

Applying the Four Factors to the WNBA and Exploring Shared Leadership as a Fifth Factor

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Founded in 1996, the Women's National Basketball Association (WNBA) was formed as the counterpart to the men's NBA (WNBA). Dean Oliver (2003), in his study of the NBA, identified four factors that contribute to a basketball team's success: Shooting, Turnovers, Rebounding, and Free Throws. Our study examines the applicability of these four factors to the WNBA. While performance analytics have long been used to understand success in the NBA, little research has explored their relevance to women's professional basketball. The purpose of this study is to address this gap, by providing empirical insights into what drives team success in the WNBA, how these factors may have changed over time, and how the findings relate to management principles. Findings reveal that the four factors hold for the WNBA, with Shooting being the most significant contributor, though Rebounding and Turnovers show distinct trends over time reflecting differences in gameplay. To extend the practical relevance of the findings, we introduce shared leadership as a fifth factor in a broader conceptual model. Our research connects performance analytics with management principles, providing actionable insights for team leadership across multiple contexts. Ultimately, this study bridges a critical gap, elevating the visibility of women's sports while providing a framework for effective management practices.

For any team, an important objective is to identify conditions, variables, or factors that can lead to successful performance. When certain variables show positive correlations with favorable outcomes, it seems prudent to investigate the contexts where those relationships would hold up. The goal of this paper is to empirically test the application of Oliver's (2003) four factors for NBA team success to the WNBA context. We are interested in exploring whether the collective importance of 1) shooting, 2) turnovers, 3) rebounding, and 4) free throws should carry the same emphasis in the women's professional league and how this could be assessed. The current study uses seasonal data and develops linear models to test these queries. Furthermore, we enhance the four factor model by developing a conceptual framework that includes a 'hidden' fifth factor, shared leadership. Most of the research in sport management has examined leadership success through individual traits and behaviors; however, more recently there has been a call to conceptualize and operationalize leadership as a collective construct and

take into account models that include shared leadership approaches (Ferkins et al., 2018; Kang & Svensson, 2023a). Our paper adheres to this recommendation. Important implications point to how both the empirical findings and the proposed model of shared leadership can be applicable to any work team environment.

Four Factors Overview

In any team sport, what challenges managers and coaches is not only how to win games or set records but also how to sustain wins by building a team that can dominate the league for many years (Cecchin, 2022). Dean Oliver (2003) identified four factors contributing to a team's success (winning games). Shooting is the most important, contributing 40%. Teams need to score on every possession and prevent their opponents from scoring. Turnovers are the second most important factor, contributing 25% to a team's success. Teams need to keep control of the ball when they have it and they need to get the ball when the opponent has it. Rebounding contributes 20% to a team's success. Finally, Free Throws contribute

15%. A team needs to score when fouled and they need to avoid giving opponents the opportunity to make a free throw by not fouling the opponent.

In 2004, Oliver expanded the four factors to identify how four important strategies relate to success in basketball to include scoring efficiently, protecting the basketball on offense, grabbing as many rebounds as possible, and getting to the foul line as often as possible, each of which relates to the termination of a possession for a team (Oliver, 2004). Some commentators argue that isolating these variables is an initial first step to identify weaknesses in a team's ability to win, to be followed by the development of metrics to acquire talent to fill the necessary roles or to identify the non-measurable qualities of a player to improve current player performance (Jacobs, 2017).

The four factors analysis can be used in more sophisticated applications, as well. For example, one study analyzed overall efficiency (offensive and defensive ratings), along with the four factors to examine winning games in the regular season versus the playoffs, concluding that the importance of defense in winning games may be greater in the playoffs than in the regular season, and that defense becomes more important for winning playoff series as a team advances further in the post-season (Teramoto & Cross, 2018). Other variables, including team height, have been examined to determine if the trait factors into winning game statistics in the NBA (Teramoto & Cross, 2010). A study that used a structural equation modeling (SEM) analysis to translate the four-factor model into a causal model showed that the proposed causal version of the four factors model is consistent with the collected data and that the four factors are relevant in explaining teams' winning ability (Cecchin, 2022). Another study examined the feasibility of using SEM for multivariate analyses of NBA four factors data, concluding that offensive four factors are indicators of a single latent quality factor (Baghal, 2012). The study also considered salary as an important part of a multivariate model and suggested that money is expended for offensive performance which affects winning.

