



University of Hradec Králové  
Faculty of Informatics and Management

# Hradec Economic Days



**Vol. 12**

proceedings of the international scientific conference  
Hradec Economic Days 2022

June 9–10, 2022

Hradec Králové, Czech Republic



University of Hradec Králové  
Faculty of Informatics and Management

# Hradec Economic Days

Vol. 12(1)

proceedings of the international scientific conference  
Hradec Economic Days 2022

June 9–10, 2022  
Hradec Králové, Czech Republic

## Conference partners and workshops co-funding institutions:



ERASMUS+ KA2 project  
no. 2020-1-CZ01-KA203-078313  
Technology transfer together



Co-funded by the  
Erasmus+ Programme  
of the European Union

EEA Funds 2014-2021 Education Program project  
no. EHP-CZ-ICP-2-006  
The technology and knowledge transfer based on Norway-Czech cooperation



Editors: Jan MAČÍ, Petra MAREŠOVÁ, Krzysztof FIRLEJ, Ivan SOUKAL  
Publisher: University of Hradec Králové

© 2022 by the authors. Licensee University of Hradec Králové, Hradec Králové, Czech Republic.

These proceedings are open access proceedings distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<http://creativecommons.org/licenses/by/4.0/>).

Proceedings were not a subject of a language check. The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use. The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, express or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Articles can be cited as **a conference contribution in edited proceedings:**

Lastname, A. (2022). Title of conference article. In J. Maci, P. Maresova, K. Firlej, & I. Soukal (Eds.), *Hradec Economic Days, part 1, 2022* (pp. page #-page #). University of Hradec Králové. <https://doi.org/10.36689/uhk/hed/2022-01-###>

or as **a conference contribution in periodical proceedings or journal:**

Lastname, A. (2022). Title of conference article. *Hradec Economic Days*, 12(1), page #-page #. <https://doi.org/10.36689/uhk/hed/2022-01-###>

**ISSN 2464-6059 (Print)**

**ISSN 2464-6067 (Online)**

**ISBN 978-80-7435-855-5**

**DOI: 10.36689/uhk/hed/2022-01-000**

## Preface

We celebrate this year Hradec Economic Days international scientific conference's 20<sup>th</sup> anniversary and commemorate its beginning in 2003. Important for establishing and further development of the conference was the initial idea, but also its specific form and protagonists on the side of the organizers and participants. The first Hradec Economic Days conference (HED) took place in 2003 under the title: Banking Sector and Regional Development. The meeting took place in two conference tracks: Finance and Banking session and Regional Development and Business Support. The conference was organized by the Department of Economics and Management of the Faculty of Informatics and Management of the University of Hradec Králové (FIM UHK) in cooperation with the regional branch of the Czech National Bank in Hradec Králové and the Banking Institute of the University of Prague. As the first invited speakers gave their speech prof. Jan Frait (a member of the Czech National Bank Board), assoc. prof. František Jirásek (rector of the Banking Institute of the University of Prague) and prof. Stanislav Polouček (head of the Department of Finance of the Commercial Business Faculty of the University of Silesia in Karviná). It was the Organizing Committee, especially Ing. Jaroslava Ditrichová, Ing. Pavel Jedlička (editor of proceedings 2003-2020), and Ing. Veronika Jašíková who contributed to the organization of the first HED conference and its successful development in the following years.

The number of participants and contributions gradually grew with the next years. While the proceedings of the first HED conference in 2003 contained 32 contributions, the proceedings of HED in 2007 had to be divided into two separate parts. Proceedings held a total of 170 contributions which dealt from different perspectives with the current problems of business development and development of regions in six separate conference tracks. The number of contributions went over the two hundred mark in 2008. The next milestone was reached at the 9<sup>th</sup> HED in 2011 where more than half of the participants were from abroad. Also, two new tracks have been added: Mathematical Models in Economics and Economics of Tourism. There was also a significant increase in the Macroeconomic Contexts of Regional Development track contributions. The next important event was the 11<sup>th</sup> HED in 2013 which was held under the auspices of the Governor of the Czech National Bank.

Inclusion of the HED proceedings 2005-2011 into the Web of Science Conference Proceedings Citation Index database was an important milestone, recognition, and great incentive for the next years for the whole organizational team. It also increased the prestige of the conference and the interest of colleagues from home and abroad in HED participation. Our proceedings were since then on a yearly basis evaluated and included in the Web of Science database. Over 300 contributions were published in five volumes of the reviewed proceedings at the 12<sup>th</sup> HED in 2014 conference. The next step in the HED development was in 2018 a cooperation with the Wrocław University of Economics, the Cracow University of Economics, and the University of South Bohemia Technology Transfer Office. We especially thank prof. Anna Cierniak-Emerych, prof. Krzysztof Firlej, and dr. Růžena Štemberková. The leitmotiv of the conference was the industry 4.0 concept. MDPI publishing from Switzerland became our journal publishing partner and sponsor of the best paper award.

We substantially improved the composition of the program committee in the following 17<sup>th</sup> year of HED in 2019. The committee ranks were joined by academics from the USA, China, Malaysia, Spain, Croatia, Slovakia, Romania, Poland, and the Czech Republic. The HED in 2019 was also held under the auspices of the Czech National Bank and included a panel discussion on the topic of 100 years of the Czech crown. The HED 2020 conference was subtitled Innovation and the upcoming challenges of developed and developing economies. It aimed to promote the idea of communication and cooperation between scientists from different disciplines and practitioners. The form and course of the HED 2020 and HED 2021 conferences were influenced by a global pandemic. Nevertheless, we managed to hold continuity, expertise, and even improve when we started issuing the DOI for all articles.

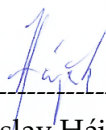
The aim of the conference HED 2022, as in previous years, holds. We aim to present the results of scientific research activities in the fields of economics, business economics, and management, to create a regular platform for meeting experts from such disciplines, strengthen interdisciplinary relations, and establish personal contacts important for the submission of joint research projects and to create space for the presentation and publication of young members of an academic community. We are honored that other institutions such as the Wrocław University of Economics, the Cracow University of Economics, and the University of South Bohemia participate in this activity with us for a long time. Proceedings from the conference HED 2022 contain 95 contributions in English. The authors of the conference papers were academics and other professionals from the Czech Republic, Poland, China, Slovakia, Romania, Turkey, Ukraine, Norway, United Kingdom, Latvia, Pakistan, Hungary, and Russia.

Even though the HED 2022 conference again had to face organizational challenges, we managed to hold a face2face conference with high-quality articles, workshops focused on practice and academia interconnection, and foremostly keynote speakers:

- Petr KRÁL as Executive Director of the Czech National Bank, Czech Republic,
- Morten IRGENS as Dean of the School of Economics, Innovation, and Technology, Norway.

HED 2022 workshop and overall conference reach were supported by the Centre for Investment, Development and Innovation, and the Hradec Králové region. The final recognition belongs to the HED secretary dr. Ivan Soukal, editor dr. Jan Mačí, our organization and scientific committee, and especially all participants of the HED conference for their contributions and favor.

