measurement tool which comprises over 200 criteria. The study explains how the tool was tested and rolled out, however results are not reported.

In contrast to the development of frameworks or systems, Getz *et al.* (2001) report on the usefulness of the service mapping approach to the evaluation of service quality at a surfing event. The technique required the distribution of a visitor survey and participant observation, which may be considered resource intensive for a one-off sporting event, however the mapping was useful in identifying capacity and flow constraints during peak times for which solutions were suggested.

4.7. Project management

Project management studies identified in the literature all dealt with the Olympic Games. Uncertainty, complexity and uniqueness were the common themes across studies by Lowendahl (1995) on the XVII Winter Olympic Games in Lillehammer and Pitsis *et al.* (2003) on the Sydney 2000 pre-Olympic Games project of cleaning up the waters of Sydney Harbor. Both studies found existing project management literature to be inadequate in addressing the challenges faced. Lowendahl (1995) identified greater task uncertainty in terms of planning, predicting and controlling outcomes by the organizing committee for the XVII Winter Olympics because it was independent from a parent organization. The longitudinal case study shows how the committee had to define specific tasks gradually as it learned what was required. Similarly, Pitsis *et al.* (2003) comment on how it was practically impossible to plan the harbor cleanup project due to the size, scale and complexity of the project. Pitsis *et al.* (2003) call for a shared culture and accountability in projects of this nature, which concurs with Lowendahl (1995) who suggests that projects that are not embedded in the operations of a parent organization should be considered as temporary organizations in order to mitigate the uncertainty associated with complex projects of similar magnitude to the Olympic Games.

4.8. Process design

Process design was considered by four studies, three of which considered golf clubs. Two studies by Collier and Meyer (1998; 2000) proposed a framework for service system design in which two axes were developed detailing the number of pathways allowed by the design of the system and the degree of customer discretion in selecting the sequence of service encounters. Golf was used to illustrate how the dominant sequence of playing holes 1-18 is defined by the design of the process, yet the golfer has some discretion within this to decide how she plays the course. Tesone *et al.* (2009) used action research to utilize the input-transformation-output framework with the aim of increasing efficiency and effectiveness within eight large golfing clubs. The study shows how concepts found in the OM literature, including mapping production systems, touch points and service transaction systems, can usefully be applied to the golf club context. The study concludes that an understanding and visual representation of production processes generates an awareness of production systems that can enhance productivity. Davis and Heineke (1994) provide an example of process design in a ski resort whereby separate queues are provided for single and group skiers. This design has the advantage of a shorter perceived waiting time for single skiers, and the opportunity for ski operations to maximize ski lift capacity during peak demand periods by using single skiers to fill otherwise empty seats as they occur.

4.9. Strategy

Research on strategy largely focused on the link between business strategy and competition strategy. A different focus was adopted by Foster *et al.* (2000). In an examination of two ski resorts, the study found strategic tensions between environmental concerns and the pursuit of better customer service and found that customer service was often the winning strategic goal. The strategic importance of experience-centric services was considered in a study by Voss *et al.* (2008), whereby winter sports were considered in a study of 'services as destinations'. A framework identifying the use of experience as a source of value creation and the degree of integration of the experience within the organization was proposed and has the potential to enhance strategic decision making within the sport context.

The importance of on-field performance to the business strategy of the sporting organization was made explicit in three separate studies. These studies were situated in very different contexts: professional football (Cross and Henderson, 2003), elite athletes (de Bosscher *et al.*, 2009) and the organization of sporting events (Emery, 2010). The studies are similar in that each attempts to shed some light on the reasons behind success or failure in sport and all find that investment in on-field performance is the key to organizational success.

Specifically, Cross and Henderson (2003) examine English professional football clubs and find, unsurprisingly, that it is the selection of football players upon which the success of the club depends. Despite 67% of the 54 clubs in the study failing to break even financially, the study finds that attracting the best players, whatever the cost, is the strategy that goes some way to creating a barrier to the increasing transferability of this valuable resource. On a similar theme, de Bosscher *et al.* (2009) study the phenomenon of elite sporting success, and consider whether success can be attributed to strategic investment. The study adopts the operations management paradigm of input-throughput-output to examine the interaction between policy inputs (resources), policy throughputs (processes) and outputs (results during international competitions, e.g. medals won or number of qualifying athletes). Over a hundred critical success factors were identified and a scoring system was developed. Defining success was found difficult because different nations prioritize success in different ways, leaving the results of the study as inconclusive. The study did find, however, that countries with the highest absolute expenditure on elite sport were also the most successful, leading the authors to conclude that countries need to identify and invest in an area in which they can outperform their competitors.