Similarly, in the collegiate setting, one study used the four factors, as well as other game related statistics including the percentage of 3-point goals made, the number of defensive rebounds and steals, the number of free throws made and attempted, as well as ball reversals, to highlight game-related statistics and the tactical actions differentiating winning and losing teams in NCAA Division I men's basketball close games (Conte et al., 2018). In sum, at times, coupled with the analysis of other variables, Oliver's four factors are routinely embraced as an informative tool for predicting success in basketball. One popular application of the four factors analysis is employed by experts and fans alike to select their brackets for March Madness (Musial, 2023; Kenpom, 2024).

WNBA Background

The Women's National Basketball Association (WNBA) was formed in 1996, nearly sixty years after the

first men's professional basketball league (Pedersen & Thibault, 2014). Created by the National Basketball Association (NBA) Board of Governors, the NBA owned the first eight franchises and initially each was in a city that was also home to an NBA team. In 2002, the NBA allowed the sale of franchises to ownership groups in cities that did not have NBA teams, as well as to groups in NBA cities that were unaffiliated with those NBA teams (Hart, 2023). The WNBA is divided into two divisions, the East and the West, each of which consists of six teams. By 2019, The WNBA had 12 teams.

There are several significant differences between men's and women's basketball (Bourne, 2010). The support for collegiate teams differs. At the professional level, women's salaries are considerably lower. The WNBA plays 34 games in a season compared to the NBA's 82 games. Women play with a smaller basketball (28.5 in circumference compared to the NBA's 29.5). Women play 10-minute quarters versus the 12-minute quarters in the men's game. Finally, the three-point line for women is 22.15 feet at its longest while it is 23.75 feet for men.

Fan support and viewership for WNBA has been on the upswing. In 2020, ESPN increased its investment in the league to air 37 games across its networks, about three times its typical slate (Kleen, 2020). Coupled with CBS Sports Network as well as Facebook and Twitter, nearly every game was televised for a national audience in 2020 (Kleen, 2020). In fact, the National Women's Soccer League (NWSL) and the WNBA were the only professional sports leagues in North America to experience increased TV ratings during the pandemic (LeBlanc, 2021). The 2022 season was the most watched in fourteen years, with viewership increasing sixteen percent from 2021 (Sports Business Journal, 2023). Moreover, professional women's basketball clearly has evolved into a global game, with its popularity growing steadily around the world for decades (Berber & Turco, 2011). Rather than the traditional and tedious comparison to the NBA, arguably, the success of the WNBA should be determined in part by a comparison to the many leagues of professional women's basketball around the globe (Agha & Berri, 2023).

Visibility and the success of the WNBA is also arguably linked to developments in NCAA basketball. In 2021 the Division I Board of Directors of the NCAA approved an interim name, image, and likeness (NIL) policy that allows all NCAA student-athletes to be compensated for their NIL regardless of whether their state has a NIL law in place (Hosick, 2021). Of the top five NIL earners during March Madness in 2022, four were women (Lever, 2022). Companies want to partner with student athletes who can effectively market their brand through social media, and NIL-compensated female athletes are engaging in 19.6% more social media activities for their deals than male counterparts (Balasaygun, 2022). Because NIL permeates college sport now, many players are arriving in the WNBA with established brands and social media followings. Therefore, viewership and interest would likely

be expected to increase even more. For example, about 2.1 million people tuned in to watch the Indiana Fever's Caitlin Clark make her WNBA debut, the most watched game since 2001, potentially signaling that the increased demand from NCAA women's basketball is carrying over to the women's professional league (Bohannon, 2024b).

The college basketball star also is being credited with the dramatic 93% increase in WNBA ticket sales this season as compared to last season (Bohannon, 2024a). One study examined the importance, perception, and relevance of media performances associated with WNBA game consumption, finding that Visual Media was considered very important by the WNBA consumers, indicating that good performance by the team in the areas of newspaper and television coverage were expected and deemed necessary (Zhang et al., 2011). As the popularity of NCAA basketball and its stars translates into increased interest in the WNBA, then media coverage for the league should increase, and, commensurately, viewership and consumption.

