

# Productivity measurement in a sports organisation

M. Arraya & R. Pellissier

## ABSTRACT

The purpose of this study is to establish whether the Productivity Measurement and Enhancement System (ProMES), a human resource intervention that provides feedback, can improve productivity in an Angolan female handball team. Two factors that are critical to the success of a sports team or organisation are motivation and productivity. The ProMES approach offers a method for measuring action results (in other words, team productivity) that takes this feature of typical team settings into account. The ProMES process, with its ability to aggregate participants around objectives, is suitable for application in the sport industry.

**Key words:** productivity, ProMES, motivation, team effectiveness and development, feedback, performance, team sport

## Introduction

The complexity that characterises the labour environment requires productivity improvement in order to influence the quality of life of all human resources (Pritchard, Weaver & Ashwood 2011). This is equally true for the success of sports organisations. Deciding how to improve productivity in the current environment is a great challenge that is only possible to comprehend within the context of dependency between the various elements (Arraya 2010). The manager, in order to be able to decide and act in this context, needs to have the right tools and understand that the organisation is not a perfectly controllable machine or a lifeless object, but a thinking, acting being (Geus 1998).

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This study is motivated by an interest in determining how to measure and improve productivity in sports organisations where the principal activity is a team sport. The interest emerged from the fact that several team sports (such as basketball, baseball, cricket, football, handball and rugby) move from amateur to professional teams, where the search for victory is essential for longevity. Victories create a dynamic that includes increasing the number of supporters; the more spectators at the stadium, the more sponsors are willing to invest, resulting in increased advertising revenue, increases in the sale of television rights and, above all, profits (Soriano 2009). In reality, modern competitive sports are highly market driven.

Production in the sports environment, as noted by Soriano (2009), is decidedly different from production in most other markets. In most industries, for example, an organisation's welfare is improved when competition is eliminated. In sport, however, the dynamics are different. The elimination of competition effectively eliminates the industry. Furthermore, other organisations must not only continue to exist, but should also be doing better when their competitors are of relatively equal strength (Berri & Schmidt 2006). The aims and objectives of the sports manager are to build teams that are stronger and better. To achieve this, they hire the best athletes and coaches they can afford, and build new sports complexes with modern facilities (Adelson 2009). In other words, they invest heavily to compete at a high level. Because of these strong investments, this study aims to broaden the debate on team sport productivity using a management organisational tool: the Productivity Measurement and Enhancement System (ProMES).

### **Research objective**

The aim of this study is to determine whether productivity will improve in an Angolan elite female handball team after the implementation of a productivity measurement system such as ProMES. Typical components of ProMES are objectives or goals, multidimensional productivity measures and indicators, and feedback. The positive effects of combining specific and challenging goals with timely, specific and positive outcome feedback have been well documented, both in laboratory and in field settings (Alvero, Bucklin & Austin 2001; Locke & Latham 2002). Given the effectiveness of such components, the hypothesis to be addressed in this study is to relate the feasibility of applying a method aimed at business organisations, in a sports organisation. The sports environment requires adopting scientific methodologies that can boost the productivity of individual and collective components of a given team.

## Productivity and productivity measurement

The terms productivity and performance are commonly used within the academic and business world. They are often confused and considered to be interchangeable, along with terms such as efficiency, effectiveness and profitability (Jackson & Petersson 1999). David (2003) believes that productivity is a concept that has profound importance in our lives. At the organisational and industry level, increases in productivity can create more competition, which can lead to industry and firm growth (Pritchard et al. 2011). At the individual level, productivity growth can lead to improvements in the quality of life, increased leisure time, and advancement within an organisation (Pritchard et al. 2011). Moreover, given the interrelatedness of economic markets across the world, it is beneficial for all countries and their competitors to experience productivity growth (Harris 1994).

Productivity has become a global concern, linked to organisational longevity (Druckman, Singer & Van Cott 1997), and forms the backbone of all organisations; being able to do more with less is a competitive advantage (Weaver 2008). Grossman (1993) discusses productivity improvement as one of the key competitive advantages of an organisation in the following way: organisations need to realise that gains in productivity are one of their weapons to achieve cost and quality advantages over their competition.

Productivity is a multidimensional term, the meaning of which can vary, depending on the context within which it is used (Tangen 2005). In industrial engineering, productivity is generally defined as the relation of output (i.e. produced goods) to input (i.e. consumed resources) in the manufacturing transformation process (Sumanth 1994). According to Voros (2006), organisational productivity is defined in terms of a task level that the firm can analyse focusing on accomplishing a task as quickly and efficiently as possible in the productivity process. This involves many production processes such as work processes, non-value tasks, and increasing product output and quality. Pritchard (1992) proposed a definition of productivity where the behavioural approach places emphasis on the aspects of productivity that the individual can control, working on the assumption that behavioural change will lead to productivity change. Although there are many different indices and perspectives on productivity, it is important to note that the choice of index is determined by the purpose for which it will be used (Mahoney 1988).

Productivity has also been defined in terms of effectiveness, expressed as the ratio of outputs in relation to standards or expectations (Mahoney 1988; Pritchard 1992). A comprehensive conceptualisation of productivity should include both efficiency and effectiveness (David 2003). Productivity is also a relative concept: it cannot be said to increase or decrease unless a comparison is made, either of variations from a

standard at a certain point in time (which can be based on, for example, a competitor or another department) or of changes over time (Tangen 2005).

The term productivity is used in a number of ways. However, this study uses the definition by Pritchard (1992: 455): "... how well a system uses its resources to achieve its goals". With this definition, productivity is a combination of both efficiency and effectiveness.

Productivity in teams is fundamentally different from individual productivity. Effective team performance requires a focus on both task work (any task-related functions) and teamwork (the ability to work cohesively to attain common goals) (McIntyre & Salas 1995). The tasks completed by teams are also different, in that they require a degree of interdependence in order to be completed (Weaver 2008). The unique nature of team-based work complicates the design of productivity interventions designed to maximise team performance (Weaver 2008). To know that productivity improved, it is necessary to measure it. Productivity measurement is used to refer to performance appraisal, management information systems, production capability assessment, quality control measurement, and the engineering throughput of a system (Drewes & Runde 2002). From a practical perspective, the measures should be as cost-effective as possible; they should make use of existing sources of data insofar as these are reliable and valid (David 2003). Additionally, the value to the organisation provided by the measurement should meet or exceed the cost of the measurement (David 2003). Productivity measures should be valid and also be perceived as valid by organisational members in order to gain increased acceptance (Tuttle 1981).