Hradec Králove, March 22, 2022



-----  
Professor Ladislav Hájek  
Conference Honorary Chairman  
Faculty of Informatics and Management  
University of Hradec Králové



-----  
Associate professor Petra Marešová  
Conference General Chairman  
Faculty of Informatics and Management  
University of Hradec Králové

---

**CONTENT**

PREFACE .....	3
FACEBOOK AS A MARKETING TOOL: A CHANCE FOR LOCAL FOOD PRODUCERS? <b>Pavel BACHMANN and Ola BAREJA-WAWRYSZUK</b> .....	11
LABOR MARKET POLICY IN THE SLOVAK REPUBLIC AND HUNGARY DURING THE COVID-19 PANDEMIC <b>Monika BÁLINTOVÁ, Anikó BARCZIOVÁ and Renáta MACHOVÁ</b> .....	20
DIFFERENCES IN FINANCIAL MANAGEMENT IN VEHICLE INDUSTRY FROM THE ASPECT OF THE COVID-19 CRISIS <b>Natália BARTEKOVÁ and Jana KAJANOVÁ</b> .....	30
EUROPEAN GROUPING OF TERRITORIAL COOPERATION NOVUM – AN EXAMPLE OF POLISH-CZECH CROSS-BORDER COOPERATION <b>Bartosz BARTNICZAK</b> .....	42
ATTITUDES TOWARDS WORK IN VISEGRAD GROUP COUNTRIES <b>Kamilla BAŠA and Patrik BAŠA</b> .....	49
THE HR MANAGEMENT CHANGES RELATED TO THE COVID-19 PANDEMIC IN CHEMICAL INDUSTRY <b>Marie BEDNARIKOVA and Jana KOSTALOVA</b> .....	59
IMPLEMENTATION OF INDUSTRY 4.0 IN CZECH FOOD ENTERPRISES: MOTIVATION AND BARRIERS <b>Jiří BEDNÁŘ and Roman BUCHTELE</b> .....	69
ANALYSIS OF MARKETING COMMUNICATION TOOLS AND BRAND BUILDING OF FAMILY BUSINESS IN TERMS OF INTERNATIONAL ENVIRONMENT – CASE STUDY <b>Vojtěch BERAN</b> .....	79
EMPLOYEES AT RISK OF POVERTY ON THE CZECH LABOR MARKET IN THE PERIOD FROM THE GLOBAL ECONOMIC CRISIS TO THE GLOBAL CORONAVIRUS CRISIS <b>Diana BÍLKOVÁ</b> .....	91
NEW CHALLENGES IN ACCOUNTING PRACTICE IN THE SLOVAK REPUBLIC RELATED TO DIGITALIZATION <b>Miriama BLAHUŠIAKOVÁ, Martina MATEÁŠOVÁ and Jitka MELUCHOVÁ</b> .....	104
DIFFERENCES IN THE LEVEL OF GLOBAL COMPETENCE: A CASE OF VISEGRAD AND BALTIC COUNTRIES <b>Aneta BOBENIČ HINTOŠOVÁ</b> .....	117
BLOCKCHAIN IN TOURISM – SYSTEMATIC REVIEW <b>Anna BORKOVCOVÁ and Miloslava ČERNÁ</b> .....	126
PREFERENCES OF THE POPULATION CONCERNING MUNICIPAL WASTE DISPOSAL SYSTEMS <b>Lenka BRANSKA, Michal PATAK and Zuzana PECINOVA</b> .....	135
PERFORMANCE ASSESSMENT IN THE BIOENERGY FIELD: EVIDENCE FROM EUROPEAN COUNTRIES <b>Claudiu CICEA, Corina MARINESCU and Nicolae PINTILIE</b> .....	144
CRYPTOCURRENCIES – “COMPARISON” OF APPROACH BY IAS/IFRS AND CZECH ACCOUNTING LEGISLATIVE <b>Marie ČERNÁ and Jana HINKE</b> .....	158
THE DEVELOPMENT OF PHOTOVOLTAICS IN THE VISEGRAD GROUP COUNTRIES <b>Maria DZIKUĆ and Maciej DZIKUĆ</b> .....	168

THE EFFECT OF PREFERRED RETURN OF VENTURE CAPITAL FUND ON VCS' ACCREDITED DIRECTOR ASSIGNMENT <b>Ting FENG, Lihong GUO and Jianwei DONG</b> .....	178
SEARCHING EFFICIENT PROJECT PORTFOLIOS USING DATA ENVELOPMENT ANALYSIS <b>Petr FIALA and Renata MAJOVSKÁ</b> .....	190
SOCIAL MEDIA MARKETING STRATEGY IN A SMALL COMPANY <b>Anna FLANDERKOVÁ</b> .....	198
CROSS-BORDER COOPERATION BETWEEN LOCAL ACTION GROUPS FROM POLAND AND THE CZECH REPUBLIC: THREE CASE STUDIES <b>Marek FURMANKIEWICZ and Gabriela TRNKOVÁ</b> .....	210
HOW AND WHY EXPLOITATIVE LEADERSHIP INFLUENCES FOLLOWERS' ORGANIZATIONAL COMMITMENT: INTEGRATING SOCIAL EXCHANGE AND JUSTICE LENS <b>Hanyu GAO, Le TAN and Po HAO</b> .....	222
ASSESSMENT OF FOOD SECURITY IN THE COUNTRIES OF THE VISEGRAD GROUP – A COMPARATIVE ANALYSIS <b>Klaudia GURKOWA, Anna Sylwia KOWALSKA, Anna OLSZAŃSKA, Joanna SZYMAŃSKA and Ivan SOUKAL</b> .....	234
CAPITAL-LABOR SUBSTITUTION AND ECONOMIC EFFICIENCY IN THE CONTEXT OF INDUSTRY 4.0 <b>Martina HEDVIČÁKOVÁ</b> .....	243
BITCOIN DATA WITH INDICATORS IN YEARS 2017-2021 <b>Jan HRUŠKA</b> .....	251
RESEARCH ON THE EFFICIENCY CALCULATION AND INFLUENCING FACTORS OF NEW URBANIZATION IN CHINA <b>Xu CHEN</b> .....	259
COMPARISON OF SELECTED MODELS FOR RANKING OF DECISION MAKING UNITS <b>Josef JABLONSKÝ</b> .....	269
COVID-19 AND ITS INFLUENCE ON KNOWLEDGE CONVERSION WITHIN AN ORGANIZATION <b>Martina JANEČKOVÁ</b> .....	277
ENVIRONMENTAL AND BUSINESS MEASUREMENT FOR SUSTAINABLE DEVELOPMENT: EMISSIONS AND ENTERPRISES' SALES LINKAGES AMONG SLOVAK INDUSTRIAL ENTERPRISES <b>Patricia JÁNOŠOVÁ and Emese TOKARČÍKOVÁ</b> .....	285
OPTIMAL CONTROL OF TECHNOLOGY DEVELOPMENT LEVEL ON PRIMARY ENERGY CONSUMPTION <b>Jing JIAO and Qingyu WANG</b> .....	297
DEVELOPMENT OF ORGANIC PRODUCTION AS A CONDITION FOR SUSTAINABILITY OF RUSSIAN AGRICULTURE <b>Mariya KAGIROVA and Stanislava KONTSEVAYA</b> .....	306
RELATIONSHIP BETWEEN INCOME INEQUALITY, POVERTY AND ECONOMIC GROWTH, COMPARATIVE ANALYSIS IN EASTERN AND WESTERN EUROPE WITH PANEL DATA <b>Sema KAZAZI and Osman KÜÇÜKAHMETOĞLU</b> .....	319