As noted previously, the four factors model has been of interest statistically to observers and analysts of men's basketball, for both the NBA and NCAA. Prior research has examined statistical data in men's and women's professional baseball leagues to confirm comparable levels of competitive balance (see York & Miree, 2023). Our study looks to examine the impact of the four factors in the WNBA context, an application of the analytical framework that is also worth considering. The following sections outline our methodology and findings related to this application. We then offer an extended conceptual model that takes into account the important role of shared leadership. Our study and conceptual model together have important linkages to organizational leadership in multiple contexts. Proven measures of success, such as the four factors, represent criterion-based indicators that can be used for effective goal-setting and motivation. From a managerial perspective, sharing leadership in a team-based context provides employees with a sense of empowerment. This often facilitates synergistic levels of performance resulting from reciprocal task interdependence and support (Jiang et al., 2024). Our inclusion of shared leadership in the extended model should offer important guidance for how managers can realize such benefits.

Methodology

Data for this project were obtained from <https://www.basketball-reference.com/wnba/>. The seasonal data from 1997 to 2019 were examined, while the 2020 and subsequent seasons were not used in an effort to avoid potential anomalies due to Covid. Because there is not a single source for complete data, multiple files from the website were utilized. The website calculates the four factors for NBA teams, but not for the WNBA teams. Using formulas found at NBAstuffer (NBA Four Factors Explained, n.d.), each of the four factors was calculated. In reality, this process involves eight factors: one for defense and one for offense for each factor. For example,

the total number of field goals for a team is considered as is the total number of field goals for the team's opponents.

Three of the calculations are the same for offense and defense. Free throws is a straight-forward ratio of free throw points, FT, to total field goal attempts, FGA, (1). The shooting factor is an effective field goal percentage, eFG%. This is calculated using the total number of baskets scored (field goals, FG) and the number of three-point baskets scored (3P) as seen in (2). This gives teams a boost for making three-point baskets. Turnovers are measured using a turnover percentage, TOV% (3).

$$\text{Free throw rate} = \text{FT} / (\text{FGA}) \quad (1)$$

$$\text{eFG\%} = (\text{FG} + .05 * 3\text{P}) / \text{FGA} \quad (2)$$

$$\text{TOV\%} = \text{TOV} / (\text{FGA} + 0.44 * \text{FTA} + \text{TOV}) \quad (3)$$

The calculations for offensive rebounding percentage (ORB%) and defensive rebounding percentage (DRB%) are slightly different in that each considers the opponents' (Opp) performance (4 and 5).

$$\text{ORB\%} = \text{ORB} / (\text{ORB} + \text{Opp DRB}) \quad (4)$$

$$\text{DRB\%} = \text{DRB} / (\text{DRB} + \text{Opp ORB}) \quad (5)$$

To address whether the four factors hold for the WNBA, linear models were developed using R. The dependent variable was the number of wins in a season and the independent variables were the factors. By using standardized coefficients (Bring, 1994), it was easier to make comparisons. "All games in all seasons" was the first model. Subsequent models included only the eastern division and only the western division to determine if either division more closely resembled Oliver's (2004) model.

To answer the second research question, to determine if the relative importance of those four factors has changed over time, models for each year were developed. All teams were used in these models. Because the number of independent variables relative to the number of data points was high (resulting in lower degrees of freedom), two-year increments were also examined.

Results and Implications

As seen in the Table 1, looking at the WNBA overall, the contributions of the factors hold for women as well. All variables are significant ($p < 0.001$). We see there are differences in the style of games played in the two divisions. In the Western Division, field goals are more important; free throws contribute less to a team's wins. All variables are significant ($p < 0.001$). Thus, the first research question is addressed:

RQ1: Can we conclude that Oliver's four factors relative weighting holds for the WNBA?

To explore the second research question (i.e., RQ2: Is the relative importance of each factor changing over time?), models were developed for each year and the contributions calculated. These are illustrated in Figure 1. The horizontal line in each graph represents Dean's suggested contribution.