Related to the validity of the measures is their understandability. Indicators of productivity should be intelligible to the people who must take action on the measurement (Kendrick 1984). Finally, productivity indices should span the range of productivity levels that could be achieved by the person or team (Sink & Smith 1994). This is usually achieved by having multiple sub-indices of productivity as components of the measurement system (Pritchard 1992). Another criterion related to the comprehensiveness of the system is the presence of an overall index of productivity (David 2003). The overall index allows the sub-indices to be captured by a single figure on a common metric, which can then be used to gauge improvements or decrements in productivity across time (Campbell & Campbell 1988). This overall index also allows better evaluation of the effects of an organisational intervention on productivity (Pritchard 1992). The overall index should be comparable across teams and organisations (Kendrick 1984). If the measurement system can quantify the progress towards the organisation's goals, it can be far more successful (David 2003).

Team sports analysis is based on systematised observation, notation and further interpretation of the actions that characterise the players' and the team's productivity during a match or competition. These constitute an important way to obtain knowledge about the team sport and the factors that contribute to its quality (Garganta 1998; Sampaio 2000).

## ProMES method

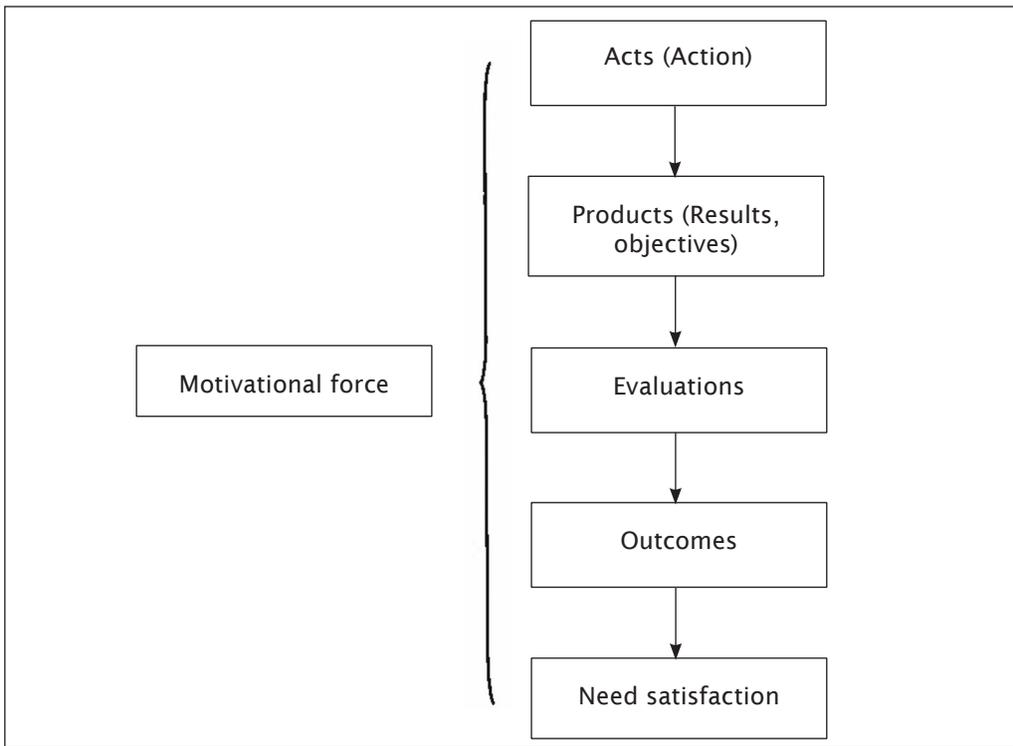
The ProMES tool selected for this research has shown significant positive effects on productivity in both individual and team level applications (Pritchard, Harrell, Diaz Granados & Guzman 2008). ProMES is an intervention aimed at enhancing the productivity of work units or teams within organisations through performance measurement and feedback (Pritchard et al. 2008). In this study, Pritchard's (1992) definition of productivity is applied, namely, how effectively an organisation uses its resources to achieve its goals.

ProMES is based on the theoretical model of motivation developed by Naylor, Pritchard and Ilgen (1980), which was later refined by Pritchard and Ashwood (2007). Founded upon the notions of expectancy theory (Mitchell & Daniels 2003; Vroom 1964), the model states that motivation is captured by the following process (see Figure 1):

- Efforts are applied to actions: individuals or teams perform task behaviours, or acts. Acts can be described as the 'doing' of something, such as playing a handball match. Acts then combine to form results (products), the end result of task behaviours (David 2003). For example, playing a match (an act) produces wins or losses (products or results).
- Actions achieve certain results: results are then subject to evaluations from supervisors, management, the self and others (David 2003).
- Results are then evaluated: evaluations determine whether the amount or quality of the result is at a desirable or undesirable level (David 2003).
- Certain outcomes result from these evaluations: outcomes are then given on the basis of these evaluations. Outcomes can be intrinsic or extrinsic and be given by the self or others (David 2003). Examples include pay, punishment, feelings of accomplishment and rewards. Outcomes then impact on the individual's satisfaction needs. According to Pritchard and Ashwood (2007), needs are relatively permanent preferences for different outcomes such as safety, self-esteem (Maslow 1954), growth, relatedness (Alderfer 1972), achievement or power (McClelland 1953), among others. Whenever these needs are met, satisfaction, in the form of positive outcomes, affects the results (Pritchard, Holling, Lammers & Clark 2002).

- The outcomes satisfy certain needs: these components dictate an individual's motivational force. Motivational force is the degree to which an individual perceives that changes in effort expended on different acts will result in changes in anticipated need satisfaction (Pritchard et al. 2002).

Motivation force is the process that determines how individual or team energy is used to satisfy needs. More specifically, the motivation process is defined as a resource allocation process through which energy is allocated across actions or tasks to maximise the person's anticipated need satisfaction (Pritchard et al. 2007).



