

## Introduction

This paper analyses the performance of the Philippine National Women's Volleyball team fielded in the 2013 Asian Senior Women's Volleyball Championship held in Nakhon Ratchasima, Thailand from September 13-21, 2013.

The match being analysed in this paper is the Philippines vs. China match held on the 15<sup>th</sup> of September 2013.

The intent of this paper is to quantitatively compare the performance of the Philippine National Team Program with that of a program that consistently competes in the top 16 in the world, and to serve as a benchmark for future performances.

## Observations

### Side-out Comparison

REPUBLIC OF THE PHILIPPINES(PHI)							PEOPLE'S REPUBLIC OF CHINA (CHN)						
ROTN	FBSO	Rally SO	Sr Err SO	NO SO	FBSO %	SO%	ROTN	FBSO	Rally SO	Sr Err SO	NO SO	FBSO %	SO%
1	4	0	1	5	40.00 %	50.00 %	1	3	2	0	0	60.00 %	100.00 %
6	3	1	0	5	33.33 %	44.44 %	6	2	1	1	1	40.00 %	80.00 %
5	2	2	0	3	28.57 %	57.14 %	5	4	0	1	2	57.14 %	71.43 %
4	2	2	1	18	8.70%	21.74 %	4	2	0	1	0	66.67 %	100.00 %
3	3	0	0	6	33.33 %	33.33 %	3	4	2	0	0	66.67 %	100.00 %
2	2	2	0	10	14.29 %	28.57 %	2	3	0	0	0	100.00 %	100.00 %
<b>TOTAL</b>	16	7	2	47	22.22 %	34.72 %	<b>TOTAL</b>	18	5	3	3	62.07 %	89.66 %

Table 1

Table 1 presents how both teams are siding out. ROTN is the rotation that the setter is currently in. FBSO means first ball side-out, the team successfully terminates the rally right out of serve receive. Rally SO means the team sides-out by winning a rally. Sr Err SO means the team sides-out on the opposing team's serving error. NO SO means the team fails to side-out.

FBSO% is the rate at which the team wins FBSOs. This is determined by the following formula:

$$FBSO\% = \frac{FBSO}{Total\_Number\_of\_Attempts} \quad (1)$$

SO% is the rate at which the team sides-out. This is determined by the following formula:

$$SO\% = \frac{FBSO + Rally\_SO + Sr\_Err\_SO}{Total\_Number\_of\_Attempts} \quad (2)$$

### Attacking Comparison by Position

REPUBLIC OF THE PHILIPPINES (PHI)

PEOPLE'S REPUBLIC OF CHINA (CHN)

POS	+	0	-	K%	E%	Keff	POS	+	0	-	K%	E%	Keff
P1	3	12	6	0.1429	0.2857	-0.1429	P1	10	2	0	0.8333	0.0000	0.8333
P2	4	5	5	0.2857	0.3571	-0.0714	P2	10	5	2	0.5882	0.1176	0.4706
M1	1	2	0	0.3333	0.0000	0.3333	M1	2	1	0	0.6667	0.0000	0.6667
M2	1	2	2	0.2000	0.4000	-0.2000	M2	5	1	0	0.8333	0.0000	0.8333
Opp	4	9	6	0.2105	0.3158	-0.1053	Opp	8	1	0	0.8889	0.0000	0.8889

Table 2

Table 2 presents the attacking results. POS is the player's position: P1 – first power hitter, P2 – second power hitter, M1 – first middle hitter, M2 – second middle hitter and Opp – opposite. These positions are based off of a 5-1 offensive system, which both teams were applying.

+ means a positive result, the attacker scored. 0 means a neutral result, opposition managed to successfully defend the attack and mount a counter attack, - means a negative result, the attacker commits an error – puts the ball out of play or was blocked.

K% is the kill percentage, or the rate at which the player is producing points. This is determined by the following formula:

$$K\% = \frac{\text{No\_of\_Kills}}{\text{Total\_Attempts}} \quad (3)$$

E% is the error percentage, or the rate at which the player produces errors. This is determined by the following formula:

$$E\% = \frac{\text{No\_of\_Errors}}{\text{Total\_Attempts}} \quad (4)$$

Keff is the “kill efficiency,” this is the difference between kill percentage and error percentage. This number is the net gain or loss that the player produces for the team. A positive Keff means the hitter is positively producing for the team, while a negative Keff means the hitter is adversely affecting the team’s performance. The Keff is determined by the following formula:

$$\text{Keff} = K\% - E\% \quad (5)$$

### Overall Team Passing by Rotation

REPUBLIC OF THE PHILIPPINES (PHI)						PEOPLE'S REPUBLIC OF CHINA (CHN)							
ROTN	4	3	2	1	0	PASS AVE	ROTN	4	3	2	1	0	PASS AVE
<b>1</b>	2	0	1	2	0	2.400	<b>1</b>	1	1	0	2	0	2.250
<b>6</b>	1	0	2	2	1	1.667	<b>6</b>	1	1	1	0	1	2.250
<b>5</b>	2	0	0	0	0	4.000	<b>5</b>	2	0	0	3	0	2.200
<b>4</b>	1	2	4	4	3	1.571	<b>4</b>	2	0	0	0	0	4.000
<b>3</b>	0	0	1	5	0	1.167	<b>3</b>	1	3	1	1	0	2.667
<b>2</b>	0	0	4	4	4	1.000	<b>2</b>	1	0	0	2	0	2.000
<b>TOTAL</b>	6	2	12	17	8	1.578	<b>TOTAL</b>	8	5	2	8	1	2.458

Table 3

Table 3 presents the Overall Team Passing statistics. This takes all the passes made by a team regardless of who made the pass. The passes are rated on the quality of serve receive delivery.