Building on the idea of developing strategies for competitive advantage, Emery (2010) asserts that there is a paucity of studies that consider planning, organizing, leading or controlling in major sporting events. In examining current practice, Emery (2010) found that the most widely used plans in major sporting events are financial, marketing and technical, with very little attention paid to bidding or feasibility. It was concluded that whilst current management practice recognizes the importance of planning, the primary focus appears to be towards achievement of the bottom line

rather than the quality of pre-determined and specific outcomes. These findings demonstrate the inter-relationship between on-field and off-field success.

4.10. Key Themes from the Literature Review

An examination of the sport OM literature shows a field of research still largely in its infancy, with similar studies being conducted in isolation and limited evidence of cumulative learning or any recognised body of knowledge. A small scale co-citation analysis carried out on the thirty four papers found that only Chelladurai and Chang (2000), Chang and Chelladurai (2003) and Collier and Meyer (1998) were actually cited by other authors; three times, six times and once respectively. The first two papers focus on aspects of quality in sport services and their citation goes some way towards building a body of knowledge. However, the rather surprising lack of further co-citation across the remaining thirty-one papers suggests that the theoretical and practical transfer of knowledge within the sports OM literature is chronically underutilized. In fact, very few papers appear to cite both OM and sport focused journals, providing further evidence that there is a gap between the two fields. Only Heim and Ketzenberg (2011), Moxham and Wiseman (2009) and Tsitskari *et al.* (2006) can be said to be making reference to both OM focused and sport focused journals. Most articles that appeared in journals that were classified as sport focused did not contain any references to the OM journals used in the systematic literature review, and similarly most articles that appeared in the OM journals made no reference to sport journals. Surprisingly, those articles that appeared in neither of the two journal types (e.g. in more general management journals), tended to have neither OM nor sport journals in their reference list regardless of the topic clearly falling under the umbrella of sport OM! This finding demonstrates that work is needed to incorporate learning from both OM and sport for the benefits of scholars and practitioners.

The existing research appears to be largely exploratory, searching for interesting phenomena and insights to report. Consequently, there is a lack of theory driven sport operations management research where hypotheses and causalities drawn from literature are tested with empirical data. In addition the survey scales used in empirical studies are not well developed and refined, as demonstrated by the very few

instances of confirmatory or even exploratory factor analysis to refine scales in the papers reviewed. The lack of survey items displayed in many studies also does little to promote continuity and scale development. Overall, it can be said that the articles found from OM-focused journals often had a stronger theoretical background, but the sports discussed tended to be selected as examples of service organizations (and often in a very minor role), rather than focusing on (or noting) the special characteristics present in the sport industry. Those articles in more sport-focused journals tended to overlook theory development and findings in the OM field, and provided limited generalizable theoretical contributions. The review has highlighted the need for a wider, more theoretically based and rigorously conducted research agenda for sport operations management; the development of which is discussed in the remainder of the paper.

5. DEVELOPING A RESEARCH AGENDA FOR SPORT OPERATIONS MANAGEMENT: TOPICS, METHODS AND QUESTIONS

5.1. Topics

Based on the systematic literature review, certain gaps in existing research can be found within the field of sport OM. These gaps present opportunities for further research. In order to begin to develop a research agenda for sport operations management, Figure 2 has been developed to demonstrate opportunities for further research in terms of the OM areas that have been studied and the unit of analysis. Figure 2 is by no means exhaustive, however its purpose is to provide a springboard for further research in sport OM; particularly the opportunity and requirement for more theory-driven, generalizable research and comparative approaches are identified. To develop the research agenda the following sections discuss the opportunities for research within each of the OM areas and go on to propose research questions.

INSERT FIGURE 2 ABOUT HERE

5.1.1. Capacity

The capacity studies mostly focused on the impact of capacity on the end user and were largely descriptive in nature, presenting ways to define or benchmark capacity, and did not consider capacity management strategies to efficiently match supply with demand (i.e. achieving optimum staffing levels in service operations (Adenso-Diaz *et al.*, 2002) and processes to manage service demand (Northcraft and Chase, 1985)). Notably, more prescriptive papers are those by Pullman and Moore (1999) and Pullman and Thompson (2003), (providing instructions on capacity management for ski resorts based on simulation studies), however few generalizable implications are provided given the specificity of the data used. More prescriptive studies would clearly be relevant for the sport industry given that demand for services is often cyclical and characterised by severe peaks during certain times of the day or at a certain point during the game/event.

All studies focused on capacity at an organization level, whereas examining capacity sharing options at a league or industry level may also be of interest. Charalambides (1984) has suggested that short-term capacity sharing on an occasional basis would be attractive to managers of service organizations that employ relatively standardized resources within a highly unpredictable business environment. Stadium operations for example face this uncertainty due to cup game locations not being known in advance and unstable demand patterns with peaks possibly occurring only once or twice a week – a situation which would certainly seem to call for some capacity sharing strategies and would be an interesting context for further study.