Source: Adapted from Pritchard et al. (2007)

**Figure 1: Model of motivation**

The motivation process can be broken down into a series of components, shown on the right-hand side of Figure 1. Energy is allocated across possible actions or tasks (in this case, the handball team's strategy training). If energy is applied to actions, results are generally produced; training (an action) generates a technical, strategic or physical adaptation (a result). Thus, a result is the team's output. When results are observed and an evaluator places the measured result on a good-to-bad continuum,

this produces evaluations. Multiple evaluators evaluate the team's training, including the team's players, coaches who give feedback, journalists and team supporters. After these evaluations are made, outcomes occur. These are intrinsic outcomes such as a feeling of accomplishment from training or performing (playing) well, or extrinsic outcomes such as forms of recognition, incentive bonus, salary raise or a new contract. Outcomes have motivating power because of their ties to need satisfaction. The more needs are satisfied, the greater the positive affect that is experienced; the less needs are satisfied, the greater the negative effect. The key is to provide the tools to do a better job, while at the same time helping people feel a sense of ownership in the resulting system, and empowerment through determining important aspects of their work. The results indicate that the system can be developed in many different types of organisations doing many different types of work, and the effects have proved to be quite strong (Larbi-Apau & Moseley 2010). The findings suggest that ProMES can successfully be used within the sport industry (Roth 2007); and conversations with the chosen handball team coaches for this research show support for ProMES.

Fuhrmann (1999) found that ProMES helped to clarify priorities, goals and roles in work teams. Clarity is crucial for the development of a competitive sports team. Weinberg and McDermott (2002) confirm this by listing the key factors that lead to team success in team sports: accurate performance measures, high levels of motivation, communication and feedback. The ideas of these authors contribute to the notion that ProMES would be very applicable in the sport industry. Roth, Young, Schmerling, Koenig and Pritchard (2010) found that ProMES intervention among work teams with knowledge-intensive tasks and high expertise showed very large increases in team productivity. Sports teams also have knowledge-intensive tasks, because an athlete can be regarded as an expert on the match field. The main task of the coach is to motivate the athletes to share this knowledge and work in a coordinated fashion to maximise productivity (Roth et al. 2010).

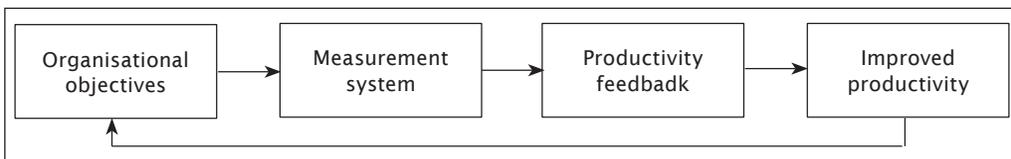
The motivation and productivity of the athletes are critical to success in sport, and especially in team sports. Team sport coaches must meet the following objectives: training, improvement, development and maintaining the capabilities and resources that generate an athlete's high performance (Queiroz 1986). The players must engage in extended and frequent practices as well as matches which require intense amounts of motivation for ideal productivity (Roth et al. 2010).

## **ProMES process**

ProMES is an intervention that relies on feedback to let all team members know their levels of performance. This knowledge then serves as a tool that leads to more

efficient and effective ways of performing tasks (Pritchard 1990). The system is developed and agreed upon by both employees and management, and provides an overall index of productivity (David 2003).

As shown in Figure 2, the process starts with the identification of the objectives of the team (or organisation). From these objectives, a productivity measurement system is developed that is consistent with the objectives. Next, the data resulting from measuring productivity constitute the feedback to members of the organisation in the form of regularly occurring formal feedback reports. These feedback reports are the basis of discussions about how to improve productivity. As productivity increases, the organisational objectives are more fully achieved. Hence, one can think of ProMES as developing a measurement system that is then used as a feedback system with the goal of improving productivity.



Source: Adapted from Pritchard et al. (2011)

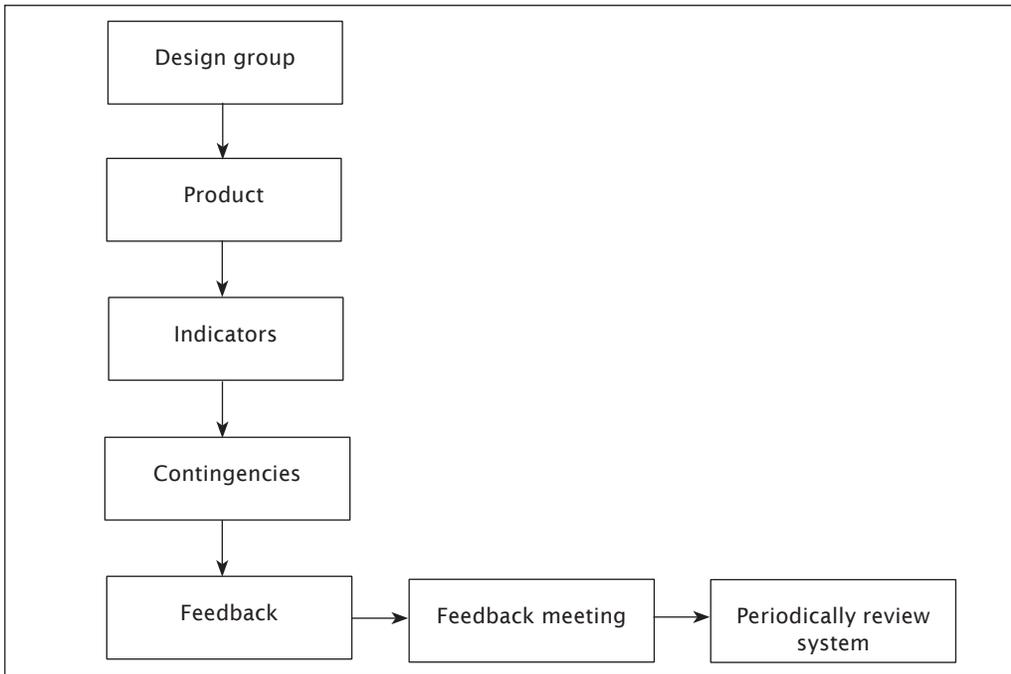
**Figure 2: Basic ProMES approach**

## ProMES implementation

A main feature of the ProMES approach is that it allows the incorporation of different performance measures and thus addresses the multidimensional nature of performance criteria typical of most group tasks in organisations (Schmidt & Kleinbeck 1997).

This is achieved by the implementation of a series of steps (Figure 3) (Pritchard 1990; Pritchard, Paquin, DeCuir, McCormick & Bly 2002; Pritchard et al. 2011):

- *Design group*: This is the group of people who will be primarily responsible for developing the measurement and feedback system. It comprises one or two supervisors and one or two facilitators to guide the design group through the process, and representatives from the team or unit are designated as design group members. An important feature of ProMES is that the people actually doing the work are directly involved in its development and participate heavily in the design and implementation of the measurement and feedback system (Pritchard, Paquin et al. 2002).