THE INFLUENCE OF THE LEVEL OF CORPORATE CULTURE ON THE ABILITY TO IMPLEMENT REVENUE MANAGEMENT PROCESSES: REVIEW	
<b>Martin KOCOUREK and Petra POULOVA</b> .....	331
CSR WEB COMMUNICATION BY CONTROVERSIAL ENTERPRISES IN THE CONTEXT OF STAKEHOLDER AND LEGITIMACY THEORIES	
<b>Jan KOPRIVA, Libena TETREVOVA and Alexandra ZAHORSKA</b> .....	340
SMART CITIES: GIS DATA FOR REALISTIC SIMULATIONS	
<b>Milan KOŘÍNEK and Kamila ŠTEKEROVÁ</b> .....	350
UTILISATION OF ONLINE PUBLIC RELATIONS TOOLS IN CHEMICAL COMPANIES IN THE CZECH REPUBLIC	
<b>Jan KREJCIK, Hana LOSTAKOVA and Martina JELINKOVA</b> .....	358
EVIDENCE ON THE USE OF INFORMATION AND COMMUNICATION TECHNOLOGY FOR EMPLOYEE TRAINING IN SELECTED COMPANIES IN U.S. – PILOT STUDY	
<b>Monika KRISTL VOLFOVÁ</b> .....	370
COEFFICIENTS FOR REAL ESTATE TAX IN STATUTORY CITIES OF THE CZECH REPUBLIC	
<b>Gabriela KUKALOVÁ, Olga REGNEROVÁ, Daniela PFEIFEROVÁ and Lucie KOVAŘÍKOVÁ</b> .....	381
AN EMPIRICAL TEST OF STACKED AUTOENCODER AS RECOMMENDATION MODEL	
<b>Jaroslav LANGER, Michal DOBROVOLNY and Ondrej KREJCAR</b> .....	391
ROLE OF ECO-INNOVATION AND TOURISM TOWARDS CARBON NEUTRALITY IN THE CZECH REPUBLIC	
<b>Taiwo T. LASISI, Kayode K. ELUWOLE and Martina PÁSKOVÁ</b> .....	400
A REVIEW OF RISK MANAGEMENT TOOLS FOR SMALL BUSINESS	
<b>Laurențiu LAZĂR, Carmen Nadia CIOCOIU and Adina PRIOTEASA</b> .....	410
THE EFFICIENCY OF EXERCISING SELF-GOVERNMENT BODIES' COMPETENCIES IN THE BUILDING SECTOR IN THE SLOVAK REPUBLIC: A STUDY OF SELECTED REGIONS	
<b>Ivana LICHNEROVÁ, Eleonóra MARIŠOVÁ, Peter FANDEL, Ladislav MURA and Marina VALENČIKOVÁ</b> .....	424
GAME ANALYSIS OF "OFFICIALS AND PEASANTS" – TAKING EPHEDRA SALES LICENSE AS AN EXAMPLE	
<b>Guobin LIU and Rong KANG</b> .....	432
DIGITAL FINANCE, E-COMMERCE DEVELOPMENT AND INCOME GAP BETWEEN URBAN AND RURAL AREAS IN CHINA	
<b>Tan LIU and Zhangyong XU</b> .....	441
TIME-VARYING SHOCKS TO LOAN DEFAULTS FROM MONETARY POLICY UNCERTAINTY	
<b>Yanni LIU and Yaqing HU</b> .....	451
RESEARCH ON THE INDIRECT IMPACT OF MONETARY POLICY UNCERTAINTY AND LOAN DEFAULT – BASED ON TWO CHANNELS OF BANKS AND ENTERPRISES	
<b>Yanni LIU and Yaqing HU</b> .....	464
RESEARCH ON THE RISK OF DEFAULT ON FARM-RELATED LOANS AND THE IDENTIFICATION OF DEFAULT MOTIVES	
<b>Yanni LIU and Yaqing HU</b> .....	477
MANAGEMENT METHODS FOR GLOBAL VIRTUAL TEAMS - A REVIEW OF CURRENT LITERATURE AND DIRECTIONS FOR FUTURE RESEARCH	
<b>Guangyan LUO</b> .....	493
A STUDY ON CARBON EMISSION PEAK FORECAST OF CHINA'S INDUSTRIAL SECTOR AND CARBON-INTENSIVE INDUSTRIES	
<b>Hao LV and Rong KANG</b> .....	505

FINANCIAL TOOLS WITH THE STATE SUPPORT. THE CASE OF BUILDING SOCIETIES IN CZECHIA	
<b>Jan MAČÍ</b> .....	517
CONSUMER AWARENESS AND THE PREFERENCE FOR DOMESTIC PRODUCTS IN SLOVAKIA AND HUNGARY	
<b>Renáta MACHOVÁ, Enikő KORCSMÁROS, Monika ESSEOVÁ and Roland MARČA</b> .....	528
EFFICIENCY OF SOCIAL POLICY IN THE CZECH REPUBLIC: THREAT OF POVERTY	
<b>Adéla MAREŠOVÁ, Martin KRÁL and Anna CIERNIAK-EMERYCH</b> .....	538
IMPACT OF WAGE INCREASE AND ESTIMATION OF PHILLIPS' CURVE IN CZECH REPUBLIC	
<b>Peter MARINIČ</b> .....	545
TRENDS IN ICT STRATEGIES IN FINANCIAL INSTITUTIONS	
<b>Milos MARYSKA, Petr DOUCEK and Lea NEDOMOVA</b> .....	553
MODEL OF SUCCESSFUL SPIN-OFF SUPPORT BASED ON THE CZECH-NORWAY COOPERATION	
<b>Pavla MATULOVA and Anis YAZIDI</b> .....	562
MULTI-CRITERIA MODEL FOR THE PERFORMANCE MEASUREMENT OF COMPANIES AND ITS APPLICATION TO PARTICIPANTS OF THE OLOMOUC REGION ENTREPRENEUR OF THE YEAR	
<b>Michal MENŠÍK, Martina PAVLAČKOVÁ and Tereza HORČIČKOVÁ</b> .....	571
REASONS OF OVERPAYMENTS AND SOLUTIONS FOR THE UNDULY PAID OUT NON-INSURANCE SOCIAL BENEFITS IN THE CZECH REPUBLIC	
<b>Lukáš MORAVEC, Jana HINKE, Enikő LÓRINCZOVÁ and Michaela CHLADÍKOVÁ</b> .....	582
DOES THE TERM STRUCTURE OF INTEREST RATES HOLD TRUE FOR EAST-ASIAN COUNTRIES? MORE POWERFUL NONLINEAR COINTEGRATION TESTS	
<b>Shijing NAN and Minna WANG</b> .....	592
COLLABORATION OF STUDENTS WITH THE COMMERCIAL SECTOR AT TWO SELECTED CZECH REGIONAL UNIVERSITIES – A CASE STUDY	
<b>Lucie NOVOTNA and Jana HAVLICKOVA</b> .....	601
ASSESSMENT OF COORDINATED DEVELOPMENT OF ECONOMIC DEVELOPMENT, PUBLIC SERVICES AND ECOLOGICAL ENVIRONMENT IN THE YELLOW RIVER BASIN	
<b>Ddan PAN and Cong WANG</b> .....	614
USE OF TWITTER AS AN EFFECTIVE COMMUNICATION TOOL – CASE STUDY ON EU POLITICIANS	
<b>Antonín PAVLÍČEK and Jana SYROVÁTKOVÁ</b> .....	624
VEHICLE ROUTING PROBLEM WITH CHOICE OF NODES	
<b>Jan PELIKÁN</b> .....	631
LOCAL FIRMS' STRATEGIES AND CLUSTER COOPERATION IN THE CZECH REPUBLIC: THE CASE OF THE PACKAGING MANUFACTURERS CLUSTER	
<b>Natalie PELLONEOVÁ</b> .....	637
EMPLOYMENT IN THE AGRICULTURE AND FORESTRY IN THE EUROPEAN UNION, V4, AND THE CZECH REPUBLIC IN THE PERIOD 2000–2019	
<b>Michaela PERUNOVÁ</b> .....	649
THE IMPACT OF COVID-19 ON THE DIGITAL TRANSFORMATION IN ORGANIZATIONS: A QUANTITATIVE ANALYSIS	
<b>Kateřina PETROVÁ, Jan ŠPATENKA and Miloš KOCH</b> .....	659