5.1.2. Layout

The layout studies did not consider in any detail how layout may impact operations by improving flows, capacity and processes (Armistead, 1990, Armistead and Clarke, 1994), with two out of three studies focusing on layout's impact on the customer experience. The studies were also very sport specific, and lacked a quantitative approach. From an industry viewpoint there would appear to be a need for layout studies within organizations such as gyms and stadiums, with an emphasis on how layout can be utilised in conjunction with process design, capacity, JIT and queue management (Fitzsimmons, 1985, Lovelock, 1992). Examining the relationship

between layout and quality in the sport context may provide the opportunity to develop existing OM concepts.

5.1.3. *Forecasting*

There are numerous studies in sport forecasting within the OR field (Wright, 2009). These studies mainly focus on how to forecast game and tournament results or individual player performance and limited attention has been paid to more traditional demand forecasting within the OM field. We would thus suggest further studies whereby the player/game/tournament results are examined as an independent rather than a dependent variable. To plan and execute the off-field operations, managers need information about attendance levels and demand for different products and services during the games, or where to transport equipment. These factors can be affected by their own team's performance or by the opponent drawn in a tournament. Additionally, sporting facilities need to forecast demand at different times of the day and for different services to better enable capacity management and aggregate planning (Buxley, 2005). Both represent fruitful areas for further research.

5.1.4. *Purchasing and SCM*

Given the findings of Lonsdale (2004) and Cross and Henderson (2003) regarding the competition and business importance of efficient management of the player supply, it would seem there are opportunities for research within talent supply chain management. Potentially some of the strategies and tools used in traditional SCM (see Chen and Paulraj, 2004, Kotzab *et al.*, 2011), as well as theories such as transaction cost economics (Williamson, 1975), could be applied to more efficiently manage the main set of suppliers for many professional sport organizations – the players.

Another important omission from this area of research is event supply management, perhaps more broadly described as management of non-continuous supply chains. Within the supply chain literature, complex project procurement has mainly been studied within construction projects (e.g. Pesämaa *et al.* 2009; Caldwell *et al.* 2009; Wickramatillake *et al.* 2007; Yeo and Ning, 2002). According to Modig (2007), the studies that have focused on project supply chains have shown them often to be associated with unnecessary costs, delays, waste and misunderstandings. While some

guidance as to how supply chains for major events should be managed can be drawn from construction project literature, there is a need for a specific examination of event SCM as differences exist, for example, in the types of products and services sourced and in the experience and life cycle of the managing organization.

Within the topic of SCM, collaboration and vertical integration offer opportunities for value chain management for sporting organizations through service value networks (Basole and Rouse, 2008, Agarwal and Selen, 2009). Vertical integration is evident in the sport industry through the acquisition of teams by media groups. Such integration is driven by improved access to broadcasting rights, the ability to hedge against structural uncertainty, gaining control over programme costs and a closer involvement in the sport's decision-making processes (Gerrard, 2000). Examples include the Sky Pro Cycling team and the Anaheim Mighty Ducks owned by Disney. It has been suggested, however, that this approach may undermine the sporting and financial viability of existing leagues (Gerrard, 2000). To investigate this topic further, future research could focus on the opportunities for collaboration and vertical or horizontal integration from the standpoint of sport industry operations, rather than the media. Research in service operations management points to elevated service offerings which can only be delivered through partnering and service value networks (Agarwal and Selen, 2011). Possible horizontal integration combined with collaboration with service organizations could entail development of multipurpose sport stadiums and sport villages with shared accommodation, training, entertainment and other related facilities. Further research examining the operations implications of integration and collaboration in sports would develop the existing service operations management body of knowledge.

5.1.5. *Distribution*

There is a lack of empirical research in this area, which is required to provide data to support the optimisation of strategic choices. Overall, this topic is ripe for studies in the OM/OR interface where, for example, transport and route optimization research (i.e. routing and scheduling of vehicles (Desrochers *et al.*, 1992)) and minimizing risk through the use of mobile technologies (Giaglis *et al.*, 2004) is combined with the managerial challenges of large-scale sporting events. In addition, the redistribution of sporting events via electronic channels offers the potential for studies that would be

enhanced by collaboration with the OM, innovation, electronic commerce and marketing fields.

5.1.6. Quality

Several empirical studies were conducted in this area, yet theory and methodological linkages in terms of scale development were lacking and limited emphasis was put on how to improve the perceived level of quality (Parasuraman *et al.*, 1985). Overall, there appears to be a gap between quality measurement and management in the studies that were identified; managerial recommendations are not formulated based on the data collected. Future studies would need a more prescriptive approach to quality management in sport events and facilities, in addition to striving for consensus and scale development in the measurement of quality.