Source: Adapted from Pritchard et al. (2011)

**Figure 3: Steps in the ProMES process**

- *Identify product (objectives, results)*: Every organisation has a set of activities or objectives that it is expected to accomplish, which ProMES calls results. ProMES utilises a process of collaboration, through discussion to consensus, in which the team's representatives, supervisors (in these case coaches) and upper-level management explicitly define the objectives of the team and develop measures that reflect how well those objectives are being met (Pritchard 1990). A single index of unit effectiveness can be calculated based on an aggregate of the individual measures, and this overall score can be tracked over time. The participatory development, focus on feedback and single index of productivity differentiate ProMES from other productivity enhancement programmes (Weaver 2008).
- *Develop indicators*: Once the results are determined, the third step is to develop indicators of these products. The multidimensional nature of performance criteria is further considered when adequate indicators for the objectives have to be developed or found (Schmidt & Kleinbeck 1997). To identify the indicators, supervisors (in this case coaches) and the team's representatives are asked to think of things they would use to show how well they are generating their results.

There may be one or several indicators for a given product. Typically, there are four to six objectives and eight to 12 indicators (Pritchard, Paquin et al. 2002). Some indicators will already be available; some will have to be newly developed. However, only then is it ensured that all important performance aspects are made salient by the resulting measurement and feedback system (Schmidt & Kleinbeck 1997).

The intervention results in a single set of objectives and quantitative indicators to be used for feedback (Pritchard et al. 2002). Since each indicator is not equally important for the productivity of a team, the ProMES approach captures their differential importance through what is called the 'contingencies' (Schmidt & Kleinbeck 1997). The establishment of contingencies is a unique feature of ProMES, as compared to other performance measurement systems (Algera, Cees & Wijnen 1997). The term 'contingency' should not be confused with the behaviourist use of the term to mean the relationship between behaviour and reinforcement (Pritchard 1990). In contrast, ProMES uses the term to mean that a contingency specifies the relationship between the indicator score and the contribution that, from the point of view of the organisation, the score of the indicator makes to the overall productivity of the team. By means of this translation of performance indicator values to effectiveness scores, a total performance score can be calculated by adding up all effectiveness scores. The total set of contingencies for a team should be set by the team in order to decide how to spend their time and energy to get a maximum total score (Algera et al. 1997). The contingency indicator amounts to the effectiveness scores and is generated for each indicator. A formal step-by-step process is followed to develop the contingencies, as described in Pritchard (1990) and Pritchard et al. (2011). The basic idea is for the facilitator to break down contingency development into a series of moves that the design group can execute. The first move is to identify the maximum and minimum realistic levels for each indicator, and the design group must ask, "What is the maximum/minimum feasible value that the team/unit could score on each of the indicators under ideal conditions?"

The last step is to put the system together as a feedback system. The team's staff members collect data on the indicators, and a printed feedback report is produced and distributed to each member of the team/unit after each performance period (match, monthly championship, series etc.). This is because ProMES is a system that uses global performance indicators and contains only outcome feedback. This feedback report includes a list of the objectives and indicators, the performance level on each indicator, the corresponding effectiveness score, and the Overall Effectiveness Score, which is the sum of the effectiveness scores across the indicators. Plots of indicators are also included, as well as effectiveness scores over time and a graphic presentation

of the feedback. A feedback meeting is held after each performance period or match to review the feedback report. As part of the feedback meeting, the supervisor and coaches identify ways of making improvements, and use the feedback report to evaluate the success of improvement attempts made in the past.

Feedback and motivation theory are central elements in the ProMES approach. Numerous laboratory experiments and field studies illustrate that feedback, combined with motivation theory, leads to performance improvement (Algera 1990). Specific difficult goals direct attention and behaviour and influence the level of effort spent (Van Mierlo & Kleingeld 2010). Feedback provides information on progress towards the goal that enables the human resources to learn, develop and improve on the job (Zhou 2003). More frequent, specific and accurate feedback enhances performance (Geister, Konradt & Hertel 2006; Pritchard, Jones, Roth, Stuebing & Ekeberg 1988). The feedback system should include both a description and evaluation of performance. This is done in ProMES by including both indicator and effectiveness scores. Because the system is known and totally transparent, people know what the evaluations will be. The feedback reports and feedback meetings support learning new ways of doing the task. The effectiveness scores reflect deviation from the standard of minimum expected performance. The fact that the unit has participated in the design of the system and that feedback is typically done at the group level should reduce the threat to self.

Objectives, indicators and contingencies can be seen as a type of shared mental model of the work that is developed by the team/unit and then used in the feedback meetings (Pritchard et al. 2007). Roles and responsibilities are clarified through the measurement system and applied during feedback meetings (Pritchard et al. 2007). The ongoing feedback meetings are a type of pre-brief, performance, debrief cycle in which new ways of doing the work are developed and then evaluated in subsequent feedback meetings (Pritchard et al. 2007). Cooperation and coordination are encouraged through the feedback meetings. Multiple criteria of performance are included in the multiple indicators (Pritchard et al. 2007).

Team goals increase motivation by affecting a task performer's perceptions of the relationship between acts and products, products and evaluations, and evaluations and outcomes (Larbi-Apau & Moseley 2010). Goals at the team/unit level, rather than individual goals, contribute to less intra-group conflict and greater goal commitment and group performance quality (Tjosvold 1991). Having clear team goals contributes to the use of more efficient communication strategies during task execution, better performance and shared mental models of one another's informational requirements (Larbi-Apau & Moseley 2010). Furthermore, clear team goals are consistent with behaviours that seek to clarify each team member's roles and responsibilities, share

information, anticipate how to deal with high workload or unexpected events, and make agreements about backing one another up (Cannon-Bowers & Salas 1998).

Another factor in team performance is group reflexivity, which is defined as “the extent to which group members overtly reflect upon the group’s objectives, strategies and processes, and adapt them to current or anticipated endogenous or environmental circumstances” (West 1996: 559). The development of the measurement system and the feedback meetings are designed to promote group reflexivity. Agrell and Malm (2002) found that group reflexivity increased after the use of ProMES.

### **ProMES intervention**

The ProMES intervention was undertaken in three major steps: (1) identifying objectives; (2) identifying indicators that measure the objectives; and (3) designing contingency graphs that differentiate the priorities of these indicators. To summarise, a design team was formed comprising the main coach and a facilitator (researcher) familiar with ProMES. This design team met to develop a measurement system for the team as a whole and subsystems, and to identify the team’s objectives and corresponding quantitative measures (indicators) that assess by feedback reports how well the team and individual players are meeting the objectives.