KNOWLEDGE AND SOURCES OF INFORMATION ON THE ENERGY EFFICIENCY OF DEVICES IN FARMS IN POLAND	
<b>Arkadiusz PIWOWAR</b> .....	670
UNEMPLOYMENT BENEFITS CALCULATION USING KNOWLEDGE SYSTEMS	
<b>Alena POZDÍLKOVÁ, Martina HEDVIČÁKOVÁ and Luděk LETÁČEK</b> .....	678
REFLECTION OF THE COVID-19 PANDEMIC IN THE COMPARABILITY ANALYSIS – A CRITICAL EVALUATION OF POTENTIAL APPROACHES	
<b>Veronika SOLILOVÁ, Marek LITZMAN, Michal IŠTOK and Karel BRYCHTA</b> .....	686
RESEARCH ON THE IMPACT OF FDI ON CHINA'S URBAN-RURAL ECONOMIC INTEGRATION	
<b>Liting SONG</b> .....	698
THE IMPACT OF THE COVID-19 PANDEMIC ON THE WIG-ENERGY STOCK EXCHANGE INDEX	
<b>Sławomir STEC and Jolanta PUACZ-OLSZEWSKA</b> .....	707
IS LINKEDIN SUITABLE FOR RECRUITMENT IN HIGHER EDUCATION IN THE CZECH REPUBLIC?	
<b>Frantisek SUDZINA, Marek BOTEK and Antonín PAVLÍČEK</b> .....	717
SPATIAL DIFFERENTIATION OF THE SITUATION ON LOCAL LABOR MARKETS IN THE AREAS OF IMPACT OF AIRPORTS IN POLAND	
<b>Agata SURÓWKA</b> .....	727
CORPORATE SOCIAL RESPONSIBILITY IN THE CZECH BANKING SECTOR	
<b>Libuše SVOBODOVÁ, Ahsan AKBAR and Minhas AKBAR</b> .....	739
EMS APPLICATION IN BUSINESSES – SYSTEMATIC REVIEW	
<b>Libor ŠIMEK and Pavel BACHMANN</b> .....	749
KNOWLEDGE MANAGEMENT AND KNOWLEDGE TRANSFER IN A TOURISM DESTINATION	
<b>Eva ŠIMKOVÁ</b> .....	761
THE EFFICIENCY OF PREMIER LEAGUE CLUBS ACCORDING TO THE COUNTRY OF ORIGIN OF THE MAJORITY OWNER	
<b>Michal TOMÍČEK</b> .....	774
PROTECTING THE ECONOMY OF SLOVAKIA AND THE CZECH REPUBLIC DURING THE COVID-19 PANDEMIC WITH THE HELP OF THE EUROPEAN UNION	
<b>Dániel TÓTH and Jana KAJANOVÁ</b> .....	785
OPTIMIZATION OF DOCUMENT WORKFLOW IN ACADEMIC ORGANIZATIONS FROM PROJECT MANAGEMENT PERSPECTIVE	
<b>Petr TUCNIK and Tereza OTCENASKOVA</b> .....	795
DESIGN OF THE SMART CITY DOMAIN CONCEPT IN THE CZECH REPUBLIC	
<b>Patrik URBANIK and Josef HORALEK</b> .....	803
CORPORATE SOCIAL RESPONSIBILITY ACTIVITIES THROUGH THE EMPLOYEES' LENSES: EVIDENCE FROM THE CZECH BREWERY SECTOR	
<b>Emil VELINOV, Simona CINCALOVA and Veronika TOPOROVA</b> .....	815
ACTIVITIES OF ORGANIZATIONS IN THE FIELD OF SOCIAL RESPONSIBILITY IN THE CONTEXT OF HUMAN RESOURCE MANAGEMENT WITH A FOCUS ON AGE MANAGEMENT	
<b>Pavla VRABCOVÁ and Hana URBANCOVÁ</b> .....	823
FINANCIAL INSTRUMENTS OF THE EUROPEAN UNION SUPPORTING THE COMMON AGRICULTURAL POLICY IN THE FINANCIAL PERSPECTIVE 2021-2027	
<b>Alina WALENIA and Božena KUSZ</b> .....	834

THE IMPACT OF INPUT DIGITALIZATION ON THE UPGRADING OF THE GLOBAL VALUE CHAIN OF MANUFACTURING INDUSTRY <b>Jue WANG and Ying LIU</b> .....	844
NON-LINEAR RELATIONSHIP ANALYSES ABOUT URBANIZATION, ECONOMIC GROWTH AND CARBON EMISSIONS IN CHINA BASED ON SEMI-PARAMETRIC FIXED EFFECTS MODEL <b>Li WANG, Qian XIE and Fei XUE</b> .....	857
MULTIDIMENSIONAL POVERTY MEASUREMENT AND POVERTY REDUCTION EFFECT ANALYSIS – BASED ON THE SURVEY DATA OF H COUNTY IN SOUTHERN SHAANXI <b>Yangchenhao WU</b> .....	868
THE FORECAST AND ANALYSIS OF PEAK CARBON DIOXIDE EMISSIONS IN CHINA <b>Fei YANG, Beibei SHI and Hao LV</b> .....	879
RESEARCH ON THE INFLUENCE MECHANISM OF CHINA'S NATURAL CAPITAL INVESTMENT ON ECONOMIC GROWTH – EMPIRICAL ANALYSIS BASED ON 30 PROVINCIAL PANEL DATA <b>Zou YU</b> .....	888
IMPACT OF DIGITAL ECONOMY ON THE TRANSFORMATION AND UPGRADING OF INDUSTRIAL STRUCTURE <b>Hui'ai YUAN, Lihong ZHAO and Hongzhi YUE</b> .....	900
EXTERNAL EMPLOYER BRANDING IN THE IT SECTOR IN POLAND: EMPLOYEE PERSPECTIVE ON EMPLOYER ATTRACTIVENESS <b>Katarzyna ZAK</b> .....	912
WHETHER THE SOCIAL INSURANCE LAW AFFECTS SCIENTIFIC AND TECHNOLOGICAL INNOVATION: EVIDENCE BASED ON CHINA'S INTER PROVINCIAL PANEL DATA <b>QiFan ZHANG and MiGang DONG</b> .....	924
IMPACT OF AGRICULTURAL FDI ON CHINA'S AGRICULTURAL GREEN TOTAL FACTOR PRODUCTIVITY <b>Zhengnan ZHAO, Shaofeng RU and Guizhi ZHOU</b> .....	935
INTELLECTUAL PROPERTY STRATEGY AND URBAN INNOVATION: EXPERIENCE FROM INTELLECTUAL PROPERTY DEMONSTRATION CITIES <b>Han ZHENG</b> .....	947
FREE TRADE ZONE CONSTRUCTION AND VALUE CHAIN UPGRADING: EMPIRICAL EVIDENCE FROM CHINA <b>Wenhui ZHOU and Xiaojing CHAO</b> .....	957
PRICE TRANSMISSION FOR BEER SECTOR IN COVID ERA: CASE OF CZECHIA <b>Olesya ZHYTNA and Tomáš MAIER</b> .....	965
THE IMPORTANCE OF KNOWLEDGE – FROM THE PERSPECTIVE OF SME LEADERS IN NITRA REGION AT THE TIME OF COVID-19 PANDEMIC <b>Tibor ZSIGMOND and Renáta MACHOVÁ</b> .....	975
SPORT CONSUMPTION HABITS IN TERMS OF GENERATIONS <b>Tibor ZSIGMOND, Renáta MACHOVÁ, Enikő KORCSMÁROS, Annamária ZSIGMONDOVÁ and Zoltán ŠEBEN</b> .....	987

# The Efficiency of Premier League Clubs According to the Country of Origin of the Majority Owner

Michal TOMÍČEK

Technical University of Liberec, Liberec, Czech Republic; michal.tomicek@tul.cz

**Abstract:** Owning a successful football club is a matter of good management, financial stability but also prestige. Owning a club participating in the English Premier League, the most prestigious and richest football competition in the world, has so far attracted investors from the Middle and Far East, the United States and other parts of the world. The aim of the presented paper was to use data envelopment analysis to calculate efficiency and then evaluate and compare the efficiency of selected clubs of the English Premier League owned by British investors and by foreign ones. The researched period are the seasons 2019/2020 and 2020/2021. The data used were obtained from the official databases of both examined sports competitions and subsequently supplemented with private databases of companies operating in the football environment. In terms of results, some implications for the management of football clubs are discussed and suggestions for increasing efficiency in inefficient clubs are made. Clubs owned by British investors are not generally less efficient than clubs owned by foreign investors and vice versa.

**Keywords:** sport management; football; data envelopment analysis; efficiency; performance factors

**JEL Classification:** C10; L83; C67; C44

---

## 1. Introduction

Currently, football is one of the most important sports, and at the same time a business of high economic importance. In the last few years, there have been active negotiations concerning the ownership of the clubs of the most prestigious football competition in the world, the English Premier League. Every year, the largest amount of funds flow into the English top football competition compared to other European top football competitions. The prestige and attention of the media and spectators has already attracted investors from the Middle and Far East, the United States and other parts of the world.