5.1.7. Project management

Project management studies in sport focused on a single empirical context: the Olympics. This is understandable given its prominence as one of the biggest sporting events in existence. Of equal importance for the development of research within sport project management are multiple, longitudinal and comparative case studies in which a variety of projects and events are analyzed. To truly advance the project management of sporting events in terms of both theory and practice researchers need to draw on multiple events. Only by this type of contingency research whereby relationships between contextual variables and the use of practices and the associated performance outcomes are examined can improvement take place (Sousa and Voss, 2008).

5.1.8. Process design

The lack of process design studies (two of the three only mention a sport as an example in the conceptual discussion of service positioning) in both sports events and facilities indicates that the field has currently overlooked the link between strategy and its implementation to daily operations (Anderson *et al.*, 1989) – this can be attributed to the shortage of operations strategy studies as discussed below. Improving service process design and operations oriented strategies to control the level of service supply are key approaches to increase service system flexibility and minimize waiting

times (Lu and Wood, 2006). Simulation studies comparing different server systems' impact on waiting times exist (Sheu *et al.*, 2003, Hensley and Sulek, 2007), yet given the short selling periods present in most sport events, it would be beneficial to include variables such as variety of products offered, payment options, and alternative back-office preparations completed prior to the selling period into the simulation models to better serve the sport industry.

5.1.9. Strategy

Given the growing emphasis on, and the sheer value of, the business organizations set up around the actual sport teams themselves, we feel that more research focusing on the links between the competition strategy and the operations strategy (and ultimately the business strategy) within sporting organizations would be of merit. Within OM, it has long been argued that there must be synergistic processes to integrate strategic business and operations issues (Anderson *et al.* 1989) and the link between operations strategy and business performance has been established both conceptually as well as empirically in previous research (Skinner, 1969; Hayes and Wheelwright, 1984; Vickery *et al.*, 1993; Ward *et al.*, 1994). For sport, it would thus seem plausible, that linking competition, business and OM strategies would improve overall organizational effectiveness. The fit between environment and organizational capabilities and resources is a central tenet of major strategic management paradigms (Ward *et al.* 1995).

Furthermore, the co-creation of the sporting experience is a characteristic of sport that could be used to develop operations strategy. A body of literature exists that examines the co-creation of the service experience (Basole and Rouse, 2008, Vargo *et al.*, 2008) which could be drawn upon to investigate the potential for value co-creation in the leisure industry. For example, gyms and leisure clubs could capitalize on the benefits of co-creation to involve customers in the development of new exercise classes and sporting activities and to allow customers to schedule events of interest at a time that suits participants. Innovative approaches to service design and delivery could be encouraged and may heighten customer's commitment to the organization and enable a strategic competitive advantage to be gained (Huggins, 2010).

5.2. Research Questions

In order to develop the area of sport OM, the research questions presented in Table 2 are proposed as a starting point for a collective exploration of the key themes that have been identified in this paper. In addition to the nine topics that have been identified, we feel that the two additional topic areas of inventory management and JIT/lean would allow further development of this body of knowledge. Specifically, inventory management of sports equipment in situations where the operations strategy and the competitive strategy are linked (e.g. during the Tour de France or Tour de Ski the competing teams need to be able to ensure that correct kits, equipment, supplies and spare parts are provided to the athletes under changing locations and “operating conditions” such as temperatures and snow densities). JIT systems focus on reduction of waste and producing goods and services exactly to demand (Schonberger, 1982). Given the operations uncertainties driven by on-field uncertainty in sport as well as the highly uneven demand patterns, utilizing principles of JIT within sporting contexts would seem instinctive; the lack of research into applying the tools and techniques seems almost surprising here.

INSERT TABLE 2 ABOUT HERE

6. CONCLUSIONS

This paper has highlighted a number of areas for further exploration in the study of sport OM based on a systematic review of previous studies and has offered a number of research opportunities. The paper has focused on discussing the applicability of OM techniques and theories to managing sport performance off-field. It is clear that sporting events and activities can have a tremendous economic and social impact. It is suggested that by engaging in the research agenda developed in this study, managers and scholars have the potential to improve the commercial impact of sport through realizing efficiency gains and also to improve the livelihoods of citizens through the provision of cost effective public sports facilities and events. Such efficiency and strategic gains may arise from collaboration, vertical integration, capacity sharing and co-creation and have the potential to yield competitive

advantages for those sporting organizations engaged in service value networks. In addition, findings indicate that on-field performance has a significant impact on factors including service quality in sport events and that the unsuccessful management of players as suppliers can make or break a professional sports teams' profits. Further research opportunities therefore include the application of operations management to the analysis and improvement of on-field performance using Quality Function Deployment (Mehrjerdi, 2010), Six Sigma (Linderman *et al.*, 2003) or by utilizing traditional SCM practices in managing a supply of talent. It should be noted that as the opportunities demonstrated in this paper are based on the findings of the study only, the proposed research agenda is not intended to be exhaustive and merely provides a starting point for further work in this area. We invite all OM researchers to offer their views and contributions to the topic and encourage OM scholars to engage in the multitude of research opportunities that are available.