Objectives can be considered the main tasks of a team. In a sports setting, objectives should be the most important aspects of the game that, when combined, lead to overall team performance. Three total objectives were identified: (1) improve defence; (2) improve attack/offensive; and (3) improve attack/offensive transition. After the objectives were agreed upon, the design team facilitated a brainstorming session to develop indicators. Indicators are quantitative measures of how well the objectives are being met. The athletes must have control over the indicator being measured, each athlete must understand the indicator, and the indicator must measure what it is intended to measure (Pritchard 1990). The ability to control that which is measured leads to greater motivation. The objectives were approved by higher management (club vice-president) and the indicators by coaching staff, and then approved in a formal meeting with the design team. The elite female handball team’s objectives and indicators are summarised in Figure 4 and Tables 1 and 2.

Once the objective and indicators were approved, the design team developed the contingencies. The steps for producing contingencies are described in Pritchard et al. (2007). Contingencies are a type of graphic utility function that relate variation in the amount of the indicator to variation in team effectiveness. In other words, a contingency is a function that defines how much of an indicator is good for the team. Contingencies capture the relative importance of different indicators, translate how

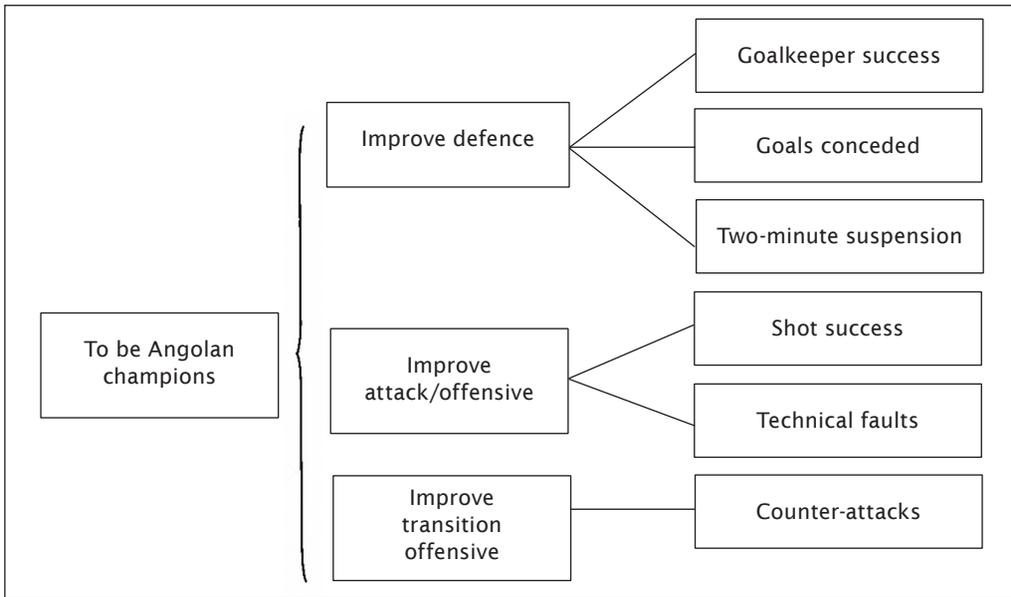


Figure 4: Team objectives and indicators

Table 1: Elite female handball team’s objectives and indicators

<b>Main objective:</b> To be Angolan champions.
<b>Sub-objectives:</b> Improve defence; improve attack/offensive; improve transition offensive.
<b>Indicators:</b> Percentage of goalkeeper success; percentage of shot success; number of counter-attacks that scored goals; number of counter goals conceded; number of two-minute suspensions; number of technical faults (Prudente, Garganta & Anguera 2004).

much was done (descriptive feedback) into how good that was (evaluative feedback), allow for an overall performance score, and identify priorities for improvement. Effectiveness is defined as the amount of contribution being made to the team. It ranges from -100, through 0 to +100. The zero point is defined as the amount of the indicator that just meets minimum expectations. Indicator amounts above this expected level get a positive effectiveness score. The higher the unit is above this expected level, the higher the effectiveness score. Indicator amounts below the expected level receive a negative effectiveness score. The design team asked: “What is the maximum feasible value that the team could score on each of the indicators under ideal conditions?” In other words, if everything went perfectly, everyone played as hard as they could, and all staff worked well, how high would it be possible to score

**Table 2:** Objectives and indicators explanation

Objective	Indicators	Relevance
1. A proficient keeper can be the difference between a competitive team and a mediocre team.	Goalkeeper success: Percentage of goal defence (balls received in relation to those saved by the goalkeeper).	“The winning teams show a better quality of interventions and efficiency from the goalkeeper” (Garganta 2007).
2. High-quality decisions from field players in shots.	Shot success: Percentage of shots that scored goals.	“Winning or losing is highly conditioned by the capacity of scoring” (Garganta 2007).
3. Moving fast and taking advantage of good recovering balls.	Counter-attack success: Number of counter-attacks (fast breaks) scored.	“The score efficient (winning) teams were found to be characterised by short continuous attacks, especially in the form of counterattacks” (Rogulj, Srhoj & Srhoj 2004).
		“Winning teams conclude more attacks and score goals in counter-attack situations than the losing ones” (Garganta 2007).
4. “Attack won a game, defence won a championship”. Fewer goals conceded means strong attitude in defence.	Goals conceded: Number of goals conceded.	“Winning or losing is highly conditioned by the capacity of avoiding goals” (Garganta 2007).
5. Play by the rules, avoiding numerical inferiority situations.	Minutes’ suspension: Number of teams’ two-minute suspensions.	
6. Decrease team mistakes.	Technical faults: Number of balls lost by team mistakes.	

on the indicator with existing athletes and facilities. Contingency development was completed within eight hours for the three indicators. For example, the maximum level for the indicator ‘percentage of shot success’ is 68%, which would lead to an effectiveness score of 80. The minimum level is 43%, which would lead to an effectiveness score of -80. This means that reaching the minimum level would be as detrimental to overall performance as reaching the maximum level would contribute to success. The contingency relates indicator amounts to the effectiveness scores. As shown in Table 3, most of the indicators share this relationship.