Every sport organization strives to evaluate its performance: its weaknesses and strengths. Nowadays, success in the professional football league is related to successful coaching and leading the entire team. But the efficiency goes beyond that kind of perspective onto the company level. There, the board and crucially the owner is willing to see club's increasing performance charts and curves. In the world of business, the comparison with the competition is important to important for objective evaluation of the company's direction. One of the most favored methods for this kind of analysis is the data envelopment analysis (DEA).

The aim of the presented paper is to contribute to previous research and to use data envelopment analysis to calculate efficiency and use it to compare the efficiency of selected clubs of the English Premier League that are owned by British investors and by foreign ones.

The hypothesis is based on an assumption that a foreign investor should have lower emotional ties to the club than the British owner. He should therefore place higher demands on club performance, both on and off the pitch. Because the financial reality of every football club is closely linked to the team's performance on the pitch, sports and economic metrics are used in the work. The presented research evaluates the performance of English professional football clubs that participated in two consecutive seasons (2019/2020 and 2020/2021) in the top-level English football competition.

## **2. Performance Management of Sports Companies**

The English professional football clubs which were playing in the Premier League, the top-tier English football competition, in the seasons 2019/2020 and 2020/2021 were selected to evaluate performance. The specificity of European football competitions is the closedness of individual performance levels (competitions). Sports companies (football clubs) do not have the opportunity to move freely between levels, but, for example, unlike professional sports competitions in the United States, there are clear rules under which they can do so – at the end of the season by relegation or promotion. Newly established companies cannot immediately participate in the highest competitions, they have to go through a long way from the lowest competitions to professional leagues. That is why it is often more advantageous for investors to buy an already “well-established” club with a history, fan base and sports and personnel facilities than to establish a club on a green field. At the same time, one investment entity may not own more than one football club that participates in European Cups. This is a safeguard for the oligopolization of professional European football (UEFA Article 5, 2021).

A wide range of authors deals with the performance of sports companies. The majority of the researchers use only sports statistics in order to evaluate the club's efficiency, the rest combines the sport and economic metrics to achieve more accurate efficiency results.

In their research, Espitia-Escuer and Garcia-Cebrian (2016) apply the DEA method and the Malmquist Indices to the ranking of football teams that have participated in the UEFA Champions League. Barros and Douvis (2009) estimate productivity changes using DEA analysis applied to a representative sample of football clubs operating in two European countries: Portugal and Greece. They rank football clubs according to their productivity changes between the 1999/2000 and 2002/2003 seasons, concluding that some clubs saw productivity growth while others saw productivity decline (Barros & Douvis, 2009).

Halkos and Tzeremes (2013) use the DEA to compare the actual level of market value of football clubs and their performance. The research shows that the level of market value of football clubs has a negative effect on their performance. The high value of football clubs does not guarantee the higher performance.

Petrović Djordjević (2015) used the nonparametric variable output-oriented DEA model and analyses technical efficiency of the national football teams in the qualifications for 2010

FIFA World Cup. DEA model has a two-stage structure, the first stage uses inputs to generate outputs that then became the inputs to the second stage.

Arabzad et al. (2013) utilized a DEA model to identify the best English Premier League football players. Another type of DEA model has been used to rank the selected players. The proposed approach has been examined in the English Premier League 2010/2011. Findings imply that Rooney, Drogba and Tevez are ranked as first, second and third players.

### 3. Statistical and Quantitative Methods Used

The methods in the work can be divided into statistical and exact. In addition to descriptive statistics, the statistical methods used include, in particular, dependency analysis especially, correlation analysis. Correlation analysis examines the relationships of variables using dependency measures (correlation coefficients). Correlation indicates the degree of association of two variables. It is important to distinguish between correlation and causality, i.e. the direct relationship between cause and effect. Hendl (2012) explains that correlation, however strong, does not by itself mean evidence of a causal relationship, i.e. that changes in the variable  $X$  actually affect the changes in the variable  $Y$ .

In the main part of the paper the method of data envelopment analysis (DEA) is used, a quantitative method based on the theory of business economics. DEA models are divided into input-oriented and output-oriented models. Using input-oriented models, it is possible to estimate the degree of technical efficiency, which determines the reduction of input indicators, so that the unit becomes technically efficient with unchanged output. Effective units get a score of 1, inefficient ones get a lower score in the interval between 0 and 1 (Cooper, 2011).

The research of sports performance of companies is also connected with their economic performance, when the club receives a financial reward from the league competition authority for placing in the table according to the points obtained at the end of the season. The better the position the club achieves, the higher the financial reward. In addition, clubs compete with each other for funding for television rights. It is true that the more often the league matches of a given club are broadcast on television screens, the greater the reward the club will receive when redistributing these funds. The financial reward for placing in the table does not cover all the costs of the clubs, so sponsorship and partnership agreements come into play and, of course, the involvement of the owners and their financial help is also taken into account.

The BCC model (Banker, Charnes and Cooper) is an input-oriented model, considering variable economies of scale and estimating Pure Technical Efficiency (PTE) (Sengupta, 1995). The CCR model (Charnes, Cooper and Rhodes) considers constant economies of scale and estimates Overall Technical Efficiency (OTE), which consists of two parts, Pure Technical Efficiency (PTE) and Scale Efficiency (SE). Scope efficiency is then determined by the relationship between OTE and PTE and indicates the extent to which the unit can improve its efficiency by changing its size (Cooper, 2011). The BCC and CCR models form two basic (mathematically simplest) DEA models.

#### 4. Methodology and Data

Creating a database is preceded by data collection from several sources. In addition to publicly available information published by the football competitions themselves, the data sources used in the paper also include private databases of a company dealing with sports data analysis, the InStat. The economic data were obtained from the specialized server Transfermarkt. The complexity of the database used in the work lies in the combination of the mentioned sources and their supplementation with data from the register of companies doing business in the United Kingdom of Great Britain and Northern Ireland (UK Business Register, 2021). The research process can be divided into the following phases:

1. **Creating a list of evaluated companies** – in the first step, a database of surveyed clubs that participated in the period under review, i.e. the 2019/2020 and 2020/2021 seasons, was created. To better work with the data, the names of the surveyed clubs were shortened to three-letter abbreviations. The majority owner and his country of origin were traced to these clubs. The majority owners and their country of origin is listed in Table 1.

**Table 1.** Majority owners of selected sports companies

Club	Parent company or fund	Majority owner name	Country
BOU	Opalus Trust	Maxim Demin	RUS
ARS	Kroenke Sports & Entertainment	Stan Kroenke	USA
AVL	NSWE Group	Nassef Sawiris	EGY
BRI	B&H Albion Holdings Ltd	Anthony Grant Bloom	GBR
BUR	ALK Capital	Alan Pace	USA
CHE	Fordstam Ltd	Roman Abramovich	RUS
CRY	Palace Holdco LP	Steve Parish (Harris, Blitzer)	GBR
EVE	OOO USM Holding Co	Ferhad Moshiri	GBR
FUL	Shahid Rafiq Khan Family Trust A	Shahid Khan	PAK
LEE	Aser Group Holding	Andrea Radrizzani	ITA
LEI	King Power	Aiyawatt Srivaddhanaprabha	THA
LIV	Fenway Sports Group	John Henry	USA
MCI	City Football Group	Sheikh Mansour	SAE
MUN	Red Football Ltd	Glazer (rodina)	USA
NEW	St James Holdings	Michael Ashley	GBR
NOR	Norwich City Plc	M. Wynn-Jones, D. Smith	GBR
SHU	Blades Leisure Ltd	Abdullah bin Mosa'ad	SAU
SOU	Lander Sports Development Co Ltd	Gao Jisheng	CHN
TOT	ENIC Group	Joe Lewis	GBR
WAT	Hornets Investment Ltd	Gino Pozzo	ITA
WBA	Yunyi Guokai Sports Development	Lai Guochuan	CHN
WHU	WH Holding Ltd	David Sullivan	GBR
WOL	Fosun International	Guo Guangchang	CHN

In the second column of the Table 1 are listed parent companies for the clubs playing the English Premier League in the observed period. For the Norwich City FC (NOR) there is no evidence of parent company, instead the major owners – Mr. Michael Wynn-Jones Mrs. Delia Smith – are the major owners of Norwich City FC Plc. The rest of the clubs has a major owner either in the form of a parent company or an investment fund.

