Institution: Liverpool John Moores University

Unit of Assessment: 26

Title of case study:

"A tactical change". Influencing professional development and supporting evidence-based practice within the football industry

1. Summary of the impact

Football has significant sporting, cultural and economic impact with reach around the globe. Despite this, football has long been resistant to evidence-based practice. Football-related research at the Research Institute for Sport and Exercise Sciences (RISES) includes match and training analysis and various aspects of player preparation and recovery. This research has been translated into evidenced-based practice to produce impact within multiple layers of football in the UK and abroad. RISES research has provoked significant developments in match-analysis procedures underpinning the global uptake of this technology within elite football. RISES research has also changed practice associated with player preparation and recovery in elite clubs and the English National team. RISES research has underpinned scientific support throughout the games as well as the development of player and coach education programs in elite football clubs and a number of National Associations. The successful translation of RISES research has enabled practitioners within the modern game to use evidence-based models for their activity.

2. Underpinning research

By way of context RISES has a long history in science and football-related research. The pioneering work of Professor Tom Reilly in the mid 1970's created gold standard methodologies and novel information on the activity profile of players and the demands of the sport. Football research continued and expanded within RISES and as a consequence the Football Exchange (FEx) was launched in 2010 as an interdisciplinary group responsible for the strategic management and delivery of research, external consultancy and translation of knowledge to the football industry. The FEx contains key staff associated with research and impact translation included in this case study; Prof Barry Drust (1990-1998; 2003-present), Dr. Warren Gregson (2004-present), Dr. Paul Ford (2007-present). Overall, FEx activity has resulted in 140+ scientific papers and ~ £1.5 million in grant and industry income since 1993.

Football research activity within the FEx has analysed multiple facets of match and training exposure, providing empirical data that forms the basis of evidence-based practice in relation to individualised physical training regimes. FEx staff have produced multiple research outputs in this area that have focused on two specific issues; **1)** the development of match analysis tools (**Sec.3, Ref.1**), and **2)** the detailed data collection of player activity in the real-world (**Sec.3, Ref.2**). The data generated in **Sec.3, Ref.1** established the validity and reliability of Prozone Ltd's automated match-analysis tool, which is now the world's leading computerised performance analysis system. The system was shown to be highly accurate (within 0.4%) and reliable (~1.5-6 %) at quantifying match-related displacement velocities. The key focus of **Sec.3, Ref.2** was match-to-match variability in the activity profiles of elite players. This paper contributed detailed insights into the match performance of players including substantial match-to-match variability in key activities such as high speed running (~16 %) and total sprint distance (~30%). This demonstrated the difficulties in obtaining accurate representations of a player's performance profile from any single match exposure.

Research from FEx staff have analysed multiple facets of player preparation and recovery. In a novel study (**Sec.3, Ref.3**) the impact of manipulating pitch dimensions on the physiological demands of training (small-sided games) was examined. Heart rate was similar between 3 different pitch sizes (30x20 m, ~176; 40 x 30 m, ~173 and 50 x 40 m, ~169 beats.min^{-1}) despite a greater frequency of game-related actions (tackles, shots on goal) when the pitch size was smallest,

suggesting that technical training can be increased without an elevation in physical training load. Fundamental scientific research linked to player recovery has also been undertaken by the FEx (**Sec.3, Ref.4**). This study provided novel physiological data on the effectiveness of cold-water immersion (CWI), a commonly used recovery practice in elite professional football. The study compared 2 x 5 min exposures to water immersion at temperatures of 8 and 22^{o}C. A similar reduction (~40 %) in whole limb blood flow (femoral artery conductance) was observed with immersion in both water temperatures. Interestingly, more blood (~15%) was distributed to the skin in the colder water suggesting a potential mechanism for the effectiveness of CWI in reducing muscle damage following exercise.