Table 1*WNBA Four Factors*

Factor (Dean's %)	WNBA Overall	Division	
		Eastern	Western
Field goals (40%)	42%	37%	45%
Turnovers (25%)	30%	33%	28%
Rebounds (20%)	17%	15%	18%
Free throws (15%)	12%	14%	9%

To get estimates based on more data points, each of the four factors was graphed across time using two-year increments, as shown in Figure 2. There is a lower than predicted contribution of rebounding to successful games in the WNBA; however, rebounding is becoming more important. There is a higher than predicted contribution of turnovers to winning but this has come down over the last 12 years.

Broader Implications

Leveraging the four factors for success has broader implications for professional women's basketball. A sports league must not only create an arena where high-quality athleticism and skill are displayed, but also must develop an entertainment product that fans will want to watch because sports leagues create customers by creating fans (York & Miree, 2023). Further, fans have an interest

in the outcome of games when there is competitive balance in the league, which in turn generates revenues for teams in ticket sales and commercial activity like merchandise sales (York & Miree, 2023). To the extent that the employment of the four factors in the WNBA creates a competitive balance in the league, then prosperity is indicated. Further, if the four factors translates into winning, then winning will drive demand and success from an economic perspective. Although three-point plays and dunking may be exciting to watch, one study shows that teams do not see more gate revenue when they dunk more often nor does building a team around three-pointers result in a revenue penalty (Walker et al., 2022). Other than the impact of being in a larger market, fans care about winning, however that goal is accomplished (Walker et al., 2022). Thus, success achieved through paying attention to the four factors strategy can have a snowball effect, particularly in the money-driven arena of professional sports, with increased ticket sales, media contracts and merchandising agreements.

Advanced analytics like the four factors is indeed significant because of its impact on evaluation, performance, roster building, strategy, and media and fan discourse about the sport (Colás, 2017). However, quantifying the previously unquantified necessarily impacts the people involved; decisions over who plays and how they play is an inevitable byproduct of the analytical results because professional basketball teams must minimize risk and