2. **Collecting of sport and economic metrics** – data concerning the sports performance of clubs in the mentioned seasons was added to the list.
  - a) The sport data can be divided by several perspectives. First, we can determine whether the statistics are offensive or defensive. Or you can determine whether the statistic is positive or negative (a typical negative statistic can be the number of fouls in the season). And last but not least it is possible to determine whether the statistic is in absolute or relative units. All the sport data with no exceptions were provided by statistical company InStat and its server instatscout.com (InStat Football Data, 2021).
  - b) Then, the information about the average attendance and a maximum stadium capacity from the official English Premier League database was added (Premier League, 2021).
  - c) The economic data consisted of a sum of market values of players who have played at least one match of the season, obtained from the open Transfermarkt database. These data do not include actual transfer amounts but estimated current market values of the players (Transfermarkt, 2021).
3. **Determination of inputs and outputs of DEA model** – one of the most important steps of creating and calculating the DEA model is determination of relevant inputs and outputs. In the paper research, three inputs and one output have been chosen. All factors are chosen so that the inputs correlate between themselves weakly or not at all, in relation to the output is required the highest possible degree of correlation. Bowlin (1998) established the rule that the number of DMUs should be at least three times the number of inputs and outputs. The chosen inputs and outputs are listed in the Table 2.

**Table 2.** Inputs and outputs of the DEA model

Factor	Resource	Input/Output
Squad size	InStatScout DB	Input
Total Market Value	Transfermarkt DB	Input
Average Stadium Occupancy	EPL DB	Input
Total points	EPL DB	Output

- a) The inputs include the squad size of the club in the season. The squad is defined as the number of players who have started at least in one match of the season. The second input is the total market value of the squad in the season. Average stadium occupancy was calculated as the share of the average stadium attendance in the season and the maximum possible capacity of the stadium.
  - b) The only output of the model is the total points achieved by club in the end of the season.
4. **Determination of technical efficiency values** – to measure the performance of football clubs, an input-oriented CCR model was used. The CCR model measures overall technical efficiency ( $OTE_{CCR}$ ). The model aggregates pure technical efficiency (PTE) and scale efficiency (SE) into a single value. The OSDEA-GUI (Open-source DEA) software was used for all the calculations related to DEA. The data were entered into the software separately after each season in the form of csv files with inputs and outputs in separate

columns. The efficiency limit defines the maximum output combinations that can be selected for a given set of inputs. Assuming a set of  $n$  DMUs, each DMU $_j$  ( $j = 1, \dots, n$ ) uses  $m$  inputs  $x_{ij}$  ( $i = 1, 2, \dots, m$ ) to create with outputs  $y_{rj}$  ( $r = 1, 2, \dots, s$ ). Input-oriented models with constant returns to scale can be formulated according to equation (1) to minimize inputs while keeping outputs at their current level.

$$\begin{aligned}
 & \min \theta - \varepsilon \left( \sum_{i=1}^m s_i^- + \sum_{r=1}^s s_r^+ \right) \\
 \text{s. t. } & \sum_{j=1}^{in} \lambda_j x_{ij} + s_i^- = \theta x_{ip} \quad i = 1, 2, \dots, m \\
 & \sum_{j=1}^n \lambda_j y_{rj} + s_r^+ = y_{rp} \quad r = 1, 2, \dots, s \\
 & \lambda_j, s_i^-, s_r^+ \geq 0, j = 1, 2, \dots, n.
 \end{aligned} \tag{1}$$

The overall technical efficiency of the DMU is measured in relation to the other units analyzed using the efficiency score. The overall level of technical efficiency (CCR-I OTE) is taking on values in the range  $(0, 1)$ . Technically efficient DMUs achieve efficiency rates of 1, inefficient units the efficiency rates are less than 1 (Cooper, 2011).

5. **Comparison of the performance of football clubs owned by the British owners and the foreign ones** – a non-parametric test was chosen because using the Shapiro-Wilk test, it was proved that the values of the individual variables do not have a normal distribution. A Kolmogorov-Smirnov test was used to compare the performance of selected club groups divided according to the origin of the majority owner. The Statgraphics Centurion XVIII software was used for statistical testing at a significance level of 5%.

## 5. Research Results

Applying an input-oriented CCR efficiency model, the performance levels achieved by English football teams for seasons 2019/2020 and 2020/21 are reported in Table 3. The analysis shows how clubs are able to convert the inputs into points gained within competition tables. The values refer to the current members of the season.

The CCR-I model described 3 clubs as efficient in the first season and 5 clubs in the second season. The efficient clubs have chosen the appropriate sports tactics and at the same time are able to efficiently transform the inputs into outputs and have the optimal size. The most efficient club in the researched period of two seasons in the English highest competition is Burnley FC. As the only one, the club has managed to be efficient in both observed seasons. Liverpool FC and Sheffield United FC achieved an efficient OTE<sub>CCR</sub> score in the 2019/2020 season. In the second season, beside Burnley FC, were determined as efficient Leeds United FC, Manchester City FC, Manchester United FC and West Ham United FC.

**Table 3.** OTECCR score of clubs playing English Premier League in seasons 2019/2020 and 2020/2021

DMU			Season				↑↓	Avg.
			2019/2020		2020/2021			
Abbr.	Full name	Owner origin	Pos.	OTE <sub>CCR</sub>	Pos.	OTE <sub>CCR</sub>		
BOU	AFC Bournemouth FC	RUS	18	0.5925	-	-	-	-
ARS	Arsenal FC	USA	8	0.6914	8	0.7815	↑	0.7365
AVL	Aston Villa FC	EGY	17	0.6493	11	0.8148	↑	0.7321
BRI	Brighton & Hove Albion FC	GBR	15	0.7543	16	0.6062	↓	0.6803
BUR	Burnley FC	USA	10	1.0000	17	1.0000	→	1.0000
CHE	Chelsea FC	RUS	4	0.7889	4	0.7637	↓	0.7763
CRY	Crystal Palace FC	GBR	14	0.7383	14	0.8695	↑	0.8039
EVE	Everton FC	GBR	12	0.7275	10	0.8365	↑	0.7820
FUL	Fulham FC	PAK	-	-	18	0.4753	-	-
LEE	Leeds United FC	ITA	-	-	9	1.0000	-	-
LEI	Leicester City FC	THA	5	0.8871	5	0.8540	↓	0.8706
LIV	Liverpool FC	USA	1	1.0000	3	0.7516	↓	0.8758
MCI	Manchester City FC	SAE	2	0.9415	1	1.0000	↑	0.9707
MUN	Manchester United FC	USA	3	0.7931	2	1.0000	↑	0.8966
NEW	Newcastle United FC	GBR	13	0.7894	12	0.7633	↓	0.7764
NOR	Norwich City FC	GBR	20	0.3888	-	-	-	-
SHU	Sheffield United FC	SAU	9	1.0000	20	0.5260	↓	0.7630
SOU	Southampton FC	CHN	11	0.9254	15	0.6553	↓	0.7904
TOT	Tottenham Hotspur FC	GBR	6	0.6846	7	0.8285	↑	0.7565
WAT	Watford FC	ITA	19	0.6164	-	-	-	-
WBA	West Bromwich Albion FC	CHN	-	-	19	0.6026	-	-
WHU	West Ham United FC	GBR	16	0.6292	6	1.0000	↑	0.8146
WOL	Wolverhampton Wanderers FC	CHN	7	0.9846	13	0.8010	↓	0.8928
Avg.			-	0.7791	-	0.7965	-	-

On the other side of the efficiency spectrum, Norwich City FC and Fulham FC were the least efficient clubs in the observed seasons. After achieving this unflattering score, both clubs have been relegated. The clubs that have been relegated in the end of the seasons (the last three clubs in the table) have never have OTE<sub>CCR</sub> score higher than 0.6200.