The development of effective practice and training for improving player's technical skills is also an important part of the training stimulus. Ford et al. (**Sec.3, Ref.5**) analysed the practice activities and instructional behaviours of coaches across multiple training sessions with youth football players. The researchers observed that 65% of the activities undertaken in training did not contribute to the development of the decision making skills in players. Moreover, the coaches made a large amount of verbalised instructional behaviours during these sessions. Both findings are considered to be detrimental to skill acquisition in football. Based on these findings, the authors made a number of recommendations to coaches and governing bodies for optimising the skill acquisition occurring from training sessions.

3. References to the research

Reference for the peer-reviewed outputs from the FE within RISES research described in Section 2.

1) Di Salvo, V., Gregson, W., Atkinson, G., Tordoff, P. and Drust, B. (2009). Analysis of High Intensity Activity in Premier League soccer. *International Journal of Sports Medicine*, 30, 205-212. DOI:10.1055/5-0028-1105950.

2) Gregson, W., Drust, B., Atkinson, G. & Di Salvo, V.D. (2010) Match to match variability of high-speed activities in Premier League football. *International Journal of Sports Medicine*, 31, 237-242. DOI: 10.1055/5-0030-1247546.

3) Kelly, D.M. & Drust, B. (2009) The effect of pitch dimensions on heart rate responses and technical demands of small-sided soccer games in elite players. *Journal Science and Medicine in Sport*, 12, 475-479. DOI: 10.1016/j.jsams.2008.01.010.

4) Gregson, W., Black, M.A., Jones, H., Milson, J., Morton, J., Dawson, B., Atkinson, G. & Green, D.J. (2011) Influence of cold water immersion on limb and cutaneous blood flow at rest. *American Journal of Sports Medicine*, 39, 6, 1316-1323. DOI:10.1177/0363546510395497.

5) Ford, P.R., Yates, I. & Williams, A.M. (2010) An analysis of practice activities and instructional behaviours used by youth soccer coaches during practice: Exploring the link between science and application. *Journal of Sports Sciences*, 28(5), 483-495. DOI: 10.1080/0264041090358275.

The journal papers have been subjected to blind peer review practice by internationally-based editorial boards.

4. Details of the impact

A dissemination strategy with significant reach across "the football family" has been developed by RISES via the FEx. Within the current REF period this has included organising the first world-wide football (soccer)-specific conference in 2008. Progression from research, through dissemination to translation has resulted in impact and change in multiple facets of industry practice.

FEx research (**Sec.3, Ref.1-2**) has directly impacted upon the development and application of

modern day computerised data analysis systems. These tools have revolutionised performance analysis capability within the football industry. For example, research (**Sec.3, Ref.1**) was crucial in allowing Prozone to demonstrate the accuracy and reliability of its computerised system in 2010. Consequently these data were instrumental in allowing Prozone to gain acceptance within the football industry as the leading provider of automated tracking solutions, enabling them to realise their aim of becoming the world's leading provider with a turnover now approaching £10 million per annum (**Sec 5, Source.1**). To date the Prozone client base includes 64 % of the 92 English professional football clubs, 100 % of the English Premier League clubs, the English senior men's national team, as well as a substantial international client base (e.g. Qatar, China). An on-going relationship between the FEx and Prozone includes a Knowledge Transfer Partnership started in 2012 (jointly funded by ESRC and the Technology Strategy Board; £144K) and joint delivery of training courses for football industry staff (25 courses with 637 participants since 2011; **Sec.5, Source.2**). The data collected using computerized systems (**Sec.3, Ref.2**) has transformed the interpretation of game-related statistics by coaching and scientific staff in football clubs. This change in interpretation and new data has proved beneficial for practitioners who use such data in the development of intervention strategies for the performance plan(s) of players, teams and organisations. This is exemplified by the use of these data and processes by the lead analyst for the England senior men's national team at the Football Association (FA; **Sec.5, Source.3**).