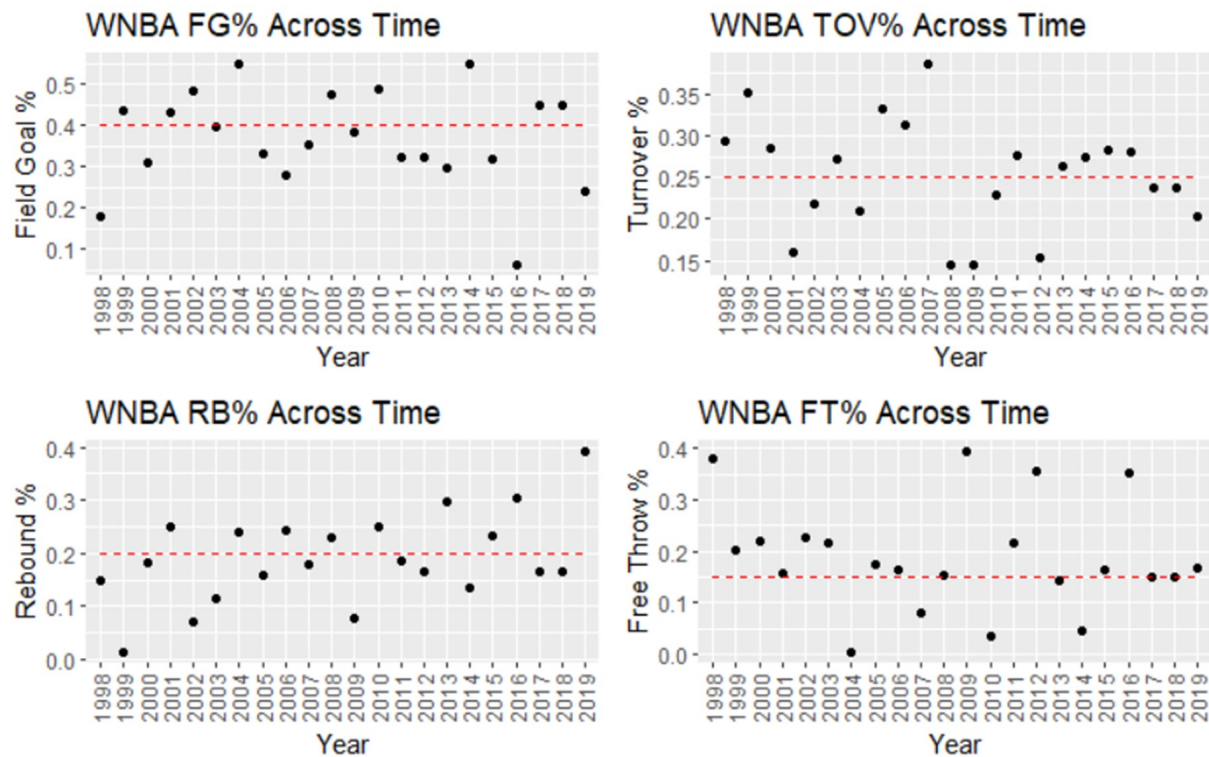
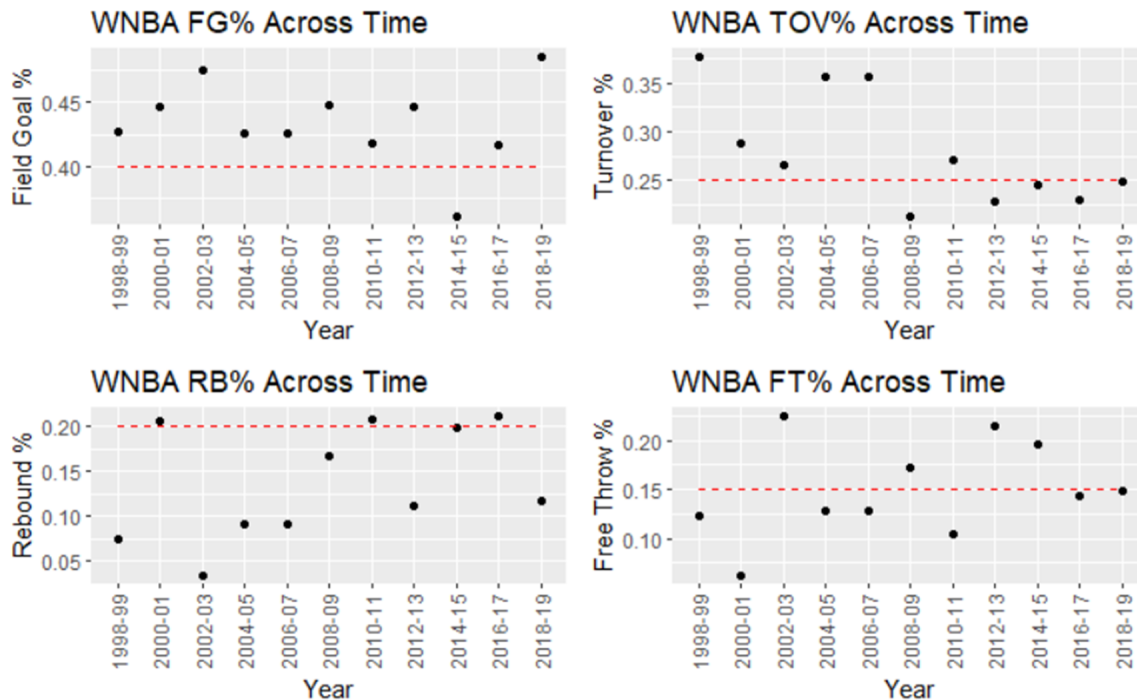
Figure 1*Graphs of Four Factors Over Time in the WNBA*

Figure 2

Graphs of Four Factors Over Time Using Two-year Increments



maximize the expected value of financial investments (Colás, 2017). Therefore, how this big data will impact the athletes personally, along with the attendant pressures from coaches, sponsors, and sport scientists, is yet to be fully grasped, even in the unionized environment of professional sport.