The average OTE<sub>CCR</sub> score in the first season was 0.7791, in the following season the score has slightly increased to 0.7965. As was already mentioned, the number of efficient DMUs has raised as well from 3 to 5 between seasons.

Among the clubs that have participate both of the observed seasons, Burnley FC (1.0000), Manchester City FC (0.9707), Manchester United FC (0.8966), Wolverhampton Wanderers FC (0.8928) and Liverpool FC (0.8758) were the top 5 clubs by OTE<sub>CCR</sub> average score. Above the seasonal average were 10 clubs in the first season and 11 in the second season. The arrows in the last but one column shows trend of the OTE<sub>CCR</sub> score among seasons. For example, Chelsea FC's down arrow shows that the OTE<sub>CCR</sub> score dropped from 0.7889 in the first season to 0.7637 in the second season. Beside the OTE<sub>CCR</sub> scores Table 3 shows the position of the clubs in observed seasons.

The first of the graphs (Figure 1) shows OTE<sub>CCR</sub> score and the rankings of clubs with the majority owned by British investors. Among these clubs, only Newcastle United FC was above the OTE<sub>CCR</sub> score average in the first observed season. In the second season, four clubs with a majority of British owners reached OTE<sub>CCR</sub> above average. The value of OTE is shown on the main vertical axis, and the rankings of the clubs in the table on the secondary vertical

axis. The horizontal axis contains clubs in the English Premier League, where the majority share is controlled by British owners. The first season is shown in blue (horizontal stripes & rhombus), the second one in red (vertical stripes & triangle).

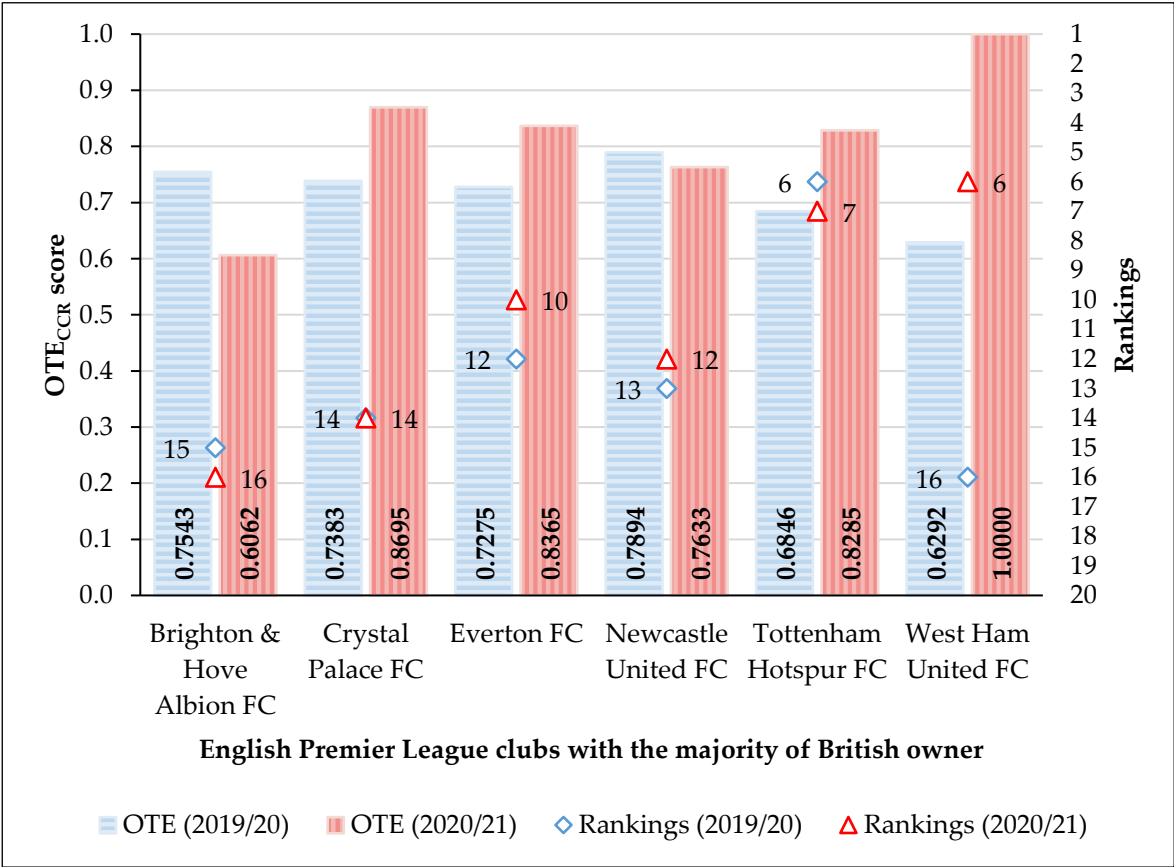
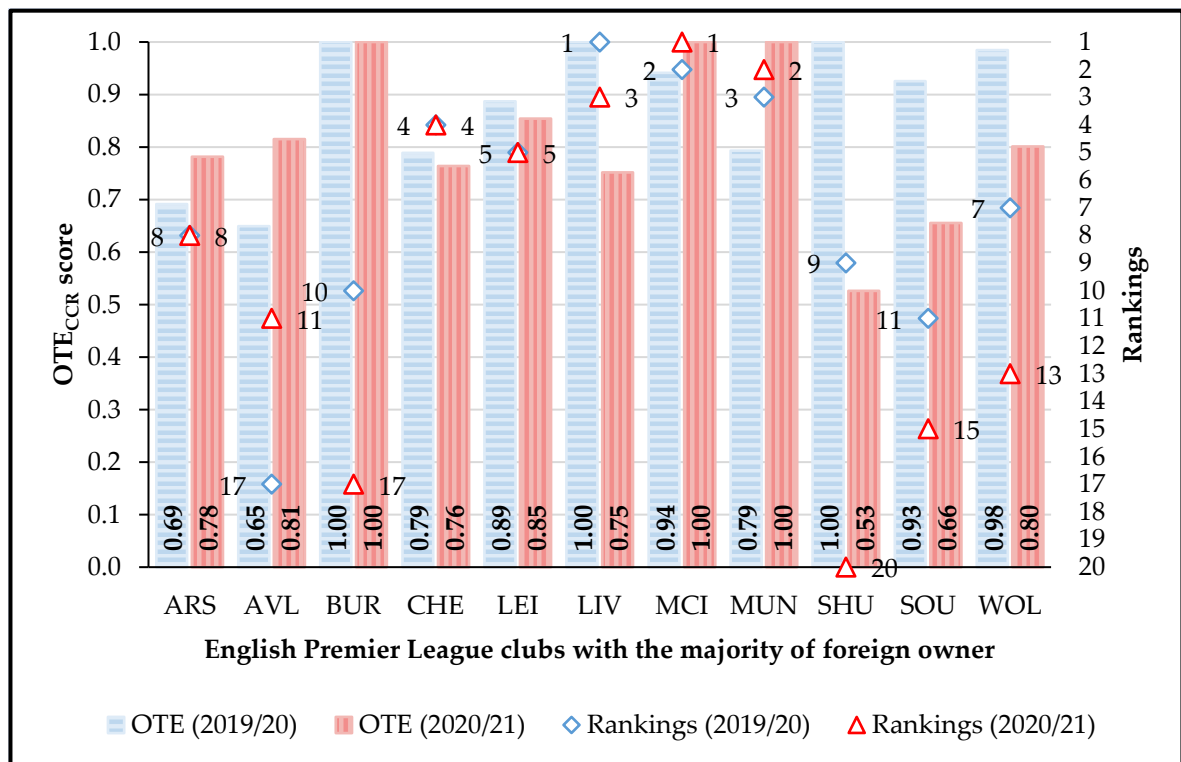


Figure 1. OTE<sub>CCR</sub> score and rankings of English Premier League clubs with the majority of British owner

The largest cross-season positive difference in both the value of OTE<sub>CCR</sub> and the ranking in the table was achieved West Ham United FC. In the 2019/2020 season, the club was on the verge of relegation to the second highest English football competition (16th place), in the following season 2020/2021 it placed sixth, thus guaranteeing the company participation in European cups. Interestingly, West Ham United FC achieved an OTE<sub>CCR</sub> score of 0.6292 in the first observed season – which was the worst score of any Premier League club that season. In the following season, the club reached the effective value of the OTE<sub>CCR</sub> score. This is the most significant cross-season improvement in the value of OTE among all the clubs surveyed.