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Figure 1 The systematic literature review process (adapted from Bakker, 2010)

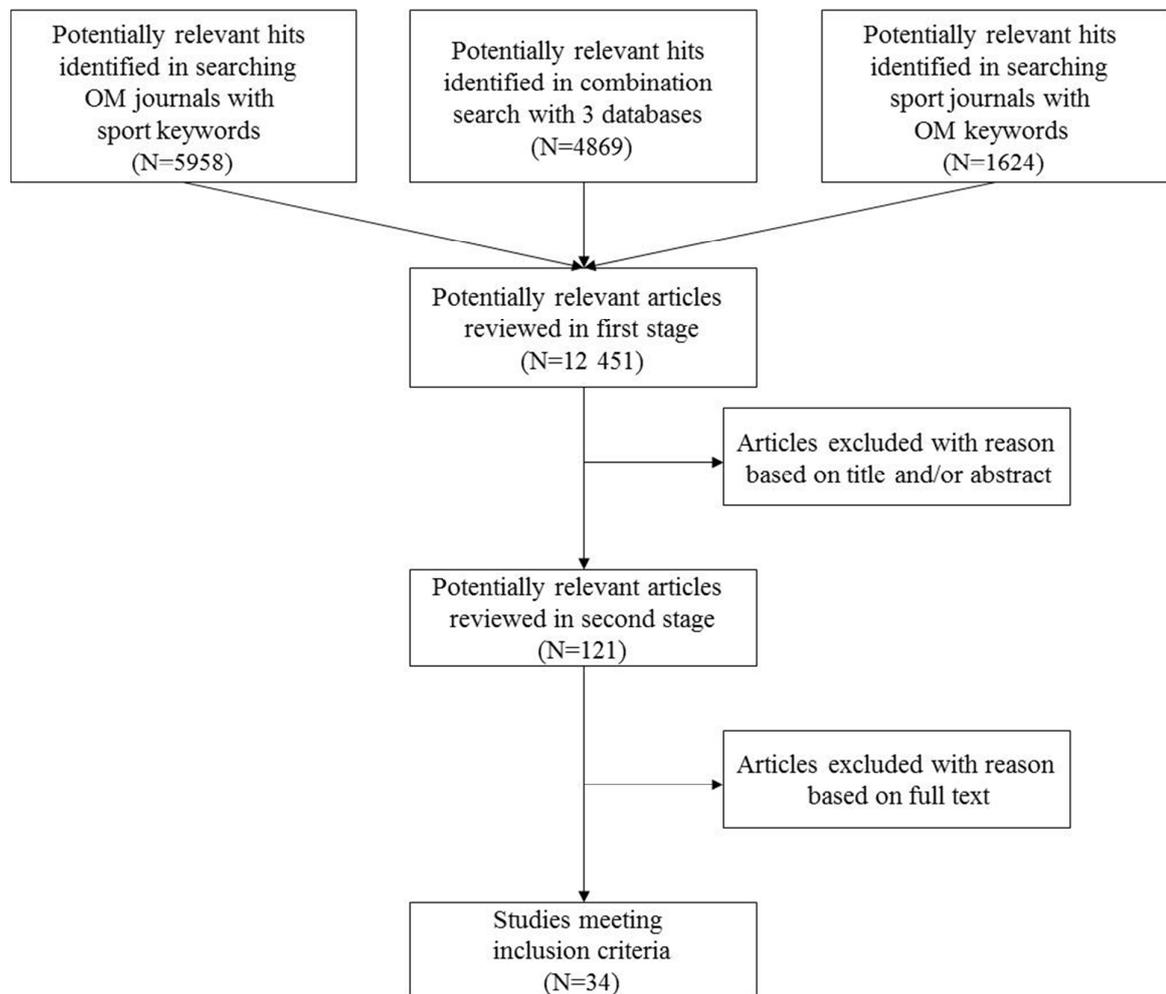


Figure 2 – Research opportunities within sport industry operations management

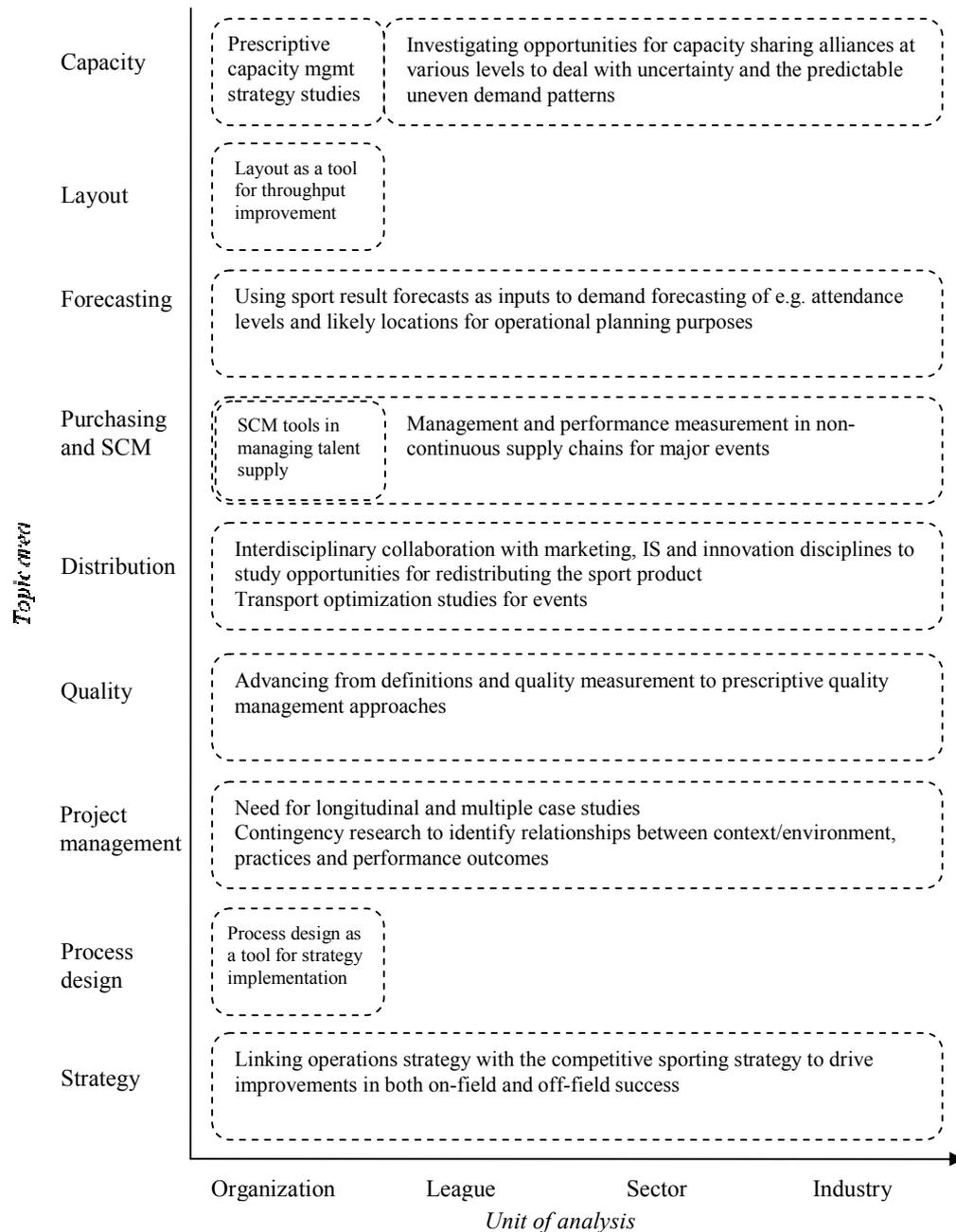


Table 1 Summary of reviewed articles

Study	OM area	Sport	Unit of analysis	Location	Research method ^a	Sampling and sample size ^a
Alexandris et al. 2001	Quality	Fitness Clubs	Organization	Greece	Survey	Random sampling, 300 responses
Beis et al. 2006	Forecasting	Olympic Games	Organization	Greece	Case study	Convenience sampling, single case study
Bodet 2006	Quality	Health Clubs	Organization	France	Interviews and survey	12 interviews, convenience sampling, survey sample size of 900, 184 responses
Burden and Li 2009	Purchasing and SCM	Basketball	League	USA	Survey	Census, sample size 119, 57 responses
Chang and Chelladurai 2003	Quality	Fitness Clubs	Organization	USA	Survey	Convenience sampling on location, 178 responses
Chelladurai and Chang 2000	Quality	Sports Services	Sector	International	Conceptual	N/A
Collier and Meyer 1998	Process design	Golf	Sector	USA	N/A ^b	N/A ^b
Collier and Meyer 2000	Process design	Golf	Sector	N/A	N/A ^b	N/A ^b
Cross and Henderson 2003	Strategy, SCM	Soccer	Sector	England	Survey	Census, sample size 92, 54 responses
Davis and Heineke 1994	Process design	Ski resort	Organization	N/A	Conceptual	N/A