4 pass means the ball is at an optimal location, and the setter did not need to move. 3 pass means the ball is close to optimal location, and the setter needed to take two

steps at most to arrive at the ball. 2 pass means the ball still allows setting in both directions (to zone 4 and 2), and the setter took three steps to arrive at the ball. 1 pass means the ball is nowhere near the setter, more than three steps or another player needed to make second contact. 0 pass means the opposing server has scored an ace.

PASS AVE is the passing average. This is simply a weighted average using the aforementioned ratings. The formula below shows the definition of PASS AVE:

$$PASS\_AVE = \frac{4 \times No\_of\_4\_passes + \dots + 1 \times No\_of\_1\_passes}{Total\_Number\_of\_Attempts} \quad (6)$$

### PHI Rotational Productivity

REPUBLIC OF THE PHILIPPINES (PHI)

	SERVE RECEIVE			DIG TRANS			FREE BALL			BLOCK			SERVE			ROTATIONAL PRODUCTIVITY
	PTS	AT	SCR %	PTS	AT	SCR %	PTS	AT	SCR %	PTS	AT	SCR %	PTS	AT	SCR %	
1	4	6	0.40	0	1	0.00	0	0	0.00	0	0	0.00	0	5	0.00	0.400
6	3	6	0.33	0	3	0.00	0	0	0.00	0	0	0.00	0	7	0.00	0.333
5	2	5	0.28	2	6	0.25	0	1	0.00	0	1	0.00	0	6	0.00	0.536
4	2	20	0.09	0	4	0.00	0	0	0.00	0	0	0.00	1	4	0.20	0.291
3	3	6	0.33	0	2	0.00	0	0	0.00	0	0	0.00	0	3	0.00	0.333
2	2	12	0.14	2	1	0.66	0	0	0.00	0	0	0.00	0	2	0.00	0.810
TOTAL	16	55	0.22	4	17	0.19	0	1	0.00	0	1	0.00	1	27	0.036	0.452

Table 4

### CHN Rotational Productivity

PEOPLE'S REPUBLIC OF CHINA (CHN)

	SERVE RECEIVE			DIG TRANS			FREE BALL			BLOCK			SERVE			ROTATIONAL PRODUCTIVITY
	PTS	ATTS	SCR%	PTS	ATTS	SCR%	PTS	ATTS	SCR%	PTS	ATTS	SCR%	PTS	ATTS	SCR%	
1	3	2	0.600	4	2	0.667	2	0	1.000	0	0	0.000	1	18	0.053	2.319
6	2	3	0.400	5	6	0.455	0	0	0.000	3	1	0.750	3	13	0.188	1.792
5	4	3	0.571	1	3	0.250	1	0	1.000	0	3	0.000	0	6	0.000	1.821
4	2	1	0.667	2	1	0.667	1	0	1.000	2	1	0.667	1	10	0.091	3.091
3	4	2	0.667	0	1	0.000	2	0	1.000	0	1	0.000	1	6	0.143	1.810
2	3	0	1.000	2	3	0.400	1	0	0.000	2	3	0.400	1	16	0.059	1.859
TOTAL	18	11	0.621	14	16	0.467	7	0	1.000	7	9	0.438	7	69	0.092	2.617

Table 5

Tables 4 and 5 analyses how the teams produce points in each rotation. For simplicity, 5 phases were analysed: Serve Receive, Defensive Transition, Free Ball, Block and Serve. Dig Trans means the team has successfully dug a ball and mounted a counterattack. Free Balls are situations wherein the opponent has given up possession of the ball though an unaggressive attack. PTS are points scored in each phase. ATTS are non-scoring attempts in each phase. SCR% is the scoring rate for that phase.

SCR% is defined as follows:

$$SCR\% = \frac{Pts\_Scored}{Total\_Attempts} \quad (7)$$

Rotational Productivity is the summation of the SCR% in all the phases in that rotation in particular. A productivity that is greater than 1 means the team is earning points in that rotation, while a productivity less than 1 but greater than 0 means the team is giving up points.

### Discussion of Findings

Table 1 compares the side-out rates between PHI and CHN. The team's side-out rate determines the team's probability of winning a match. If both teams side-out at the

same rate, then they both have a 50% chance of winning the match; however, as the differential increases the leading team has a greater probability of winning the match. The table below gives us the Predicted Winning Probability given the side-out differential (Fellingham, 2004).