Other impact derived from FEx research includes changes to the training and recovery strategies employed with players in elite clubs in order to promote recovery and subsequent performance, as well as reducing the incidence of injury. For example, research on small-sided games (**Sec.3, Ref.3**) provided coaches with data to help guide, control and optimise the training stimulus, thereby reducing the likelihood of inappropriate loading patterns for individual players. As a consequence of adopting these evidence-based procedures for the planning and monitoring of training load there has been an increase in player availability via a reduction in overall (14%) and "potentially preventable" injuries (16%) within the Liverpool FC first team squad from 2012-2013 (**Sec 5, Source.4)**. Research into recovery strategies (**Sec.3, Ref.4**) has been fundamental to the development of a specialist muscle recovery and regeneration program at Manchester United FC that has also contributed to increases in player match availability (14%; **Sec.5, Source.5)** through a reduction in injury across the last three domestic seasons.

A significant component of impact derived from FEx research (**Sec.3, Ref.1-5**) is the development and delivery of; **1)** formal academic training for key staff in the football workforce (e.g. Head of Performance, The Premier League; The FA's Head of Exercise Science [Female]; The FA's Head of Exercise Science [Male]; Head of Sports Science, Manchester United FC); **2)** club or association-specific scientific support and continuing professional development; **3)** structured mentoring programs; **4)** the production of independent audit documentation for sport science and medicine provision within the FA, and; **5)** the development of coach education materials for the FA. For example, FEx research and support were crucial to the accreditation, by the British Association of Sport and Exercise Sciences, of the High Performance Laboratory located at Manchester United FC's training complex (**Sec.5, Source.6**). The FA has been one of the major beneficiaries of the knowledge created from FEx research activity for the development of evidence-based practice (**Sec.5, Source.7)**. The FA is responsible for the delivery of all technical, medical and science curricula related to football and coaching in England. Through important physiological insights (**Sec.3, Ref.1-4**) the FEx have delivered core components, and revised the entire syllabus of the Applied Football Science and Conditioning Award (between 2010 and 2012) that directly shapes the activity of the science and medicine community within the sport (to date in excess of 60 practitioners) (**Sec.5, Source.8)**. Specific research (**Sec.3, Ref. 5**) has also been important in creating the strategies and approaches to player learning detailed in coach education curricula within the new FA Youth Awards (**Sec.5, Source.9**).

Overall the research activity of the FEx has demonstrable impact across key areas of activity within the football industry. As a consequence the FEx has been at the forefront of the implementation of evidence-based practice within the football industry both nationally and internationally over the current REF cycle.

5. Sources to corroborate the impact

External source of corroboration	Claimed impact corroboration provided for
1. Prozone services development document and a Prozone letter documenting financial turnover.	Support for the impact of the validation data in developing tools for the global football industry and driving sales
2. Head of Business Operations, Prozone Sports Ltd	Testimony related to development of KTP and joint training schemes for those in the football industry.
3. Head of Performance Analysis, The FA	Testimony providing support for the impact of the performance insights provided through the implementation of Prozone to support to the England Men's Football team.
4. Player Availability and Injury Statistics. Document from the Sport Science and Medicine Department, Liverpool FC	This evidence supports the impact of the research that informs training prescription and physiological load management.
5. Player Availability and Injury Statistics. Document from the Sports Science Department, Manchester United FC	This evidence supports the impact of the research informing decisions around recovery interventions.
6. BASES Lab Accreditation Certificate and supporting document from Manchester United detailed the role and impact of FE staff	This is evidence of FE research support for Manchester United Sport Science Lab Accreditation
7. Qualifications Manager, The FA	Testimony providing support for the impact of the influence of FE research on the development of course material for the sports science related programmes within FA Learning.
8. Attendance and completion records from The FA's Fitness Trainers/Applied Football Science and Conditioning Award	Documentation supporting the influence of the FE research driven curriculum design on the education and professional development of practitioners in the UK.
9. Documented testimony from the Research Manager (Coaching), The FA	Support for the impact of the research input into FA learning educational programmes