De Bosscher et al. 2009	Strategy	Elite Sports	Sector	International	Survey	Convenience sampling, multiple surveys, total of 1414 responses
De Knop et al 2004	Quality	Sports Clubs	Sector	Belgium	Survey	Census, sample size 17000, 1657 responses
Emery 2010	Strategy	Sporting Events	Sector	International	Multiple Case Study	Convenience sampling, N=46
Foster et al. 2000	Strategy	Ski resort	Sector	USA	Multiple Case Study	Convenience sampling, N=6
Getz et al. 2001	Quality	Surfing event	Organization	Australia	Survey and observation	Convenience sampling, sample size 500, 239 responses
Greenwell et al. 2002	Capacity	Ice hockey	Organization	USA	Survey	Convenience sampling, sample size 534, 218 responses
Heim and Ketzenberg 2011	Layout	Golf courses	Organization	USA	Secondary survey data	Sample size 102
Kellett and Russell 2009	Layout	Skateboarding	Sector	Australia	Case study	Convenience sampling, single case study
Kelley and Turley 2001	Quality	Basketball	League	USA	Survey	Convenience sampling on location (4 games), 316 responses
Lonsdale 2004	Purchasing and SCM	Soccer	League	England	Conceptual	N/A
Lowendahl 1995	Project Management	Olympic Games	Organization	Norway	Case study	Convenience sampling, single case study
Mawson 1993	Quality	N/A	Industry	N/A	Conceptual	N/A
Minis et al. 2006	Distribution	Olympic Games	Organization	Greece	Case study	Convenience sampling, single case study