Differential	Predicted Winning Percentage
0.00	50
0.02	64
0.04	74
0.06	85
0.10	94
0.20	99

Table 6

Given Table 6 and the Over-all Side-out differential in Table 1, CHN had a winning probability close to 100%. The information in Table 1 points to a massive skill differential between the two teams. Competitive women's programs at the international level tend to side-out in the low-50s to the mid-60s. CHN reaching over 60% means that PHI was unsuccessful at defending against CHN; furthermore, PHI failed to launch a successful offense against CHN.

Table 2 paints an even clearer picture of the PHI offense. Four of the five PHI attackers were producing negative Kill Efficiencies, and the one attacker in the positives only had 3 attempts the whole match. For PHI to be competitive, their P1 and P2 needed to have a Kill Percentage of 40-50% and Kill Efficiency of 0.250-0.350. Table 2 also tells us that the PHI defense was not able to limit CHN to a Kill Percentage of 40-50%. Again pointing to the poor defense design chosen by the coaching staff.

Normally, when a team's attacking numbers are low, one must analyse the setting performance and the passing performance. Qualitatively analysing the PHI setter, her setting mechanics were biomechanically inefficient. She did not align herself properly to her target location; she had the tendency of being late at arriving to the ball; these two key issues led to her inability to consistently locate her sets.

The lack lustre PHI offense was not entirely the setter's fault. The passing was equally at fault. Looking at Table 3, the passing quality did not allow the setter to run a successful offense. PHI passed 1.578 out of 4.000, which means the team was scrambling to set an attack majority of the time. PHI did not manage to develop an offensive rhythm given the quality of serve receive. Ideally this number should be at least 2.250 or higher for a competitive national team program.

Their underperformance in this category can be summed up into three issues: poor passing mechanics, poor seam management (how athletes are supposed to interact when the ball passes between them), and a disorganized serve receive system. The serve receive system this coach opted for is successful for lower ball speeds; however, these three key issues were amplified with the increased ball speed.

Conversely speaking PHI did not serve aggressively enough against CHN or seem to have a clear serving plan to disrupt the CHN offense seeing how CHN passed a 2.458. Another ratio to consider when analysing serving is the Ace-to-Error Ratio. This is the quotient of aces made over errors. See formula below:

$$\text{Ace/Error Ratio} = \frac{\text{No of Aced Serves}}{\text{No of Serving Errors}} \quad (8)$$

The Ace-to-Error Ratios for PHI and CHN are 0.333 and 3.500 respectively, using the data from Tables 1, 4 and 5. If PHI were to be competitive, it should aim for an Ace-to-Error Ratio of 1.000 or even 1.500, furthermore, it should work to limit the opposition's Ace-to-Error ratio to 1.000 or less.

Defensively speaking, CHN had 35 attack attempts against PHI according to Table 2; furthermore, PHI only managed to dig 21 of those attacks and successfully converted only 4 digs. Based on the video, PHI did have a defensive system; however, they positioned themselves 1.5-2 metres too deep, this spacing led to an increased number of CHN kills. Also the poor setting caused transition issues, thus limiting the PHI counter attack to only 4 transition points.

A competitive women's program digs about 60-70% of the total attacks and scores around 40-50% of their attempts. Given the skill differential, CHN was scoring at a much higher rate than their average against programs their own calibre.

Tables 4 and 5 compare the point productivity in each rotation. These charts look at how well teams produce point-scoring opportunities and how well they convert these point-scoring opportunities to actual points. Table 4 presents PHI's point productivity in all rotations. From this chart one can confirm the lack of point scoring opportunities made by the team. Their Dig Transition numbers are far less than what is typical of a women's program.

Blocking in women's volleyball account for less than 10% of the points scored; however, in this match CHN was well above the average mainly because of the inconsistent set location by PHI. The setter also had a tendency to put the set between 0.67 m away from the net to right on top of the tape. This made it difficult for the PHI attackers to hit the ball and much easier for CHN to block their attack.

## **Conclusion**

Using a war analogy, the phases of the game are small battles, and the whole game is the war. Winning the right battles leads to winning the war. The key battles in women's volleyball are serving and serve receive, followed by defensive transition. The last two – blocking and freeball – are negligible to the over-all result of the match.

For a PHI volleyball program to be successful internationally it must have effective serve receive mechanics, it must pass at a 2.250 or higher. Its P1 and P2 must terminate rallies at a rate of 40% to 50% and a kill efficiency of 0.250 to 0.350. Serve aggressively enough to have an ace-to-error ratio of 1.100 or higher. Most importantly win FBSOs at 30% or higher and have a side-out percentage in mid-50s. If those numbers are satisfied, PHI should be able to medal at SEA Games quite readily and present respectable results at the Asian Championships.

## **Sources**

Shondell, Don, and Cecile Reynand. *Volleyball Coaching Bible*. Champaign: Human Kinetics, 2003.

Fellingham, Gil. "Sideout Efficiencies and Expected Wins and Losses." *Journal of Physical Education, Recreation and Dance*, April 2004.