

Assessing field performance efficiency of Korean professional soccer teams

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Abstract 159**

In the 2002 Korea-Japan World Cup, the Korean national team advanced into the semifinals by winning games against strong teams such as Portugal, Italy, and Spain. The Korean professional soccer league (K-league) has been a crucial component for the Korean soccer's success. However, the league currently confronts challenging problems to solve. Specifically, the league has been criticized due to inefficient league administration, low game quality, low fan attendance, and a lack of marketing. In a broad perspective, all the problems are importantly interconnected, but for the current study we focused on the K-league teams' game quality, specifically performance efficiency, because it is a fundamental factor for teams' overall success (Kim, 2005). Therefore, we aimed to provide an objective assessment of the teams' performance efficiency by using data envelopment analysis (DEA).

DEA is a linear programming formulation that shows a nonparametric relationship between multiple inputs and outputs by forming an efficient frontier (Cooper, Seiford, & Tone, 2006). DEA is used to measure the efficiency of a number of decision making units (DMUs; i.e., teams in this study). An optimal efficiency value of 1 means that the team is efficient, whereas an efficiency value less than 1 implies that the team is inefficient (Cooper, Seiford, & Tone, 2006). Unlike a typical central tendency approach which assesses each unit relative to an average unit, DEA compares each team with the benchmark teams that represent the best practice. According to Haas (2003), DEA is useful in evaluating efficiency of a team sport like soccer, because the tool has merit in dealing with a team sport where nonmarketed inputs or outputs are involved.

The aim of this study was to measure the performance efficiency of the professional soccer teams in the K-league by analyzing statistical data. To that end, we applied DEA. The K-league has suffered from inefficient attack moves (e.g., the excessive number of shots resulting in few goals scored or points earned) for many years, and such inefficiency has downgraded the performance level of the K-league (Kim, 2005). Using four input variables (players used, assists, corner kicks, and shots at goals), we evaluated the league teams' performance efficiency for three seasons (2004 to 2006) in achieving two output variables (points earned and goals scored).

The data was collected from the Korean Football Association website (<http://new.kleague1.com>). Thirteen teams were evaluated for the 2004 and 2005 seasons, and fourteen teams were evaluated for the 2006 season (Gyeongnam FC was newly founded in 2006). The inputs were the number of players used, the number of assists, the number of corner kicks, and the number of shots at goals (all representing attack moves). Based on the recommendations of Dawson, Dobson, and Gerrard (2000), we chose points earned throughout the season as an output. In addition, we also included goals scored as another output to investigate how sensitive the efficiency measurements results are to different output combinations, since the inputs were more highly correlated to goals scored than to point earned.

The results revealed that the highest ranked teams (i.e., teams with the most points earned) for each of the three seasons were always efficient by achieving an efficiency score of 1. However, an efficiency score of 1 did not guarantee the highest ranking, because some teams recorded low rankings despite achieving this optimal score. This is probably because the game results are considered important regardless of the amount of attack moves. In other words, a team could be effective without being efficient and, moreover, it is the former that is rewarded (Espita-Escuer and Garcia-Cebrian, 2004). On the other hand, if we would have included defensive moves in addition to the current attack inputs, efficiency scores might have explained the teams' performance better. This was inferred from a sensitivity analysis, which showed that the inputs were more correlated with goals scored than points earned. In fact, teams with the most goals scored were not necessarily the highest ranked teams. Rather, the highest ranked teams tended to allow fewer goals than lower ranked teams. Lastly, although the highest ranked teams tended to retain the highest potential, actual and potential rankings did not coincide in many other teams. DEA calculates ideal outputs (i.e., potential) using given or less amounts of inputs. For example, Incheon United FC should have recorded the fifth highest ranking at the end of the 2005 season according to its potential, but the team was actually ranked first. However, despite a high potential, actually low ranked teams did not fulfill such a potential. This consequently confirms that a team's final ranking depends more on its efficient use of attack moves than on its potential.

Lots of criticism has been made about inefficient field performance of K-league teams, but objective evaluation of such inefficiency has been rarely done. DEA allowed us to measure the teams' efficiency, the importance of the harmonious combination of attack and defensive moves, and the teams' potential. Quantification of performance by DEA allows managers

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and decision makers to objectively assess the teams' current status, consequently leading the teams to play high quality games with greater efficiency.

Future studies need to consider financial factors (e.g., the players' annual wage, the annual wage of the head coach) as inputs. The significant impact of such factors on a team's performance is supported by research (e.g., Clement & McCormick, 1989). Lee and Kang (2007) presented management efficiency for the 2004 season of the K-league with player salary as the input and fan attendance and winning percentage as the outputs. It is a notable study that could be expanded to longitudinal research containing more financial factors. Lastly, we did not include defensive moves as inputs due to the limitation of data. Access to valid data on defensive moves will enable researchers to perform more comprehensive efficiency analysis on field performance.