Misener and Doherty 2009	Capacity	Sports facilities	Organization	Canada	Case study	Convenience sampling, single case study
Moxham and Wiseman 2009	Quality	Fitness Clubs	Organization	UK	Case study	Convenience sampling, single case study
Pitsis et al. 2003	Project Management	Olympic Games	Organization	Australia	Case study	Convenience sampling, single case study
Pullman and Moore 1999	Capacity	Ski resort	Organization	USA	Case study and simulation	Single case study provided data for simulation model
Pullman and Thompson 2003	Capacity	Ski resort	Organization	USA	Case study and simulation	Single case study provided data for simulation model
Sampson 2006	Capacity	Olympic Games, Soccer	Organization	USA	N/A ^b	N/A ^b
Smith and Stewart 2010	Distribution	N/A	Industry	International	Review	N/A
Taylor and Godfrey 2003	Capacity, quality	Sports facilities	Organization	UK	Secondary survey data	Responses of 77 facilities
Tesone et al. 2009	Process Design, layout	Golf	Organization	USA	Action research	Convenience sampling, multiple case study (N=8)
Tsitskari et al 2006	Quality	Sports Services	Sector	International	Review	N/A
Voss et al. 2008	Strategy	Sport resorts	Organization	Canada	Multiple Case Study	Multiple case study, 1 case sport related

^a In some studies the research and/or sampling method was not explicitly stated by the authors and the information here is the interpretation based on available information.