In summary, findings suggest that the factors leading to a WNBA team's success are similar to the success factors in the NBA. We see that field goals make a higher contribution to the success of women's games and rebounds contribute less. That conclusion was supported by the most recent season, as well (Wingenbach, 2023). In the last season limiting turnovers was second and getting to the free-throw line was third (Wingenbach, 2023).

In the early days of the WNBA, turnovers were more of a factor than they are today. Rebounds are becoming more important in the women's games. However, the last season suggested that offensive rebounding has little correlation to winning because transition offense is drastically more efficient than halfcourt offense (Wingenbach, 2023). Nevertheless, the relative importance of the four factors in the women's game is shifting close to that of the men's game. As the WNBA and Women's NCAA basketball become more popular, it is expected that the collective skill of players will continue to increase. Future studies should continue to track such trends over time.

One limitation of this study is the number of data points in a season. The league began with eight teams. Alt-

hough there are currently 12 teams, the 32-game season results only in 192 total games. The errors on the eight estimates are high. Combining seasons as in Figure 2 causes a loss of granularity.

Exploring a Conceptual Model of the Four Factors and Shared Leadership

The findings of this study clearly support the importance of the four factors. In thinking about broader implications for both sports teams and business organizations, the analysis is extended here to account for the potential impactful role of shared leadership. Cecchin's (2022) research indicated that sustaining wins by building a team that can dominate the league for many years has been a persistent challenge for managers and coaches. There is no doubt that professional basketball players bring their best to the court and that includes their individual leadership characteristics. But basketball is a team sport, and therefore the idea of collective (or shared) leadership comes to mind. Shared leadership in a WNBA athlete team can be understood as a dynamic and integrative approach where leadership responsibilities are distributed among team members rather than being centralized in a single individual. This model emphasizes the selective utilization of expertise within the team network, allowing for more effective problem-solving and decision-making processes. The concepts of shared and collective leadership also align with the idea that leadership is an emergent state, evolving over time as team members build trust and receive performance feedback, which in turn influences

subsequent levels of team trust and performance (Friedrich et al., 2016). This approach contrasts with traditional leader-centric models by incorporating processes that foster direction, alignment, and commitment within the team, thereby enhancing collaborative efforts, shared interests, and the development of human capital (Tesone et al., 2004; Shoukat et al., 2023).

Moreover, shared leadership acknowledges the social context of leadership, emphasizing the importance of considering the collective's needs and dynamics in understanding leader performance (Mumford et al., 2012). It involves collective intentionality and action, where team members' actions are combined and aligned to achieve coherent and integrated outcomes, facilitated by shared meanings and narratives (Tipurić, 2022). In the context of a WNBA team, this means that leadership is not just about the head coach or star player, but involves contributions from all team members, leveraging their unique skills and perspectives to drive the team towards success (Kang & Svensson, 2023b). Shared leadership is "a dynamic, interactive influence process among individuals in (teams) for which the objective is to lead one another to the achievement of group or organizational goals" (Pearce & Conger, 2003: 1). This holistic approach can help overcome obstacles and ensure that the team operates as a cohesive unit, capable of achieving its goals through collective effort and shared leadership.

Figure 3 presents a model showing how the four factors can facilitate shared leadership in a team context.

The findings from this research, and prior research from the NBA, suggest that the four factors are valid and credible criteria that can be used to set meaningful targets for players. In terms of goal-setting theory, the part that is important here has to do with a key goal-setting concept which suggests that members will only be motivated by goals if they deem those goals to be relevant and credible (Jeffries & Hunt, 2004; Locke & Latham, 1990). For example, a sales supervisor may set targets for the salesforce that are solidly based on figures from previous years. While the targets may be challenging, commitment should be fostered based on the credible evidence anchored in data. The evidence from this study can be used to establish such credibility and offer sources of motivation for team members. From an expectancy theory perspective (VIE theory), the evidence from our study showing a clear link between success on the four factors and team performance is clearly a source of motivation (Chatterjee et al., 2021; Vroom, 1964). The instrumentality (I) component has to do with player understanding that goal-attainment across the four performance areas is instrumental in achieving ultimate team success. The data from this study confirms that important motivational link.