**Table 3:** ProMES contingency worksheet for the Angolan National Championship

Indicator	Maximum level	Minimum expected level	Minimum level	Rank of maximum	Effectiveness score: Maximum	Rank of minimum	Effectiveness score: Minimum
Goalkeeper success	43%	33%	25%	1	+80	1	-80
Shot success	68%	53%	43%	2	+80	2	-80
Counter attacks (fast breaks) that scored goals	10	8	6	3	+70	3	-70
Goals conceded	21	23	25	4	+70	4	-70
Two-minute suspensions	2	4	6	5	+60	5	-60
Technical faults	10	15	19	6	+60	6	-60

Upon approval of the contingencies, the feedback system was completed and ready for implementation. Normally, a member of the team staff collects data (statistics) during the match and transforms the data into indicators. A feedback report is then provided to the coaches, who in turn provide it to team members during regular feedback meetings. However, in this case this work was done by the facilitators. Contingencies were integrated, which corresponds to an effectiveness score. The contingencies rescale all the indicators to a common metric of effectiveness. Thus, they can be added together to produce an Overall Effectiveness Score for a particular match or competition. Other aspects of the feedback included plots of the Overall Effectiveness Score over time and changes in indicator scores from match to match.

After the decision that the team's main goal was to win the national championship, the coaching staff had to study which competitors had to win and create an index of the relative difficulty of each match (for example, with values ranging from 1 to 5, where 1 = easy and 5 = maximum difficulty). The games against competitors that have the same aim as the elite female team in the study will be the matches with the highest level of difficulty (level 5). The elite female team's goal is to win the championship. The relative difficulty of the matches must coincide with the absolute difficulty. It is usually also interesting to readjust the real difficulty of the match depending on whether teams play at home or away, or according to events that have occurred during the season. If after, a serious and profound analysis, the coaching staff encounter many hard games at the 5 level, they may need to review the goal-setting for the season. The ProMES contingencies must therefore vary according

to the competitor (opponent), which means that it will be possible to compare effectiveness.

The feedback meetings (first practice session after a match) were held with all members of the team (coaches and athletes) to review the feedback report, identify ways to make improvements, and evaluate previous improvement attempts. Where the coaching team had essentially designed the system and management had approved it, an understanding and alignment of organisational goals and objectives was more likely, because any misunderstandings or misalignments were discussed and resolved. This process of regular feedback reports and meetings continues over time in a continuous improvement model. The feedback system must be reviewed periodically to determine whether changes are necessary.

## **Participants and procedure followed**

The implementation of ProMES started in January 2011 and ended with the National Championship match on 8 July 2011. The ProMES process used with the team was that summarised earlier and followed the procedures outlined in Pritchard and Payne (2003). The design team met almost every day for a week to develop a single set of objectives, indicators and contingencies that would apply to the team. The system was then approved by higher management (club vice-president) and indicators were approved by the technical team (coaches). The three objectives and six indicators developed by the design team are shown in Table 3. Feedback was given through a spreadsheet designed for ProMES use. The spreadsheet provides for both the entry of indicator data and a variety of types of feedback reports. The team received their first feedback reports in April 2011, after the first official season match. Thus, data collected during 11 matches – regional championship (10 matches) and Angolam Super Cup (one match) – were considered as experimental data, and data collected in five matches (National Championship and teams with level 4 and 5 of difficulty) were considered as data under the feedback condition. The club had no baseline information about the team. However, the experimental data indicated seven matches at levels 5 and 4 that will be used to compare the evolution between preparation matches and the championship. According to the Angolan National Championship's match system, the championship was played in the format of a tournament. It consisted of a preliminary round and a final. The preliminary round was played in a group consisting of six teams, in which all teams competed against one another (round robin system). After the completion of the preliminary round, the first- and second-ranked teams played a playoff on the best of three matches; and Calendar (match sequence) and team level, as shown in Table 4.

**Table 4:** Match sequence and difficulty

Match sequence/ Team name	Petro	ASA	Marítimo	Electro	Ferrovia	Middle final: Electro	Playoff final: Petro		
Team level	5	4	2	2	1	2	5	5	5

## Effects of the ProMES intervention

Productivity will improve in an elite female handball team after the implementation of a productivity measurement system like ProMES. Tables 5 and 6 show these results.

**Table 5:** productivity data for preparation matches

Objectives and indicators	Expected value	Indicator value	Effectiveness score
Shot success	53%	31%	-40
Goalkeeper success	42%	62%	21
Counter-attack success	12	8	-33
Goals conceded	19	26	-60
Two-minute suspensions	4	5	-17
Technical faults	14	15	-16
Overall Effectiveness Score			-145

**Table 6:** Basic productivity data for the National Championship

Objectives and indicators	Expected value	Indicator value	Effectiveness score
Goalkeeper success	33%	37%	64
Shot success	53%	58%	37
Counter-attack success	8	4	-126
Goals conceded	23	22	84
Two-minute suspensions	4	2	54
Technical faults	15	12	31
Overall Effectiveness Score			144

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Because contingencies rescale each measure to the common metric of effectiveness, a single overall effectiveness score can be formed by summing the effectiveness scores for each indicator, as shown in Table 7 and Figure 5. Table 8 indicates the teams' productivity during the tournament.

**Table 7:** Effectiveness match score during the National Championship

Objectives and indicators	Indicator value average	Effectiveness score					Effectiveness score average
		Petro 5	ASA 4	Petro 5	Petro 5	Petro <sup>a</sup> 5	
Shot success	37%	10	183	-29	107	49	64
Goalkeepers success	58%	43	16	0	37	91	37
Counter-attack success	4	-70	-140	-280	0	-140	-126
Goals conceded	22	140	175	-70	315	-140	84
Two-minute suspensions	2	90	30	60	60	30	54
Technical faults	12	12	0	12	48	84	31
Overall Effectiveness Score		225	264	-307	567	-26	144
Match score		Defeat	Victory	Defeat	Victory	Victory	

Note: a. This was the third match of the best-of-three matches, in other words, a final. After the scheduled time, the score was a draw, 23–23. After ten minutes' overtime, the score was again a draw, which forced a second overtime of ten minutes, resulting in a score of 31–30 to D'Agosto. In this evaluation, the authors considered the full match (regular time plus two overtimes).

**Table 8:** Indicator match score during the National Championship

Objectives and indicators	Indicator match score					
	Petro 5	ASA 4	Petro 5	Petro 5	Petro 5	Effectiveness score average
Goalkeeper success	31%	46%	26%	43%	36%	37%
Shot success	58%	58%	50%	57%	67%	58%
Counter-attack success	5	3	2	6	4	4
Goals conceded	22	15	28	17	30	22
Two-minute suspensions	1	3	2	2	3	2
Technical faults	14	14	14	11	8	12

The design team considered the minimum expected level as the ‘sufficient numbers’ to win the matches and subsequently the championship. The overall effectiveness score, or effectiveness score totals, for each indicator show positive evolution during the tournament. However, because the last match had two overtimes and the contingency worksheet was designed for a 60-minute match, the final number was not as strong. Once feedback started during the championship, the team’s productivity improved right up to the final.