^b The data collection is not related to the sport context within the paper

Table 2 Proposed research questions

OM Topic	Research Questions
Capacity	<p>What types of operating resources would be suitable for capacity sharing alliances in the sport industry?</p> <p>Which queuing model maximizes half-time service operations efficiency at sporting events?</p>
Layout	<p>What types of operations management layout configurations are applicable to sports operations?</p> <p>How can layout be used to improve the customer experience at large-scale sporting events?</p>
Forecasting	<p>Which factors impact attendance levels in league games?</p> <p>How can on-field performance forecasts be used as an input to off-field operational planning?</p>
Purchasing and Supply Chain Management	<p>How do SCM strategies designed for continuous operations need to be modified for use in managing supply chains for one-off events?</p> <p>Should key suppliers be included in the bidding process for major events?</p> <p>Can the costs and risks of (player) talent supply management be reduced by utilizing SCM tools and strategies designed for materials management?</p> <p>What are the opportunities for value chain management in sport operations through collaboration and horizontal and vertical integration?</p>
Distribution	<p>How can OM approaches assist in the efficient and effective distribution of sports equipment in large scale international events (e.g. Olympic games, New York Marathon, Tour de France)?</p>
Quality	<p>How should quality in the sports industry be defined from an operational (as opposed to spectator) perspective?</p> <p>Can quality function deployment be used to translate customer preferences into operational criteria for quality improvement?</p> <p>Do changes in layout or process design improve customer satisfaction at sport events or facilities?</p> <p>Can professional team's poor on-field performance be treated as a service failure, and can off-field operations be used to recover from it?</p>
Project Management	<p>Which types of project management approaches work best given contextual differences in operating environments?</p> <p>How can successful project management practices be transferred between separate, one-off organizations in charge of major sporting events?</p>
Process design	<p>How can process design principles of factory material processing operations be utilized in the customer processing operations of gyms and other sport facilities?</p> <p>How can preparatory and back-office operations be used to reduce waiting times for half-time service offerings at sporting events?</p> <p>Can customer scripting be used in gym settings to improve the level of equipment utilization?</p>
Strategy	<p>Are the competition and operations strategies of professional sport organizations linked?</p> <p>What are the current best practices in operations strategy in the sports industry?</p> <p>Can improvements in operations strategy drive improvements in on-field performance?</p> <p>Does the engagement of customers in the development of sporting services result in a strategic competitive advantage?</p>
Inventory	<p>How are operational inventory levels determined and managed for competitive advantage within sport operations?</p> <p>How can technologies including RFID be applied to sports equipment inventory management?</p>
Lean/JIT	<p>How can lean/JIT be applied to improve sports operations?</p> <p>How can sports operations identify the 'customer' in order to drive lean operations?</p>

Search 1: Full text search with sport keywords in OM/SCM focused journals

Journals included (n=15)	Keywords included (n=59)			
<i>International Journal of Logistics Management</i>	“formula 1”	cycling	netball	soccer
<i>International Journal of Logistics: Research and Applications</i>	“formula one”	diving	olympic*	softball
<i>International Journal of Operations and Production Management</i>	“martial arts”	event	orienteering	sport*
<i>International Journal of Physical Distribution and Logistics Management</i>	“motor cycl”	fencing	pool	squash
<i>International Journal of Quality and Reliability Management</i>	“racquet ball “	football	racing	stadium
<i>Journal of Business Logistics</i>	“world championship**”	golf*	riding	surfing
<i>Journal of Operations Management</i>	arena	gym	rock climbing	swim*
<i>Journal of Purchasing and Supply Management</i>	athlet*	gymnast*	rowing	taekwondo
<i>Journal of Service Management (formerly IJSSIM)</i>	baseball	handball	rugby	tennis
<i>Journal of Service Research</i>	basketball	hockey	running	tournament
<i>Manufacturing & Service Operations Management</i>	bowling	horse	sailing	volleyball
<i>Production and Operations Management</i>	boxing	hunting	shooting	weightlifting
<i>Supply Chain Management: International Journal</i>	club	judo	skating	wintersport
<i>The Journal of Supply Chain Management</i>	cricket	karate	skiing	wrestling
<i>Total Quality Management and Business Excellence</i>	curling	league	snowboard*	

Search 2: Full text search with OM/SCM keywords in sport focused journals

Journals included (n=5)	Keywords included (n=35)
<p><i>European Sport Management Quarterly</i> <i>Journal of Quantitative Analysis in Sports</i> <i>Journal of Sport Management</i> <i>Journal of Sport and Tourism</i> <i>Sport Management Review</i></p>	<p>benchmark* capacity distribut* "Economic Order Quantity" forecasting inventor* JIT layout "lean manag*" logistic* "Master Production Schedule" "Materials Requirements Planning" operation* outsourc* "performance manag*" "performance measur*" "process control" "process improv*"</p>
	<p>"process manag*" "process measur*" "project management" purchas* "Quality Function Deployment" "quality improv*" "quality manag*" "quality measur*" "resource planning" "service quality" "service science" "Statistical Process Control" "supply chain" "Total Quality Management" TQM "Vendor Managed Inventory" VMI</p>

Search 3: Limited search with combination keywords in ProQuest, ScienceDirect and ISI web of science

Each sport keyword (n=9) was combined with each OM/SCM keyword (n=28) to create a total of 252 search terms

Sport keywords	OM/SCM keywords
arena	"performance measur*"
club	"process control"
event	"process manag*"
league	"process measur*"
olympic	"process improv*"
sport*	"project management"
stadium	"quality improv*"
tournament	"quality manag*"
"world championship*"	"quality measur*"
	"resource planning"
	"service quality"
	"service science"
	strateg*
	"supply chain"
	benchmark*
	capacity
	design
	distribut*
	forecasting
	inventor*
	JIT
	layout
	"lean manag*"
	logistic*
	operation*
	outsourc*
	purchas*
	"performance manag*"