The link between criterion-based goals (i.e., the four factors) and motivation / performance, is importantly related to shared leadership in the team. This component of the model has to do with the direction offered by the coach, and the role assignments based on knowledge of each member's skill area(s). Using the four factors as a

key basis of direction, the leader can instill in the team the importance of goal achievement around shooting, turnovers, rebounding and free-throws. The clarity and instruction provided is consistent with self-determination theory and how the quality of direction (horizontal and vertical) provides key paths to success and motivation (Grenier et al., 2024). Importantly, the credibility (evidence) associated with the established criteria build trust among the team and provide essential preconditions for shared leadership (Klasmeier & Rowold, 2020). Furthermore, it is important to note that heightened motivation should have a reciprocal relationship with performance: Intensity, direction and persistence drive performance levels, and achieved success instills heightened self-efficacy and intrinsic satisfaction, which in turn provide essential bases for motivation.

Of course, throughout these processes, the role of shared leadership cannot be understated. There is ample research supporting our theoretical model showing the potential favorable impact of collective efforts toward team success. Shared leadership allows for an enhanced understanding of members' roles and relationships. It is consistent with empowerment and responsibility sharing. The team and the coach use criteria such as the four factors to better understand each member's specific skills and levels of expertise. Consistent with social learning theory (Bandura, 1977), this knowledge then allows for effective role assignment and role sharing to deliver optimal performance. "Every team member is a leader, and they all learn from one another to improve" (Shoukat, et al., 2023: 428).

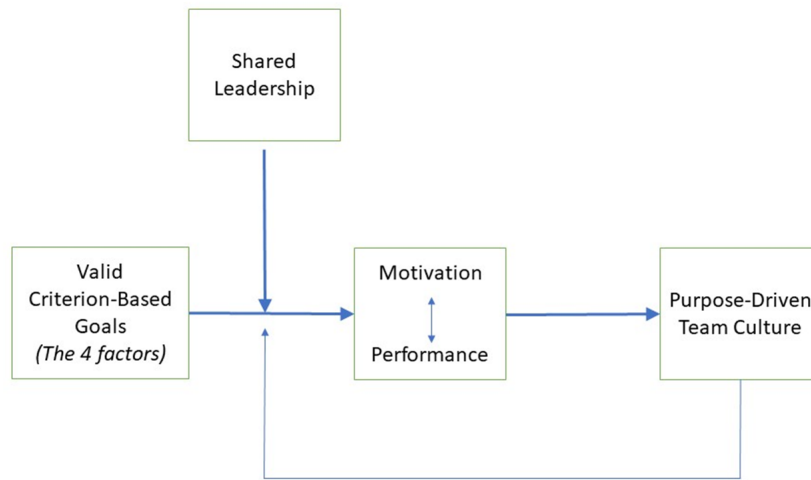
Finally, there is an important outcome of shared leadership that has to do with a purpose-driven team culture. When team members align their role assignments and levels of commitment around clear goals and vision, the ultimate outcome is an environment that strives to achieve the purposes at individual and group levels. Carson et al. (2007) suggest that this kind of collective leadership can drive such a purpose through aforementioned links between motivation and performance.

Conclusion

In conclusion, the findings from this study may offer lessons for building teams and incorporating principles of shared leadership. Dean Oliver's four factors (2003) have proven to be robust indicators of basketball performance and serve as exceptional goal-related criteria. In the context of the WNBA, it should be noted that the use of shared leadership may be particularly applicable. At least some research has shown, for example, that in terms of team composition, teams with higher percentages of female representation showed a greater potential for success with shared leadership (van Dalfsen et al., 2023). However, all teams, regardless of composition, should have the capacity to benefit from this leadership approach. It should also be noted that any organization can use valid, criterion-based, goals to provide team cultures consistent with shared leadership, vision, motivation and performance. The framework presented in Figure 3 should offer

Figure 3

An Extended Conceptual Model of the Four Factors and Shared Leadership



guidance in this area. The direct influences of shared leadership have the potential to improve team effectiveness through enhanced efficacy, trust, commitment, and role coordination (Kang & Svensson, 2023b; Porter et al., 2024). Future research should attempt to operationalize the constructs in Figure 3 to provide evidence of the proposed relationships.

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