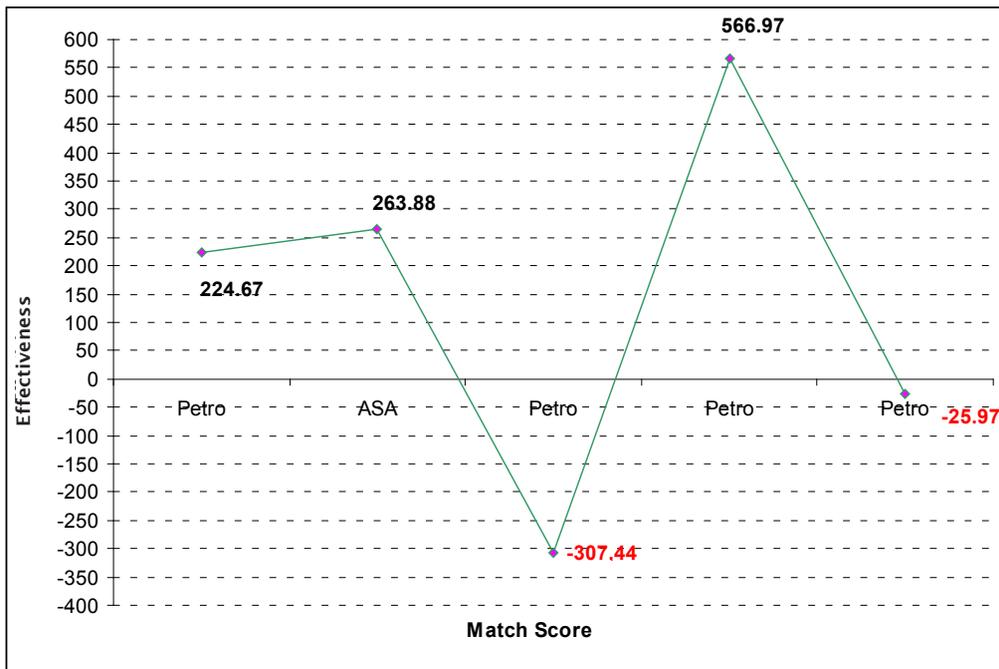


Figure 5: Overall effectiveness score graph

## Discussion

The primary purpose of this study was to determine the effects of the ProMES intervention on productivity. The ProMES effectiveness scores indicated gains in productivity on all indicators, and the club/team objective was accomplished. The results support the findings by Roth et al. (2010) that ProMES can be an effective way of responding to the requirements for measuring team sport effectiveness and also increasing productivity in the face of stressful environments. In other words, implementing ProMES for team sports does seem practical.

ProMES aligns the efforts of the team's staff and athletes with the broader goals of the organisation/club in the way the measurement system is developed. The objective, indicators and contingencies are reviewed by higher management (club vice-president), and a key issue is how well they are aligned with the broader organisational goals. Once the team goals and the measurement systems are approved, the resulting feedback system provides information on how to allocate resources so as to maximise the contribution to the organisation/club, and it is possible to develop feedback meetings and priority-setting subjects. Thus, the feedback report provided by the ProMES intervention led to increases in ambition, collectivism and task-orientation. A possible reason for the efficiency of ProMES could be that the athletes become accustomed to measurement and feedback, as these are typical aspects of elite athletes and teams. Pritchard and Payne (2003) found that organisations that received prior feedback had lower effect sizes than those without prior feedback. Elite teams rely on feedback and measurement for training and progress, which could lower the effect size seen in athletics (Roth 2007).

Coaches believe that the system helps find a tangible way of determining relative priorities through the contingencies. This means that the team can see the present effort and the necessary devotion to the future. They therefore perceive the system as a continuous process, because the staff get experience with it and the team feedback helps to revise and improve the system as necessary. The development of team and staff involvement is a major structural factor. Most of all, the coaches appreciate the use of a single index of productivity summarising the effectiveness of the aggregate indicators into one easily communicable number. Finally, the coaches believe that the system helped the productivity of the team and are committed to carry on using ProMES feedback.

An empirical way of looking at the degree of improvement is to look at the effect size used, as indicated by  $d$  (Thalheimer & Cook 2002). To calculate the effect size, the mean difference in the Overall Effectiveness Score between National Championship feedback (see Table 6) and preparation matches (baseline, see Table 5) was calculated. The mean Overall Effectiveness Score with ProMES feedback was higher than the baseline score. Expressed differently, the mean Overall Effectiveness Score with ProMES feedback was 2.8, which was 4.2 standard deviations higher than the baseline score. An effect size of 0.8 is considered large (Cohen 1992), so the values obtained in this study were very large. Thus, the data from the research indicate that ProMES is a feasible system for sports feedback.

## Practical considerations

This was the first time these Angolan elite female handball athletes had taken the time to sit down and clarify their dreams and their opinions about how to achieve them. The main objective (namely, to be champions) was really important as a motivational factor during the practices. By the end of this process, however, the athletes had quite a different idea of how to carry out their training. By pooling their knowledge and experience, they realised that it would be a good idea to focus on those things that would have the greatest impact such as training better, being psychologically strong and doing 'invisible training' (namely, good nutrition and sufficient rest). According to Ward, Smith and Sharpe (1997), if athletes improve their productivity in practice, they will perform better in matches. This finding lends credence to the aphorism that 'you play as you practice'. They were surprised when the first feedback indicated that they were not actually doing what they were supposed to do. This led to several attempts to change the way they 'see' practices. They were then able to assess how good the coaching staff's vision was by reading the subsequent feedback reports. This process led to interesting improvements in their feedback scores. The steadily increasing feedback scores had a very positive effect among the athletes and ultimately led to victory.

## Conclusion

Coaches, athletes and sport managers have become increasingly interested in explanations for why productivity varies among teams and new ways to improve it. This field is not new (according to the literature), but the ProMES application is, and the results of the current research yielded some important information for them, not on why productivity varies, but how to improve it. Coaches that have an in-depth knowledge of their athletes' characteristics (including goal orientation, locus of control belief, confidence, physical capacity, and technical and tactical skills) could develop effective training regimens for teams to fulfil their goals. Furthermore, the coach could alter their coaching style to enhance athletic productivity. Sport managers and coaches could develop goal-setting programmes that are consistent with the reality of the team and the club. This could provide athletes with more effective performance results.