The ranking in the table for other British-owned clubs differed by a maximum of two places seasonally, which means a relatively constant sports performance of the clubs. The value of OTE<sub>CCR</sub> of other clubs in the 2019/2020 season ranged from 0.6846 to 0.7894, in the 2020/2021 season from 0.6062 to 0.8695.

The OTE<sub>CCR</sub> score of Premier League clubs owned by foreign investors showed a higher range of variation compared to companies owned by British investors. Due to the high number of DMUs, club names are shown as three-letter abbreviations in the following graph (Figure 2).



**Figure 2.** OTE<sub>CCR</sub> score and rankings of English Premier League clubs with the majority of foreign owner

A phenomenon typical for football clubs, called the second season syndrome has taken place in the case of Sheffield United FC (SHU) in the 2020/2021 season. This phenomenon is connected with the fact that a club that promote to the top-tier football competition in its country can compete with the best clubs in the first season, but in the second season it does not build on successes and relegates from the top-tier competition.

The average OTE<sub>CCR</sub> score for clubs with domestic owners increased from 0.7206 to 0.8173 seasonally. West Ham United FC had the greatest impact on improving the average. On the other hand, the average seasonal score of OTE<sub>CCR</sub> fell from 0.8042 to 0.7876 for clubs with a foreign majority. Sheffield United FC had the biggest impact on the deteriorating average.

In the first observed season, clubs owned by foreign investors were in average more efficient than clubs owned by British investors. In the second season, clubs owned by British investors were in average more efficient.

## 6. Discussion and Conclusion

In this paper, the effectiveness of professional football clubs playing the English Premier League was measured. For this purpose, the time span of two seasons from 2019/20 to 2020/21 was taken. The efficiency of football clubs was measured using the non-parametric DEA method. Number of players, total market value of the team and average stadium occupancy were chosen as club inputs. The average stadium occupancy was added to the standard models used by other several authors. Output was measured by the total number of points in the season. This particular specification proved to be suitable for this application, but can also be used to analyze the effectiveness of other team sports.

Nowadays, there is an increasing need to know how efficiently a club uses its resources due to the current economic and financial situation. Based on the analyzed seasons, there are several conclusions of the research: in both of the observed seasons, the winner of English Premier League was always marked as efficient. The club with the lowest efficiency was relegated in both cases. Also, it can be stated that there are no significant differences between clubs owned by British and foreign investors. It is also possible to discuss the sources of clubs' inefficiency. The first source of clubs' inefficiency is related to the waste of resources. Clubs should only need a lower value of inputs (either a lower number of players, a lower total squad market value or a lower average stadium occupancy) to achieve the same output.

As the hypothesis of the paper was stated, clubs owned by foreign investors should be in average more efficient than clubs owned by British investors. But in the second season, the clubs owned by British investors achieved higher average OTE<sub>CCR</sub> score. The hypothesis cannot be confirmed nor rejected – the following research could be done on longer time period. Also, the BCC model can be compiled for scale efficiency and pure technical efficiency calculation. By calculating the scale efficiency, the second source of inefficiency could be determined. The BCC model should be applied in further research to assess a detailed view on the sources of inefficiency. The smaller football clubs have always an opportunity to get inspired by the big clubs, e.g. Manchester City FC or Chelsea FC. They should transfer practices that can be useful for them and gradually improve – at the level of sports management, medium and long-term vision or financial management.

**Acknowledgements:** Creation of this case study was supported by a dedicated postgraduate research grant under the student project SGS-2022-1017 at Technical University of Liberec.

**Conflict of interest:** none

## References

- Arabzad, S. M., Ghorbani, M., & Shahin, A. (2013). Ranking players by DEA the case of English Premier League. *International Journal of Industrial and Systems Engineering*, 15(4), 443. <https://doi.org/10.1504/ijise.2013.057479>
- Barros, C. P., & Douvis, J. (2009). Comparative analysis of football efficiency among two small European countries: Portugal and Greece. *International Journal of Sport Management and Marketing*, 6(2), 183. <https://doi.org/10.1504/ijismm.2009.028801>
- Bowlin, W. F. (1998). Measuring performance: An introduction to data envelopment analysis (DEA). *Journal of Cost Analysis*, 7, 3–27.
- Cooper, W. W., Seiford, L. M., & Zhu, J. (2011). *Handbook on Data Envelopment Analysis (International Series in Operations Research & Management Science, 164)* (2nd ed.). Springer.
- Espitia-Escuer, M., & Garcia-Cebrian, L. I. (2016). Productivity and competitiveness: The case of football teams playing in the UEFA Champions League. *Athens Journal of Sports*, 3(1), 57–85. <https://doi.org/10.30958/ajspo.3-1-3>
- Guzmán-Raja, I., & Guzmán-Raja, M. (2021). Measuring the efficiency of football clubs using data envelopment analysis: Empirical evidence from Spanish professional football. *SAGE Open*, 11(1), 1–13. <https://doi.org/10.1177/2158244021989257>
- InStat. (2021). *InStat Scout: Football*. Retrieved March 30, 2022, from <https://football.instatscout.com/>
- Halkos, G., & Tzeremes, N. (2013). A two-stage double bootstrap DEA: The case of the top 25 European football clubs' efficiency levels. *Managerial and Decision Economics*, 34(2), 108–115. <https://doi.org/10.1002/mde.2597>
- Hendl, J. (2012). *Přehled statistických metod: analýza a metaanalýza dat* (4th ed.). Portál.
- Petrović Djordjević, D. (2015). Measuring efficiency of football teams by multi-stage DEA model. *Tehnicki vjesnik-Technical Gazette*, 22(3), 763–770. <https://doi.org/10.17559/tv-20140306134047>

- Premier League. (2021). *Premier League: Tables*. Retrieved March 30, 2022, from <https://www.premierleague.com/tables>
- Sengupta, J. K. (1995). *Dynamics of Data Envelopment Analysis: Theory of Systems Efficiency*. Springer Science+Business Media.
- Transfermarkt. (2021). *Transfermarkt: English Premier League*. Retrieved March 30, 2022, from <https://www.transfermarkt.com/premier-league/startseite/wettbewerb/GB1>
- UEFA. (2021). *UEFA Article 5: Integrity of the competition*. Retrieved March 30, 2022, from <https://documents.uefa.com/r/Regulations-of-the-UEFA-Champions-League-2021/22/Article-5-Integrity-of-the-competition/multi-club-ownership-Online>
- UK Business Register. (2021). *UK Business Register: Find and update company information*. Retrieved March 30, 2022, from <https://find-and-update.company-information.service.gov.uk>

**Hradec Economic Days**

**Volume 12**

**Issue 1**

Proceedings of the International Scientific Conference

Hradec Economic Days 2022

June 9–10, 2022.

Editors: Jan MAČÍ, Petra MAREŠOVÁ, Krzysztof FIRLEJ, Ivan SOUKAL.

Hradec Economic Days are published annually.

Edition size: electronic edition only.

Published: June 6, 2022.

Publisher: University of Hradec Králové.

Publisher's office: Rokitanského 62, Hradec Králové 3, 500 03, Czech Republic.

VAT ID: CZ62690094.

**ISSN 2464-6059 (Print)**

**ISSN 2464-6067 (Online)**

**ISBN 978-80-7435-855-5**

**DOI: 10.36689/uhk/hed/2022-01-000**



University of Hradec Králové  
Faculty of Informatics and Management