Empirical research to investigate performance analysis in team sports has generally been limited to studies exploring specific aspects of the match, such as patterns of play of teams or physiological estimates of positional work rates of individual players (Hughes & Franks 2005; Taylor, Mellalieu & James 2004). The complex and multidimensional nature of competitive activity represents a constraint in terms

of hierarchy and interpretation of the factors that influence athletic performance. This statement becomes even more pertinent in team sports, where the final result, expressed in terms of victory or defeat in a tournament or by the classification achieved in a competition, consists of the individual performances of the players, which are in turn influenced by physical, psychological, technical, tactical and strategic factors.

Team sports are distinguished from other groups of modes in the relevance of technical and tactical factors. This relevance is associated with the situational nature of these arrangements, so that often the decision-making behaviours overlap these aspects of the game (Garganta & Cunha e Silva 2000). Thus the observation and analysis of the activity of competitive players and teams represent an indispensable factor for the study of technical and tactical games (Hughes & Franks 2005). Match analysis is the objective recording and examination of behavioural events that occur during competition (Carling, Williams & Reilly 2005). The main aim of match analysis is to identify the strengths of one's own team, which can then be further developed, as well as its weaknesses, which suggest areas for improvement. Similarly, a coach analysing the performance of an opposition side will use the data to identify ways to counter that team's strengths and exploit its weaknesses (Carling, Le Gall, Reilly & Williams 2009; Ribeiro & Volossovitch 2004). Performance indicators are defined as the selection and combination of variables that define some aspect of performance and help achieve athletic success (Hughes & Bartlett 2002). These indicators constitute an ideal profile that should be present in the athletic activity to achieve success and can be used as a way of predicting the future behaviour of sporting activity (O'Donoghue 2005). The indicators can be used in a comparative way with the opponents, or with other players or groups of pairs of players or even other teams, but often are used in isolation as a measure of the performance of a team or individual only (Hughes & Bartlett 2002).

Statistics can be used to analyse any competition, including any team sport. Performance indicators are an action or their combination, and attempt to define certain aspects of performance. To be useful, performance indicators should be related to the performance or the outcome of games, whether success or failure (Hughes & Bartlett 2002). If presented in isolation, a data set can give a distorted view of performance, ignoring other variables that may be important. In the literature it is evident that many tests do not provide enough information about the performance to fully represent the significant events of this performance (Hughes & Bartlett 2002). The comparison of performance between teams, team members and individuals is often facilitated if performance indicators are expressed in ratios; these proportions represent a binomial response variable (Nevill, Atkinson, Huges & Cooper 2002). The fact that athletic performance depends on several factors makes it difficult to

determine which of these factors have more influence on its variation, which is why the whole is bigger than the sum of the parts. However, in sports organisations the use of a tool that proves that the team is improving and achieving its goals is not common. This study offers the opportunity to consider ProMES as a valid tool for measurement and feedback in team sport productivity.

The focus of this intervention was on the overall productivity improvement of the Angolan senior female handball team, and not on athletes in the team. Thus, no athlete differences were assessed in this research measurements. Differences between athletes could, however, have impacted on some of the results of the current research. For example, athletes vary in terms of skills, motivation, intelligence and personality traits. Each of these could influence how much effort they put into a task or their perceptions of an outcome. Furthermore, it is not possible to say whether the athletes who left, those who joined and those who remained in the team during the intervention were different from one another. During the ProMES intervention with an Angolan female handball team, it was shown that the tool has aspects of goal-setting: formal and clear definition of goal-setting; feedback meetings focused on the behaviours necessary to attain those goals and help improve productivity; and less formal processes such as private individual goal definition. These aspects are supported by the findings of Frese and Zapf (1994), Locke and Latham (2002), Brown and Latham (2002), and Latham and Pinder (2005).

ProMES also promoted collectivism through participation. During all interventions, the team (coaches, athletes, board and general staff) participated heavily in formulating the measurement system and were encouraged to discuss the development process. There is considerable evidence that participation is an important issue that has positive effects on individual performance and attitudes (Cawley, Keeping & Levy 1998; Crown & Rosse 1995); collectivism is essential in team sports.

Finally, the teamwork was relevant and ProMES intervention was important because the roles and responsibilities were clarified during the development of the tool/system. Moreover, the goals were clear, so the athletes performed better; everybody was more satisfied; the whole team worked together to achieve the objectives; and cooperation and coordination were encouraged through the collectivism that characterised feedback meetings. Lastly, when the team met regularly in feedback meetings to review the team's effectiveness and consider how it could be improved, they felt that they were participating in something useful. These aspects are in line with the research of Salas, Kosarzycki, Tannenbaum and Carnegie (2004); Salas, Rosen, Burke, Goodwin and Fiore (2006) and West (2007). This study also reaffirms the relationship between motivation and productivity.

## Limitations and future directions

This research was limited to a single elite senior female handball team from Luanda, Angola. Therefore the findings should not be generalised to other team sports or teams. The research represents an exploratory and descriptive evaluation of ProMES. As with any preliminary research, not all questions can be answered, and additional questions are usually brought to the surface. Although the research provided important information concerning female handball athletes and team productivity measurement and feedback, there are certain limitations that need to be addressed. A potential limitation of the present research is that the ProMES process was used with a single team. However, the consistency of the outcomes adds to the value of the research. A potential problem encountered with ProMES concerns the contingencies – Roth et al. (2010) experienced a similar situation. When creating contingencies, the design team had some difficulty in determining the importance and range of each chosen indicator.

Additional research is needed to determine whether differences exist between top-performing teams compared with teams with lower performance. Further research is also needed to determine differences between top-level teams participating in different team sports. Future researchers who use ProMES, or any other intervention aimed at increasing productivity, would do well to consider more variables in their design of the system. Furthermore, although the research was undertaken using a single team, this should not discredit or diminish the findings for several reasons. Firstly, there is no reason to believe that the composition of an African team (in this case Angolan), that practises between eight and nine times a week and has seven players who regularly participate in the Continental Cup, World Champions and Olympics Games, was any different from the composition of the best teams in the world. Secondly, a critical issue is whether the findings could be generalised to other Angolan teams, and to other teams across the world. As noted in the literature, it is well documented that ProMES has been effective in many settings in many different countries. Thus, the positive results of this study are consistent with a broad pattern of similarly positive results. Therefore, although the specific variables that were examined here are similar to those examined in other research, the odds of these findings being generalisable to other team sports and teams is higher based on the similarly positive results in other research.

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